HOLOS

SUICIDE MORTALITY IN THE SOUTHERN REGION OF BRAZIL: AN ECOLOGICAL STUDY

L. R. ARRUDA, I. S. ASSIS*, J. D. ALVES, D. RISSATO, L. J. F. FLORES, M. A. M. ARCOVERDE
Universidade Estadual do Oeste do Paraná (UNIOESTE)
ORCID ID: https://orcid.org/0000-0003-1166-6644*
ivaneliza.assis@hotmail.com*

ABSTRACT

The study aimed to analyze suicide rates and spatial autocorrelation in municipalities within the Southern region of Brazil. It is an ecological, descriptive, and retrospective epidemiological study that utilized mortality data from the Information System provided by the Department of Informatics of the Unified Health System for the period from 2010 to 2020. Suicide mortality rates served as the basis for spatial analysis, including spatial autocorrelation, using Global and Local Moran's Index. A total of 28,468 suicide cases were confirmed in the Southern region, with Rio Grande do Sul accumulating the highest proportion of deaths (n=13,250; 46.54%) and the highest mortality rate (15.40/100,000 inhabitants) among the states. Spatial analysis revealed areas with a higher association of elevated suicide mortality rates in the Southern region of Brazil, enabling the identification of priority areas for attention within the states of this region.

KEYWORDS: Ecological Studies, Suicide, Border health, Health Information Systems.

MORTALIDADE POR SUICÍDIO NA REGIÃO SUL DO BRASIL: UM ESTUDO ECOLÓGICO

RESUMO

O objetivo do estudo foi analisar as taxas e a autocorrelação especial de suicídios nos municípios da região Sul do Brasil. Trata-se de um estudo ecológico, do tipo epidemiológico descritivo e retrospectivo, que utilizou dados do sistema de informação de mortalidade fornecidos pelo Departamento de Informática do Sistema Único de Saúde no período de 2010 a 2020. A taxa de mortalidade por suicídio foi utilizada como base para a análise espacial, incluindo a autocorrelação espacial, através dos Índices de Moran Global e Local. Foram confirmados 28.468 casos de suicídio na região Sul, verificou-se que o Rio Grande do Sul acumulou maior proporção de mortes (n=13.250; 46,54%) e a maior taxa de mortalidade (15,40/100.000 habitantes) entre os estados. A análise espacial permitiu visibilizar áreas de maior associação de altas taxas de mortalidade por suicídio na região Sul do Brasil e possibilitou identificar áreas prioritárias de atenção nos estados dessa região.

Palavras chave: Estudos ecológicos, Suicídio, Saúde na fronteira, Sistemas de informação em saúde.

1

1 INTRODUCTION

Suicide is a multifactorial and complex phenomenon, being one of the main causes of potentially preventable death (Simões, Santos & Martinho, 2020). It is considered the act of intentionally causing one's own death, the result of a deliberate action executed by a person with full knowledge of the fatal outcome. It is configured as a serious Public Health problem, identified as one of the top ten causes of death worldwide (Carmo *et al.*, 2018).

This serious situation, deliberately causing one's own death, is related to multiple determining and explanatory factors resulting from the complex interaction of psychological, biological, social, cultural, and economic conditions. Globally, there are reports of suicide dating back to ancient times, evidenced by the myths of primitive societies (Tavares *et al.*, 2020).

According to the World Health Organization (WHO), over 700,000 cases of suicide occur annually worldwide, making it the fourth leading cause of death among young people aged 15 to 29 years (WHO, 2021). Between 2000 and 2019, the Americas reported a 17% increase in the suicide rate, with approximately 100,000 deaths per year (PAHO, 2023).

The analysis of suicide rates reveals a gradual increase in this phenomenon across all regions of Brazil. According to Epidemiological Bulletin 33 (Brasil, 2021), there was a 43% growth in the annual number of deaths, rising from 9,454 in 2010 to 13,523 in 2019. The analysis of adjusted mortality rates points to an increased risk of death by suicide in all regions of Brazil, with emphasis on the Southern and Central-Western Regions, which have the highest suicide rates among Brazilian regions. According to data released in Epidemiological Bulletin 33, in 2019, the Southern Region presented a mortality rate of 10.41 deaths per 100,000 inhabitants, while the Southeast, North, and Northeast regions were below the national average of 6.65 deaths per 100,000 inhabitants (Brazil, 2021).

Although the data indicate growth in recent years, the distribution of suicide cases is not homogeneous across macroregions. Therefore, understanding how a health issue is spatially distributed in a region allows for comprehension of its spread, and in the case of suicide, enables the identification not only of territories with a health care deficit but also the promotion of actions aimed at preventing and controlling the issue. Furthermore, observing how suicide disperses geographically facilitates an understanding of accessibility to the type of care this issue requires. Given this scenario, the following research question arose: Where are the highest rates of suicide distributed, and what is their correlation with the states in the Southern Region of Brazil? Thus, this study aimed to analyze the spatial autocorrelation of suicide cases in individuals over 5 years of age residing in municipalities in the Southern Region of Brazil. These norms aims to provide general guidance to authors regarding writing instructions and academic organization of these communications.

2   METHOD

This is a quantitative, descriptive, and retrospective epidemiological study employing an ecological approach with spatial analysis. It is worth noting that the spatial approach has been applied in various fields of knowledge (Silva *et al.*, 2018; Oliveira *et al.*, 2019), thus being an interdisciplinary tool. In the ecological study, the data refers to groups of people based on aggregated information (e.g., rates, coefficients, indices), rather than individuals. Thus, the units of analysis are geographical areas (municipalities, states, countries) that carry information to be analyzed and compared over time and space (Merchán-Hamann & Tauil, 2021). For this study, municipalities were considered the units of analysis, with the study setting being the southern region of Brazil.

