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ORIGINAL ARTICLE

Suicide mortality in Brazil: temporal analysis (2010-2021) and comparison with the first two years of the COVID-19 pandemic

Mortalidade por suicídio no Brasil: análise temporal (2010-2021) e comparação com os primeiros dois anos da pandemia de COVID-19

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KEYWORDS

Health
Mortality
Suicide
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ABSTRACT

Objective: To analyze suicide cases in Brazil from 2010 to 2021, and sociodemographic characteristics of this phenomenon, including the first two years of the COVID-19 pandemic, with aim for assessing whether there is a relationship between the increases in suicide cases in Brazil and this illness.
Methods: ecological timeline study, with 140,339 cases analyzed from the databases of the Mortality Information System (SIM). Statistical rates and regressions were applied using STATA® software.
Results: higher suicide rates in men, singles, and residents of the south and midwest regions were observed. The age group of 10 to 19 years old had an increase of 1.7 cases x 100 thousand inhabitants/year. Analysis by region revealed significant variations in rates, suggesting the influence of contextual factors. Although the pandemic has had impacts on mental health, it was not possible to establish a direct relationship between COVID-19 and increased suicide rates.
Conclusion: These results reinforce the need for public policies and preventive interventions, especially for vulnerable groups such as young people. A multifactorial approach is suggested, considering socioeconomic factors, access to mental health services and reduction of stigma associated with mental illness. In short, this study contributes to understanding the temporal trends and demographic characteristics of suicides in Brazil, highlighting the importance of further longitudinal investigations to better understand this complex phenomenon. It is hoped that this evidence will strengthen mental health policies and promote more effective suicide prevention strategies in the country.

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PALAVRAS-CHAVE

Mortalidade
Prevenção ao Suicídio
Saúde
Suicídio

RESUMO

Objetivo: Analisar casos de suicídio no Brasil de 2010 a 2021 e as características sociodemográficas deste fenômeno, incluindo os primeiros dois anos da pandemia de COVID-19, para avaliar a existência de relação dos aumentos de casos de suicídio no Brasil com esta doença.
Métodos: Estudo ecológico de linhas temporais, com 140.339 casos analisados a partir das bases de dados do Sistema de Informações sobre Mortalidade (SIM). Taxas e regressões estatísticas foram aplicadas no software STATA®.
Resultados: Observou-se maiores taxas de suicídio em homens, solteiros, e residentes nas regiões Sul e Centro-Oeste. A faixa etária de 10 a 19 anos teve crescimento de 1,7 casos x 100 mil habitantes/ano. A análise por região revelou variações significativas nas taxas, sugerindo influência de fatores contextuais. Embora a pandemia tenha gerado impactos na saúde mental, não foi possível estabelecer relação direta entre a COVID-19 e o aumento das taxas de suicídio.
Conclusão: Esses resultados reforçam a necessidade de políticas públicas e intervenções preventivas, especialmente para grupos vulneráveis, como os jovens. Abordagem multifatorial é sugerida, considerando fatores socioeconômicos, acesso a serviços de saúde mental e redução do estigma associado com doenças mentais. Em suma, este estudo contribui para a compreensão das tendências temporais e características demográficas dos suicídios no Brasil, ressaltando a importância de investigações longitudinais adicionais para melhor compreensão desse fenômeno complexo. Espera-se que essas evidências fortaleçam as políticas de saúde mental e promovam estratégias mais eficazes de prevenção do suicídio.

INTRODUCTION

According to the World Health Organization (WHO), approximately 700,000 people commit suicide yearly worldwide, making it a global challenge to face[1]. The WHO considers suicide to have a multifactorial character involving biological, social, psychological, cultural and economic aspects. It is associated with a low demand for health services by people with suicidal ideation and is considered a global public health problem. However, according to the WHO, suicide can be avoided, and intersectoral prevention strategies (clinical and non-clinical) are in order, given the complexity of this phenomenon[1].

Suicide cases in Brazil have shown increasing rates in recent years, particularly among men, as shown in the article "Suicide time trends in Brazil from 1980 to 2005"[2]. More knowledge about the profile of people who commit suicide helps combat risk factors and identify the most vulnerable populations[3,4]. In a study published in 2016, the characteristics of suicides in the Brazilian adolescent population were analyzed using data from secondary sources. The results show that the cases were related to social factors, family problems, school problems and alcohol and drug consumption. This study suggested the need to improve public policies among adolescents as a target population[5].