The Southern Region, one of the five regions in Brazil, comprises the states of Paraná (PR), Santa Catarina (SC), and Rio Grande do Sul (RS). It covers an approximate area of 564,000 km² (Figure 1), representing 7% of the Brazilian territory, with an estimated population of 29,975,984 inhabitants, equivalent to approximately 14% of the national population. The region boasts a per capita household income of R$1,744.33, a population density of 53.19 inhabitants per km², and a Human Development Index (HDI) of 0.756. Regarding the number of municipalities, the study includes all 1,191 municipalities in the Southern Region, divided into 399 municipalities in the state of Paraná, 295 municipalities in the state of Santa Catarina, and 497 municipalities in the state of Rio Grande do Sul (IBGE, 2010).
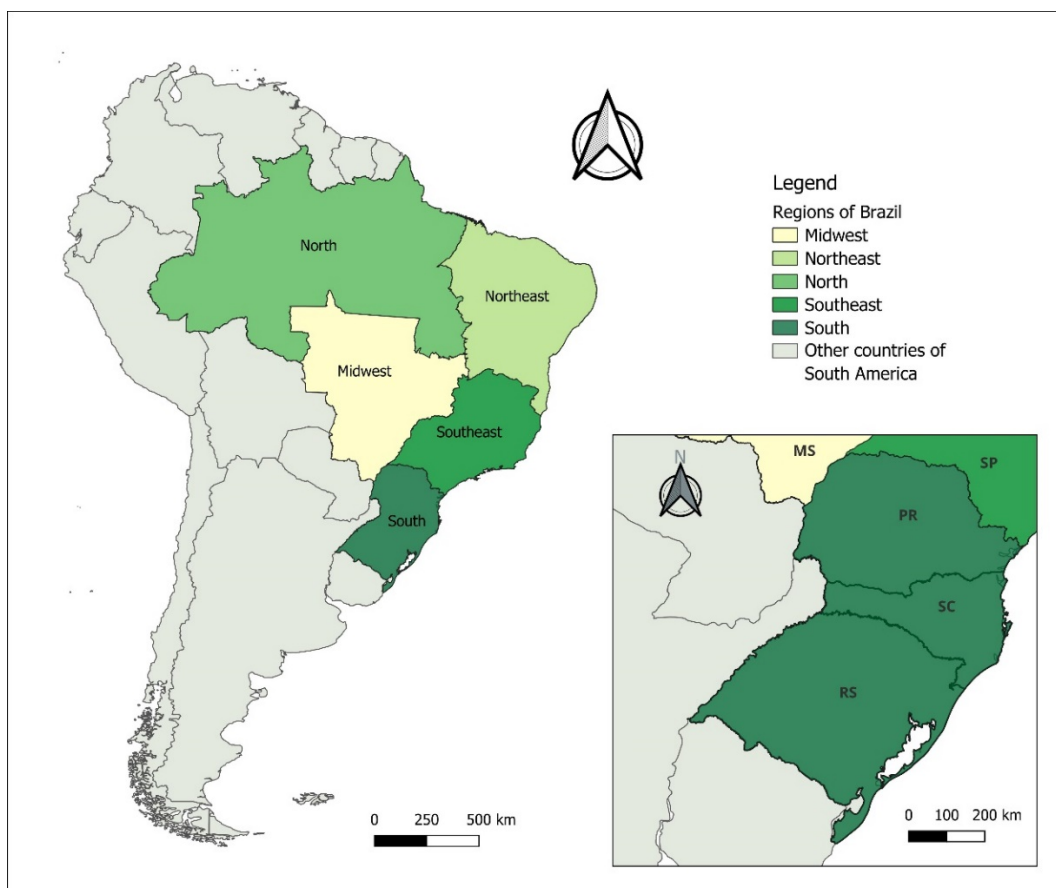

Figure 1: Highlight of the South region, Brazil, and South America.

The data were collected from the database registered in the Mortality Information System (SIM) of the Department of Informatics of the Unified Health System (DATASUS), which has the Death Certificates (DO) as its primary source of information. In this database, information was collected on the following variables: municipality of residence, sex, age, race/skin color, and classification of death. Census population information was obtained from the Brazilian Institute of Geography and Statistics (IBGE) website for the census year 2010, while for non-census years (2011 to 2020), estimated population data were used, obtained from DATASUS (IBGE, 2010; Brazil, 2022).

To minimize potential distortions in the reading and analysis of reality caused by significant seasonal variations, the study period covered 11 years. It is believed that this approach helped dilute such effects, reducing their unwanted influence on data analyses. For non-census years, the estimated population was adopted as the divisor.

The study encompassed suicides recorded in DATASUS, involving the population over 5 years of age residing in the Southern Region of Brazil from 2010 to 2020. Suicides lacking information on age and municipality of residence were excluded from the study.

To calculate mortality rates, deaths with a basic cause coded within the range of two-digit categories X60 to X84 (self-inflicted injuries) of the International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD-10) (WHO, 1995) were used as the numerator. Population data for those over 5 years of age (Brazil, 2021) were used as the denominator. Suicide mortality rates in the municipalities were calculated using the following formula (1):

$$\text{Mortality rates} = \left(\frac{\left[\Sigma\left(\frac{S}{pop_a}\right)\right]}{11}\right) * 100,000 \text{ (Brasil, 2021)} \tag{1}$$

Where S refers to the annual cases of suicide in each municipality for individuals over five years of age; the variable "pop_a" refers to the census or estimated population of the municipality in the specific year (census or non-census year) considering only individuals over 5 years old (Brazil, 2021). In order to mitigate any bias in the analysis, the divisor 11 was chosen to represent the study period, spanning 11 years.

Mortality rates were grouped into five categories: null (zero); low (0.1 to 4.9 deaths/100,000 inhabitants); moderate (5.0 to 14.9 deaths/100,000 inhabitants); high (15.0 to 29.9 deaths/100,000 inhabitants); and very high (30.0 or more deaths/100,000 inhabitants), following the proposal by Diekstra and Gulbinat (1993).

The calculation of mortality rates was performed using Microsoft Excel version 2016 from Microsoft Office. Sociodemographic data and rates were imported into the Jamovi Software version 2.2 for statistical analyses.

The integration of case files with the shapefile of states and municipalities was carried out using the QGIS 3.4 application, enabling the construction of thematic maps on suicide mortality rates, with municipalities in the Southern Region as the unit of spatial analysis.

Exploratory spatial data analysis allows for the identification of the presence or absence of clusters and presents the reliability of the analysis through a probability map called a Lisa map (Anselin, 1995). This is a choropleth map generated from the Local Indicators of Spatial Association (LISA), expressing local spatial dependence. In the Lisa map, situations of spatial autocorrelation are presented when the index is less than 0.05, i.e., 5% (Anselin, 1995; Nunes, 2013). According to Nunes (2013), the LISA index generates a map where areas are classified as follows: non-significant; significance at 0.05 (95% confidence); at 0.01 (99% confidence); at 0.001 (99.9% confidence); and at 0.0001 (99.99% confidence).

The Local Indicators of Spatial Association (LISA) is a statistical parameter that presents values proportional to those of global statistics, helping describe how similar or different each event is to its neighbors. Consequently, the total sum of the LISA for all zones is proportional to the value obtained for the Global Moran's Index (Anselin, 1995; Santos & Raia, 2006; Chen *et al*., 2015).

The significance level of the tests was considered at 5% ($p < 0.05$).

As this is a research study using publicly available secondary databases, it was not necessary to submit it to the Research Ethics Committee. However, the research followed the recommendations of Resolutions 466/2012 and 510/2016, which address ethical relationships and procedures in research involving human subjects and their data.

3   RESULTS AND DISCUSSION

Aims to present the subject, addressing general aspects and seeking to introduce general outline of the article Also, it points out a brief description of the research objectives. The section emphasizes the importance of research within the scientific and/or technological context, addressing possible contributions of the outcomes.

According to the information collected during the investigated period, there were a total of 28,468 suicides in the Southern Region of Brazil. The states of Rio Grande do Sul and Santa Catarina showed the highest and lowest proportions, recording 13,250 (46.54%) and 7,111 (24.98%) suicides, respectively. The overview of suicide cases in individuals over 5 years of age residing in the Southern Region of Brazil from 2010 to 2020, with variables such as total cases, participating states, gender, and skin color, along with their frequencies and proportions, is detailed in Table 1.

Regarding the gender variable, males accounted for a total of 22,518 deaths (79.10%). Concerning skin color, the majority of deaths were among white individuals, totaling 24,823 (87.20%).

Table 1: Study Characterization by State, Gender, and Skin Color of Suicide Cases in the Southern Region of Brazil, from 2010 to 2020.

Variables	Frequency (N)	Proportion (%)
Total	28,468	100
States		
PR	8,107	28.48
SC	7,111	24.98

RS	13,250	46.54
Gender		
Female	5,950	20.90
Male	22,518	79.10
Skin Color		
White	24,823	87.20
Brown	2,373	8.34
Black	878	3.08
Indigenous	73	0.26
Yellow	70	0.25
Unknown	251	0.88

Source: Developed by the authors.

The analysis of the variables and their frequencies and proportions points to a similarity in the health issue, primarily affecting males, with 6,469 (79.80%) cases in Paraná, 5,509 (77.47%) in Santa Catarina, and 10,540 (79.55%) in Rio Grande do Sul. Regarding the number of suicide deaths in indigenous individuals, the highest rate was 35/100,000 (0.43%) in the state of Paraná, compared to 15/100,000 (0.21%) in Santa Catarina and 23/100,000 (0.17%) in Rio Grande do Sul (Table 2).

Table 2: Frequency and proportion of the gender and skin color variables of suicide cases in the Southern Region of Brazil, from 2010 to 2020, according to the state of residence.

Variables	PR		SC		RS	
	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion
- Gender						
Female	1,638	20.20	1,602	22.53	2,710	20.45
Male	6,469	79.80	5,509	77.47	10,540	79.55
- Skin color						
White	6,521	80.44	6,330	89.02	11,972	90.35
Brown	1,238	15.27	533	7.50	602	4.54
Black	206	2.54	131	1.84	541	4.08
Yellow	52	0.64	9	0.13	9	0.07
Indigenous	35	0.43	15	0.21	23	0.17
Unknown	55	0.68	93	1.31	103	0.78

Source: Developed by the authors.

Regarding the suicide issue, the mortality rate in the Southern Region, in this study, was 12.20/100,000 inhabitants, with the highest and lowest averages observed in Rio Grande do Sul and Paraná, with (15.40/100,000 inhabitants) and (8.31/100,000 inhabitants), respectively. Municipal rates were analyzed according to the parameters presented in Table 3.