Suicide refers to the set of actions and thoughts that lead a person to decide to end their own life. In this sense, it is considered that the suicide process is not acute since it does not occur suddenly or immediately. The term synchronic describes this process, as thoughts, emotions and behaviors related to suicide develop continuously and with complexity[6]. This process takes weeks or months and may have warning signs before a person attempts or commits suicide[7]. The scientific approach is fundamental and essential for breaking stigmas and misinformation and reducing the taboo surrounding this topic. Opening prevention paths are paramount, encouraging an open dialogue and promoting awareness and empathy with those facing suicidal thoughts. Thus, the scientific perspective in the study of suicide is a powerful tool for reducing cases, protecting mental health, and caring for human life[8].

The COVID-19 pandemic became an aggravating factor for psychological, mental health, sociability, and economic conditions. Studies have shown increased suicide numbers in 2003 during the SARS outbreak in Hong Kong[9]. During the COVID-19 pandemic, increased stress, anxiety, and depression due to the restrictions imposed by the disease, in addition to economic and social uncertainty, may have been a significant contributing factor to the increase in suicide rates in the country. Social distancing and lack of social and sports activities may also negatively affect people's mental health, especially those who already suffer from disorders such as depression or anxiety[10]. Furthermore, the limitation of mental health services, or even the fear of contracting the disease, may have affected access to help or treatment[11]. Thus, the analysis of epidemiological data on suicide is of great importance for the elaboration of more effective actions by society and the creation of public policies by the government. Therefore, the objective of this study was to analyze the calculated rates and main characteristics of suicide in Brazil from 2010 to 2021 and to assess whether there was a relationship between the increase in cases in the first two years of the COVID-19 pandemic (2020-2021).

METHODS

This is an ecological study of time series that included all notifications of deaths by suicide from 2010 to 2021 available in the database of the Mortality Information System (SIM)[12] of the Brazilian Ministry of Health, classified as "voluntarily self-inflicted injuries" in the International Classification of Diseases - ICD X60 to X84, as described in Table 1. The observed variables were sex, age, skin color, marital status, underlying cause of death, and place of death by region of Brazil. Both suicide data and population estimates were obtained in November 2022.

The choice of a 12-year study is justified by the

viable and manageable approach for researching extensive time series, avoiding difficulties in collecting and analyzing a large amount of data, which could compromise the identification of significant patterns and trends. This period is suitable for detecting relevant changes in suicide rates and allowing for a more accurate interpretation of the data[13], ensuring up-to-date information close to current reality, considering that suicide rates may vary depending on socioeconomic, cultural, and political factors in different moments[14]. Therefore, the use of more recent data becomes relevant for the purposes of the study, including the formulation of public policies aimed at improving mental health.

Table 1 — Death categories according to the Mortality Information System (SIM) from 2010 to 2021.

Category	Deaths
X60 Intentional self-poisoning by and exposure to analgesics, antipyretics, and antirheumatics, non-opiates	145
X61 Intentional self-poisoning by and exposure to anticonvulsant [antiepileptic] drugs, sedatives, hypnotics, antiparkinsonians, and psychotropics, not elsewhere classified	2,531
X62 Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	848
X63 Intentional self-intoxication by and exposure to other pharmacological substances acting on the autonomic nervous system	160
X64 Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances	3,291
X65 Voluntary alcohol self-intoxication	614
X66 Intentional self-poisoning by organic solvents, halogenated hydrocarbons and their vapors	150
X67 Intentional self-poisoning by other gases and vapors	364
X68 Intentional self-poisoning by and exposure to pesticides	5,650
X69 Intentional self-poisoning by and exposure to other unspecified harmful chemicals and substances	2,848
X70 Intentional self-harm by hanging, strangulation and suffocation	95,733
X71 Intentional self-harm by drowning and submersion	1,532
X72 Intentional self-harm by handgun discharge	3,441
X73 Intentional self-harm by shotgun, rifle, or larger caliber firearm	519
X74 Intentional self-harm by other and unspecified firearm discharge	7,639
X75 Intentional self-harm by explosive devices	69
X76 Intentional self-harm by smoke, fire and flames	2,109
X77 Intentional self-harm by steam, gases or hot objects	61
X78 Intentional self-harm by sharp or penetrating object	2,270
X79 Intentional self-harm by blunt object	878
X80 Intentional self-injury by falling from a high place	5,263
X81 Intentional self-harm by rushing or standing in front of a moving object	249
X82 Intentional self-harm by motor vehicle impact	626
X83 Intentional self-harm by other specified means	296
X84 Intentional self-harm by unspecified means	3,053
Total (2010-2021)	**140,339**

Data were tabulated and organized in a Microsoft Excel® spreadsheet and exported to the STATA® statistical package, version 17.0. Descriptive analysis was performed (absolute and relative frequencies, dispersion measures and averages), followed by calculations of mortality rates, considering populations of 100,000 inhabitants based on population projections from the Brazilian Institute of Geography and Statistics (IBGE)[15], from the 2010 Census. A p-value of 0.05 was considered statistically significant, and a 95% confidence interval was used in the analysis.