Table 3: Parameters and classification of municipal suicide rates in the Southern states of Brazil.

Parameters	South	PR	SC	RS
Medium	12.20	8.31	11.90	15.40
Standard Deviation	7.07	4.38	5.48	8.03
Median	10.7	7.30	10.7	13.9
Minimum	0	0	0	0

Maximum	62.3	33.4	32.1	62.3
Classification and frequency of mortality rates n (%)				
Nulls	21 (1.8%)	8 (2.0%)	5 (1.7%)	8 (1.6%)
Low	100 (8.4%)	72 (18.0%)	12 (4.1%)	16 (3.2%)
Medium	742 (62.3%)	286 (71.75)	196 (66.4%)	260 (52.3%)
High	299 (25.1%)	32 (8.0 %)	79 (26,8)	188 (37.8%)
Very High	29 (2.45)	1 (0.3%)	3 (1.0%)	25 (5.0%)
Total	1.191 (100%)	399 (100%)	295 (100%)	497 (100%)

Legend: * Classification according to Diekstra and Gulbinat (1993): null (zero); low (0.1 to 4.9 deaths/100,000 inhabitants); medium (5.0 to 14.9 deaths/100,000); high (15.0 to 29.9 deaths/100,000); and very high (30.0 or more deaths/100,000).
Source: Developed by the authors.

Figure 2 represents the distribution of suicide rates in the municipalities of the Southern Region of Brazil from 2010 to 2020, grouped and separated according to Diekstra and Gulbinat's proposal (1993). When analyzing the map, it is observed that the majority of municipalities in the Southern Region are in the medium and high categories, (5.0 to 14.9 deaths/100,000) and (15.0 to 29.9 deaths/100,000), respectively. Additionally, the map shows an increase in this issue in the central and southern border areas.
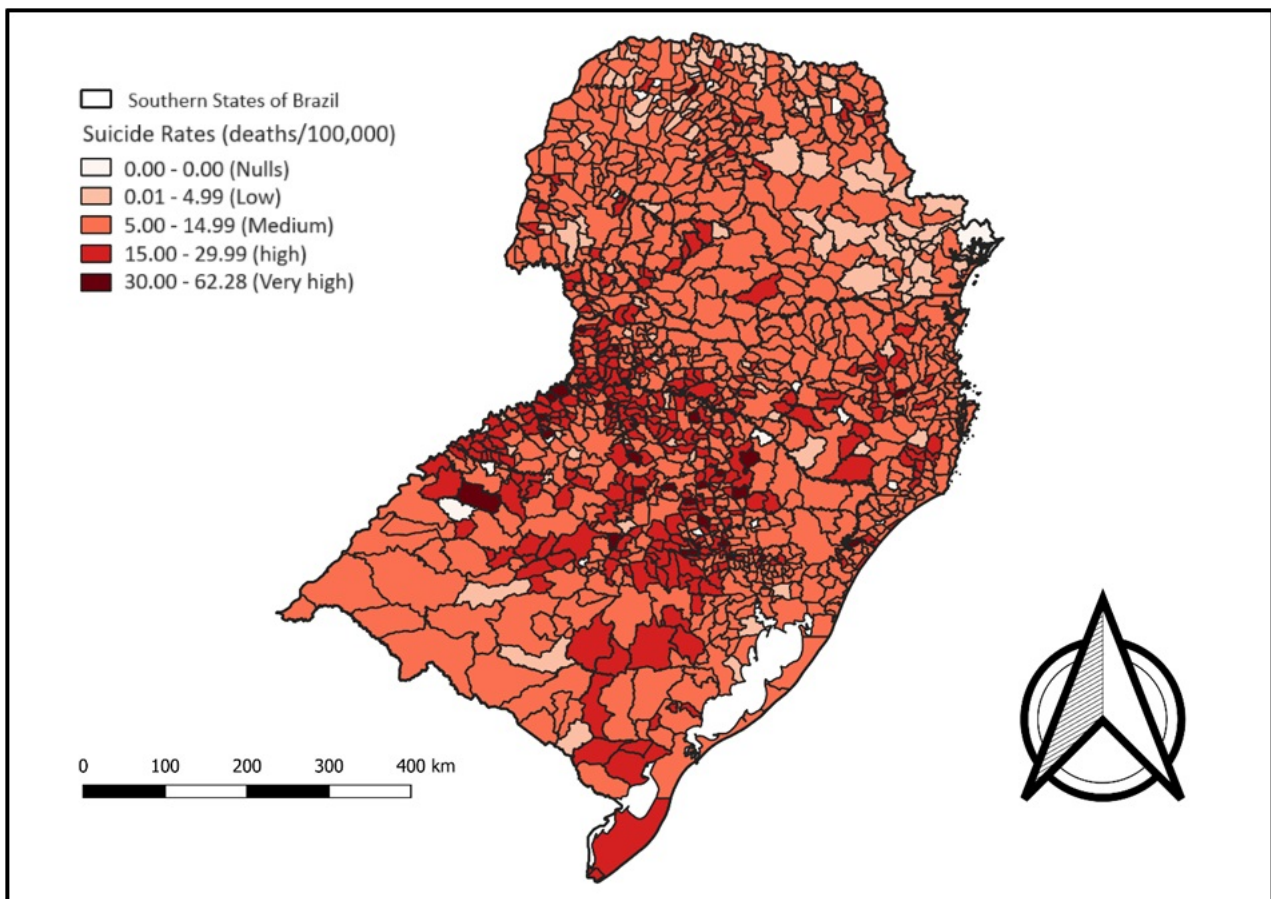

Figure 2: Spatial distribution of suicide mortality rate in Southern Brazil, from 2010 to 2020.

The Global Moran's Index indicated positive spatial autocorrelation for suicide cases in the Southern Region of Brazil, with a value of 0.3403 ($p \leq 0.001$). Clusters were formed based on clusters composed of municipalities that showed significance regarding the relationship between suicide rates and the place of residence. In total, 812 municipalities showed no significance, while 120 exhibited a high-high pattern, meaning that these municipalities have high suicide rates and are surrounded or close to municipalities that also have high rates of suicides. This high-high association pattern (H-H) was mainly observed between Santa Catarina and Rio Grande do Sul. Regarding the low-low association pattern (L-L), it was identified in 201 municipalities. Although this pattern appears in all three states, in Paraná, the largest cluster of this association was recorded, meaning that these are municipalities with a low suicide rate that are close to or surrounded by municipalities with a low rate during the study period (Figure 3).
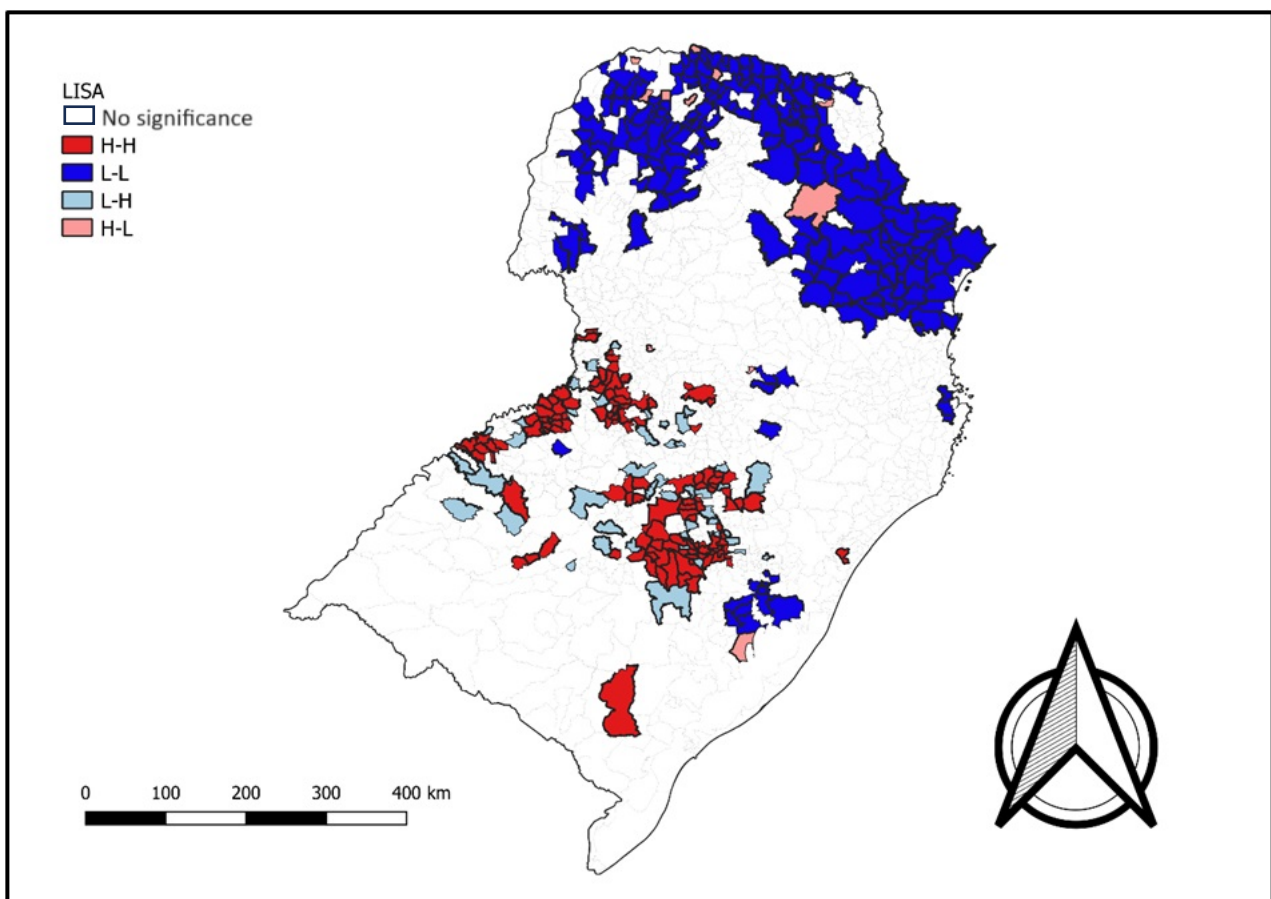

Figure 3: Local Spatial Analysis (LISA) map related to suicide mortality rate in Southern Brazil, from 2010 to 2020.
Legend: H-H: High-high association; L-L: Low-low association; L-H: Low-high association; and H-L: High-low association.

The analysis of spatial autocorrelation among suicide cases in the municipalities of the Southern Region, using spatial analysis tools, allowed the identification of vulnerable regions and municipalities in the southern states. It also provided an understanding of the relationship between the event and neighboring municipalities, analyzing the behavior of this health issue. In this study, 28,468 suicide cases were identified over an 11-year period, with Rio Grande do Sul

(n=13,250) being the state with the highest number of cases. The study also highlights a higher proportion of deaths among men (n=22,518; 78.94%) and whites (n=24,823; 86.60%).