Finally, correlations between region/year rates were analyzed to identify their statistical significance. Considering that the values of increased cases in these years in Brazil were relatively low and did not have relevant changes (Table 2), a Poisson regression was performed given the particular characteristics of the data and the nature of the events of interest. Poisson regression is an appropriate statistical technique for modeling the relationship between a response variable that is a rare event (such as suicide) and a set of explanatory variables (such as demographic or socioeconomic factors). When studying timelines of suicide rates, Poisson regression is a solid methodological choice that considers the inherent characteristics of the data and allows for adequate modeling of trends and factors associated with suicide events over time[16].

Likewise, a Prais-Winsten regression was performed, considering that the application of this regression in a study of timelines on suicide rates presents justifications similar to conventional Poisson

regression but with the advantage of dealing with the overdispersion in the data. Praise-Winsten regression is an approach that considers the extra variability not captured by the Poisson distribution, making it more appropriate for data with variance greater than the mean[17].

As this was a study with secondary data, approval by the research ethics committee was not required.

Table 2 — Suicide mortality rate in Brazil per 100,000 inhabitants, 2010-2021.

Year	Deaths	Population	Mortality rate
2010	9,448	194,890,682	4.8
2011	9,852	196,603,732	5.0
2012	10,321	198,314,934	5.2
2013	10,533	200,004,188	5.3
2014	10,653	201,717,541	5.3
2015	11,178	203,475,683	5.5
2016	11,433	205,156,587	5.6
2017	12,495	206,804,741	6.0
2018	12,733	208,494,900	6.1
2019	13,520	210,147,125	6.4
2020	13,835	211,755,692	6.5
2021	14,338	213,317,639	6.7

Source: Mortality Information System (SIM).

RESULTS

Suicide mortality cases are highlighted by categories and by region of Brazil, as shown in Table 1 on the means used for suicide, where higher deaths can be observed in the following categories: (1) intentional self-harm by hanging, (2) strangulation or suffocation, (3) intentional self-injury by other and unspecified firearm discharge plus intentional self-injury by handgun discharge, (4) intentional self-injury by precipitation from high ground, (5) intentional self-intoxication to pesticides, (6) self-intoxication by intentional exposure to other drugs, and (7) drugs and biological and unspecified substances.

Suicide data recorded in Brazil from 2010 to 2021 total 140,339 cases. Suicide rates per 100,000 inhabitants are shown in Table 2. There was an overall average of 11,694 deaths/year, with an average rate of 5.7 cases/100,000 inhabitants for the years studied.

Suicide rates according to the age group are presented in Table 3. Despite the increase in all age groups, the mortality rates of people between 10 and 19 years due to suicide increased significantly over time by 1.7 cases, which suggests that, on average, there were 1.7 additional cases of suicide for each population unit considered in this age group between 2010 and 2021. The age group younger than 10 years had no relevant cases and could have biases at the time of registration, so it was not included in this study.

From 2010 to 2021, of the total number of suicides in Brazil (140,339), 110,242 (78%) were men and 30,069 (21%) were women (Table 4). Brazil showed a linear increase in suicide cases in both sexes, with a 26% increase in the rate among men and 31% among women during the study period. “Ignored” gender classifications with 25 cases were ignored. Among the regions that make up Brazil (Table 5, Figure 1), it was observed that all had significant suicide mortality rates, with emphasis on the South and Midwest regions.

A Poisson regression (Table 6) was performed by the total population of Brazil and by the deaths in the regions in contrast with the suicide rates and started with the interactions as part of the proposed model. We noticed that the Northeast and Southeast regions presented significant estimated coefficients with values of $P > |z|$ equal to 0 (i.e., very close to zero). This indicates a statistically significant association between these regions and increased suicide rates. These findings suggest that differences in cases in these regions cannot be attributed to chance and may be related to specific factors that deserve further investigation. On the other hand, the North, South, and Midwest regions presented non-significant estimated coefficients, with P values $> |z|$ greater than traditional significance levels, such as 0.05. Based on the data and variables considered in this analysis, calculations suggest insufficient evidence to

Table 3 — Absolute number and rate of suicides per 100,000 inhabitants according to age group and year. Brazil, 2010-2021.