Gender difference is a clear risk factor for suicide, with men presenting a higher risk compared to women worldwide, aligning with other studies such as one conducted in Iran from 2006 to 2016, which revealed rates of 6.75 deaths per 100,000 inhabitants for men and 2.88 deaths per 100,000 inhabitants for women (Nazari *et al*., 2022). However, women have a higher prevalence of suicidal thoughts and attempts. These differences have been associated with greater aggression and intent to die in men, leading to the use of more lethal methods (Brazil, 2021).

The Southern Region presented data that places it in a concerning situation regarding the numbers of cases and suicide mortality rates when compared to other regions of the country. According to the latest epidemiological bulletin (Brazil, 2021), while the mortality rate in the Southern Region reached 15.1/100,000 inhabitants, the maximum among other regions was 10.2/100,000 inhabitants, representing a difference close to a 50% increase. It is worth noting that this disparity was particularly noticeable in the population over 60 years old; however, in the population aged between 20 to 59 years, the Southern Region still had an increase of around 30%.

In light of this, the development of specific actions for the control and prevention of suicide is of paramount importance, especially because the prominent position of the Southern Region states in the national ranking of suicide cases by federal states has been maintained over the years (Rosa, Oliveira, Arruda & Mathias, 2017; Junior, 2020; Brazil, 2021).

A literature review indicates an exponential and steady growth in the number of confirmed suicide cases worldwide. The evidence shows that human self-destruction results from a combination of factors: sociodemographic aspects (gender, age group, income, and skin color), psychiatric factors (depression, bipolar disorder, schizophrenia, anxiety disorder), and psychological factors (loss, personality with traits of impulsivity and aggression). Other contributing factors to the number of suicides include a family history of suicide, alcoholism, physical and sexual abuse, social isolation, unemployment rate, economic situation, and degree of inequality. The nature of this phenomenon is simultaneously historical, cultural, and individual, manifesting in individuals as a biopsychosocial synthesis. In other words, there is an overlap of external and internal elements found in the individual's history (Lira *et al*., 2020; Meleiro, 2018).

The specific results of the Southern Region presented in this study indicate significant differences in the distribution of suicide cases among municipalities. The identified disparities can be justified by various factors, such as demographic and population density, age distribution and characteristics of populations, healthcare conditions, control and prevention of the condition, practice and reliability of case notification, and intervention capacity (Brazil, 2021).

The highest prevalences of suicide cases in the Southern Region were observed in municipalities within the central territorial strip, with values above the average, while the Southern border macro-region remained at the average. In the spatial analysis map (LISA), it is observed that the cluster set with high-incidence spatial autocorrelation is geographically concentrated in the interior of the states of Rio Grande do Sul and Santa Catarina, demonstrating the internalization of cases, justified by the deficient sociodemographic characteristics of these regions (Cordeiro, Campos & Souza, 2021).

At the same time, clusters with low-incidence autocorrelation are concentrated in the boundary areas of the Southern Region with the Midwest/Southeast regions. Therefore, understanding the social, economic, and healthcare networks and dependencies within the boundaries of municipalities, states, or regions is of paramount importance for understanding this condition and promoting prevention and control actions. Furthermore, this study identifying clusters by the Local Moran's Index highlights priority areas of attention in the states. It is worth noting that one of the principles of the Unified Health System (SUS) is the regionalization of sanitary actions for the care of populations.

As limitations of the study, it is worth noting that calculating rates using estimated populations can lead to some distortions, although these are smaller than those resulting from using the census population for the entire study period. Another limitation concerns the identification of clusters in the spatial analysis itself, as there may be isolated municipalities with high rates that did not associate with others. For this reason, rate and cluster maps should be analyzed together. Another restrictive aspect is related to the fact that, although data collection occurred in 2022, the available database only covers up to 2020, limiting the analysis of recent years, a period coinciding with the COVID-19 pandemic.

However, despite the described limitations, it is hoped that this study can support future epidemiological research on the spatial analysis of suicide and assist state and municipal health managers in decision-making.

4 CONCLUSIONS

In the face of the high incidences of suicide identified in all study areas, particularly with higher rates in the state of Rio Grande do Sul, it is crucial to direct efforts toward addressing this serious public health issue. The presence of areas with a relative risk above 1 and statistical significance in the Southern border region indicates a substantial probability of risk over both space and time. In this epidemiological context, an effective approach to the problem requires strengthening public policies for suicide prevention, especially in areas identified as more vulnerable.

Thus, a decentralized action by the Ministry of Health is imperative, which should, through the provision of training, lectures, and seminars in areas such as Family Health Strategies, schools, community centers, large companies, among others, guide a care network that involves the entire society, capable of identifying, managing, and preventing situations of individuals at risk of suicide.

Therefore, for individuals with suicidal potential to be saved, it is crucial that they have full access to this support network. It is necessary for the Ministry of Health, represented by the Psychosocial Care Network, in partnership with the entire society, to be at the right place and time to provide support and thus prevent a fatal outcome.

Given the impulsive nature of the suicidal act, another public strategy for prevention should aim at reducing access to lethal methods. In this sense, preventive measures include the monitoring and strict control of access to poisonous products, medications, firearms, and drugs, whether legal or illegal. The early treatment of mental illnesses, crime control, and the reduction

of social inequality also play essential roles, potentially having significant deterrent effects on reducing the number of suicide cases.

5   REFERENCES

Anselin, L. (1995). Local indicators of spatial association—LISA. *Geographical analysis*, 27(2), 93-115. https://doi.org/10.1111/j.1538-4632.1995.tb00338.x

Brasil, M. D. S. (2021). Mortalidade por suicídio e notificações de lesões autoprovocadas no Brasil. *Boletim Epidemiológico 33*, 52, 1-10. Disponível em: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2021/boletim_epidemiologico_svs_33_final.pdf

Brasil. Ministério da Saúde. Banco de dados do Sistema Único de Saúde (DATASUS). (2022). *Informações de Saúde, Sistema de Informações sobre Mortalidade*. Brasília. Disponível em: http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sim/cnv/obt10uf.def

Carmo, É. A., Santos, P. H. S., Ribeiro, B. S., Soares, C. D. J., Santana, M. L. A. D. A., Bomfim, E. D. S., ... & Oliveira, J. D. S. (2018). Características sociodemográficas e série temporal da mortalidade por suicídio em idosos no estado da Bahia, 1996-2013. *Epidemiologia e Serviços de Saúde*, 27, e20171971. https://doi.org/10.5123/S1679-49742018000100001

Chen, X., Pei, Z., Chen, A. L., Wang, F., Shen, K., Zhou, Q., & Sun, L. (2015). Spatial distribution patterns and influencing factors of poverty-a case study on key country from national contiguous special poverty-stricken areas in China. *Procedia Environmental Sciences*, 26, 82-90. https://doi.org/10.1016/j.proenv.2015.05.005

Cordeiro, R. A., de Moura Campos, E., & de Souza, M. L. P. (2021). Desigualdade da mortalidade por suicídio entre as macrorregiões de saúde do estado do Ceará, Brasil, 2012-2016. *Journal of Health & Biological Sciences*, 9(1), 1-4. http://dx.doi.org/10.12662/2317-3076jhbs.v9i1.4148.p1-4.2021

Diekstra, R. F., & Gulbinat, W. (1993). The epidemiology of suicidal behaviour: a review of three continents. World health statistics quarterly. *Rapport trimestriel de statistiques sanitaires mondiales*, 46(1), 52-68. Disponível em: https://europepmc.org/article/med/7694430

IBGE. Instituto Brasileiro de Geografia e Estatística. (2010). *Panorama das Cidades: Censo de 2010*. Disponível em: https://cidades.ibge.gov.br/brasil/panorama

Junior, C. S. (2020). Os riscos sobre o aumento dos casos de suicídio no contexto de Pandemia: perspectivas para a prevenção no Estado do Rio Grande do Sul–Brasil. *Ágora (St. Cruz Sul, Online)*, 22(2), 02-21. https://doi.org/10.17058/agora.v22i2.15422

Lira, S. C. M., Bento, M. I. C., Santiago, B. M., Nascimento, R. P. D., Fernandes, L. C. C., & Rabellov, P. M. (2020). Perfil das vítimas de suicídio em município da Paraíba/Brasil. *Rev. bras. ciênc. saúde*, 123-132. https://doi.org/10.22478/ufpb.2317-6032.2020v24n1.47352

Meleiro A. (2018). *Psiquiatria - Estudos Fundamentais*. Guanabara Koogan.

Merchán-Hamann, E., & Tauil, P. L. (2021). Proposta de classificação dos diferentes tipos de estudos epidemiológicos descritivos. *Epidemiologia e Serviços de Saúde*, 30, e2018126. https://doi.org/10.1590/s1679-49742021000100026

Nazari, S. S. H., Mansori, K., Kangavari, H. N., Shojaei, A., & Arsang-Jang, S. (2022). Spatio-temporal distribution of suicide risk in Iran: a Bayesian hierarchical analysis of repeated cross-sectional data. *Journal of preventive medicine and public health*, 55(2), 164. https://doi.org/10.3961/jpmph.21.385

Nunes, F. G. (2013). Análise exploratória espacial de indicadores de desenvolvimento socioambiental das regiões de planejamento do norte e nordeste goiano. *Ateliê geográfico*, 7(1), 237-259. https://doi.org/10.5216/ag.v7i1.19809

Oliveira, T. R.; Oliveira, V. S.; Pontes, M. A.; Libório, M. P.; Hadad, R. M.; Laudares, S. (2019). Metodologia para análise de danos ambientais do rompimento da barragem de fundão em Bento Rodrigues (MG). HOLOS, 7(35),1-17. https://doi.org/10.15628/holos.2019.6187

OMS. Organização Mundial de Saúde. (1995). *Classificação estatística internacional de doenças e problemas relacionados à saúde* (2. ed.). EDUSP, 201-312. Disponível em: https://www.acdc.com.br/arquivos/cid.pdf

OPAS. Organização Pan-americana da Saúde. (2023). *A prevenção ao suicídio deve ser uma prioridade*. Disponível em: https://www.paho.org/pt/noticias/8-9-2023-prevencao-ao-suicidio-deve-ser-uma-prioridade-diretor-da-opas

Rosa, N. M. D., Agnolo, C. M. D., Oliveira, R. R. D., & Mathias, T. A. D. F. (2017). Tendência de declínio da taxa de mortalidade por suicídio no Paraná, Brasil: contribuição para políticas

públicas de saúde mental. *Jornal Brasileiro de Psiquiatria*, 66, 157-163. https://doi.org/10.1590/0047-2085000000165

Rosa, N. M. D., Oliveira, R. R. D., Arruda, G. O. D., & Mathias, T. A. D. F. (2017). Mortalidade por suicídio no Estado do Paraná segundo meios utilizados: uma análise epidemiológica. *Jornal Brasileiro de Psiquiatria*, 66, 73-82. https://doi.org/10.1590/0047-2085000000153

Santos, L., & Junior, A. A. R. (2006). Análise espacial de dados geográficos: a utilização da Exploratory Spatial Data Analysis-ESDA para identificação de áreas críticas de acidentes de trânsito no município de São Carlos (SP). *Sociedade & Natureza*, 18(35), 97-107. Disponível em: https://www.redalyc.org/articulo.oa?id=321327189007

Silva, E. P.; LAUDARES, S.; LIBÓRIO, M. P.; EKEL, M. P. (2018). Criminality spatial dynamic in Manaus city, AM. HOLOS, 1(34), 259-270. https://doi.org/10.15628/holos.2018.5698

Simões, R., Santos, J. C., & Martinho, J. (2020). As representações sociais do suicídio em adolescentes: Scoping review. *Revista Portuguesa de Enfermagem de Saúde Mental*, (23), 54-62. https://doi.org/10.19131/rpesm.0273

Tavares, F. L., Marti Pedroni Borgo, V., Marabotti Costa Leite, F., Gomes Ferreira Cupertino, E., dos Anjos Pereira, J., Nascimento Ribeiro Alves, R., & Rosa, M. (2020). Mortalidade por suicídio no Espírito Santo, Brasil: análise do período de 2012 a 2016. *Avances en Enfermería*, 38(1), 66-76. Disponível em: https://revistas.unal.edu.co/index.php/avenferm/article/view/79960

WHO. World Health Organization. (2021). *Suicide: facts and figures globally*. Disponível em: https://www.who.int/publications/i/item/WHO-MSD-UCN-MHE-22.03.

ABOUT THE AUTHORS
Leandro Ricardo de Arruda
Universidade Federal do Paraná – UFPR. Mestre em Saúde Pública em Região de Fronteira pela Universidade Estadual do Oeste do Paraná -UNIOESTE. Especialista em Gestão em Saúde pela Universidade Estadual do Mato Grosso-UNEMAT. Preceptor do internato Médico do curso de Medicina da Universidade Federal do Paraná - UFPR.
ORCID ID: https://orcid.org/0000-0001-5045-6805
E-mail: leandroaricardo@gmail.com

Ivaneliza Simionato Assis
Universidade Estadual do Oeste do Paraná. Pós doutorando do Programa de Pós-graduação em Saúde Pública em região de fronteira da Universidade Estadual do Oeste do Paraná - UNIOESTE. Doutora em Ciências pela Universidade de São Paulo - USP. Mestre em Saúde e Meio Ambiente pela Universidade da Região de Joinville - UNIVILLE. Docente do Centro Universitário Dinâmica das Cataratas - UDC, Foz do Iguaçu, PR.
ORCID ID: https://orcid.org/0000-0003-1166-6644
E-mail: ivaneliza.assis@hotmail.com

Josilene Dália Alves
Universidade Federal de Mato Grosso – UFMT. Doutora em Ciências pelo Programa Interunidades de Doutoramento em Enfermagem (Escola de Enfermagem de Ribeirão Preto-USP). Mestre em Imunologia e Parasitologia Básica e Aplicadas pela Universidade Federal de Mato Grosso. Possui Graduação em Licenciatura em Matemática e Bacharel em Enfermagem pela Universidade Federal de Mato Grosso. Docente do curso de Enfermagem da Universidade Federal de Mato Grosso - UFMT.
ORCID ID: https://orcid.org/0000-0001-5007-9536
E-mail: josydalia@hotmail.com

Denise Rissato
Universidade Estadual do Oeste do Paraná - UNIOESTE - Campus de Foz do Iguaçu-PR. Doutora em Políticas Publicas e Formação Humana pela Universidade do Estado do Rio de Janeiro - UERJ. Mestre em Economia Aplicada pela Escola Superior de Agricultura Luiz de Queiroz - USP. Professora Adjunta da Universidade Estadual do Oeste do Paraná, Campus de Foz do Iguaçu. Professora do Programa de Pós-graduação em Saúde Pública em Região de Fronteira, UNIOESTE, PR.
ORCID ID: https://orcid.org/0000-0001-7027-3408
E-mail: denise.rissato@hotmail.com

Lucinar Jupir Forner Flores
Universidade Estadual do Oeste do Paraná - UNIOESTE - Campus de Marechal Cândido Rondon, PR. Pós Doutorado em Educação Física- UEL. Doutorado em Educação Física - UNICAMP. Mestrado em Educação Física pela Universidade São Judas Tadeu-SP, especialização em Fisiologia do Exercício pela Universidade Veiga de Almeida e graduação em Educação Física (bacharelado) pela Universidade Estadual do Oeste do Paraná - UNIOESTE. Docente do Programa de Pós-graduação em Saúde Pública em Região de Fronteira - UNIOESTE, Foz do Iguaçu, PR.
ORCID ID: https://orcid.org/0000-0002-4010-7596
E-mail: lucinar05@gmail.com

Marcos Augusto Moraes Arcoverde
Universidade Estadual do Oeste do Paraná - UNIOESTE - Campus de Foz do Iguaçu-PR. Doutor em Enfermagem em Saúde Pública. Mestre em Enfermagem. Professor do Programa de Pós-graduação em Saúde Pública em Região de Fronteira. Universidade Estadual do Oeste do Paraná - UNIOESTE, Foz do Iguaçu, PR.
ORCID ID: https://orcid.org/0000-0001-5104-559X
E-mail: marcos.arcoverde@unioeste.br

HOLOS
ISSN 1807 - 1600