Year	Deaths / Age Group					Rates / Age Group				
	10-19	20-39	40-59	60-79	80 more	10-19	20-39	40-59	60-79	80 more
2010	706	4,206	3,082	1,180	246	2.2	6.5	6.7	5.7	7.1
2011	733	4,402	3,176	1,282	220	2.3	6.8	6.8	6.2	6.3
2012	792	4,473	3,352	1,408	262	2.4	6.8	7.1	6.7	7.5
2013	785	4,494	3,536	1,432	258	2.4	6.8	7.4	6.8	7.3
2014	814	4,603	3,526	1,419	259	2.5	6.9	7.4	6.7	7.3
2015	854	4,602	3,753	1,665	278	2.6	6.8	7.8	7.8	7.7
2016	897	4,610	3,896	1,725	271	2.7	6.8	7.9	7.8	7.2
2017	1,047	5,009	4,195	1,923	287	3.3	7.4	8.4	8.3	7.3
2018	1,049	5,147	4,219	1,982	298	3.3	7.5	8.2	8.3	7.3
2019	1,211	5,601	4,400	2,022	271	3.9	8.2	8.4	8.1	6.4
2020	1,168	5,447	4,572	2,265	354	3.8	8.0	8.6	8.8	8.0
2021	1,214	5,802	4,685	2,237	369	3.9	8.4	8.8	8.6	8.1

Source: Mortality Information System (SIM).

Table 4 — Absolute number and rate of suicides per 100,000 inhabitants according to gender and year. Brazil, 2010-2021.

Year	Death		Rate	
	Men	Women	Men	Women
2010	7,375	2,073	7.7	2.1
2011	7,762	2,089	8.1	2.1
2012	8,061	2,257	8.3	2.2
2013	8,309	2,223	8.5	2.2
2014	8,419	2,233	8.5	2.2
2015	8,780	2,396	8.8	2.3
2016	9,053	2,378	9.0	2.3
2017	9,826	2,664	9.7	2.5
2018	9,999	2,729	9.8	2.6
2019	10,599	2,919	10.3	2.7
2020	10,868	2,964	10.5	2.7
2021	11,191	3,144	10.7	2.9

Source: Mortality Information System (SIM).

state that suicide rates in these regions differ significantly from the overall mean. Therefore, it can be justified that including these regions in the Poisson regression did not provide relevant or statistically significant information.

Prais-Winsten regression analysis (Table 7) was performed to investigate the coefficients related to the variables of interest. The estimated coefficient for the variable "Men" was 5.065234. This means that, holding other variables constant, for every 1-unit increase in the "Men" variable, the suicide rate increases by approximately 5.065 units. The associated p-value is 0 (indicated as 0.000), suggesting that the coefficient is statistically significant. This indicates a positive relationship between male gender and suicide rates. The estimated coefficient for the variable "Women" was -5.801305. This means that, holding other variables constant, for every 1-unit increase in the "Women" variable, the suicide rate decreases by about 5.801 units. However, the associated p-value is 0.088, indicating that the coefficient is not statistically significant. This suggests that the relationship between female gender and suicide rates is not statistically clear.

DISCUSSION

The results show that the highest proportions and rates of suicide are male and single, from Brazil's southern and midwestern regions. The age group from 10 to 19 years showed an increase of 1.7 cases/100,000 inhabitants in the analyzed period.

The WHO included as a global goal among the United Nations Sustainable Development Goals (SDGs) the reduction of mortality by suicide, seeking to prevent the tragedy of deaths and the effects generated on people close to those involved. Between 2000 and 2019, the global suicide rate decreased, having increased only in the America region, according to data found in the present research for Brazil. The global rate for 2019 was 9 suicides per 100,000 inhabitants[1]. The Brazilian rate between men and women was 6.4 in the same year[4].

Concerning distinctions between the sexes, the notorious disparity between men and women shows that the gender context intrinsically influences the phenomenon of suicide. Generally, males adopt more lethal approaches to consummate the suicidal act, showing less inclination to seek help when faced with depressive states. Furthermore, there is a greater male exposure to the consumption of alcohol and other narcotic substances, adding to the manifestation of more energetic and competitive behaviors. On the other hand, females are less prone to alcoholism problems, exhibiting a more prominent behavior of seeking assistance in situations of psychological distress. In addition, they exhibit more adaptable attitudes towards life and occupy social roles characterized by care, notably exemplified by motherhood. Note that women are subject to aggravating factors, including gender inequality, domestic violence, and physical abuse, which can increase their vulnerability to the risk of suicide[18,19].

The Prais–Winsten regression results indicate that suicide rates for men have a positive relationship, while for women, although there is a negative coefficient, the relationship was not statistically significant. This may suggest that male gender had a clearer influence on suicide rates during the studied period. The p-value for the "Women" coefficient was close to 0.05, so a more conservative interpretation could consider the possibility of a trend to be explored in future studies with larger samples.

Regarding marital status, note that being married, which means, having a partner, gives a greater chance of protection against suicide (lower rates). The same result was observed by Fattah et al.[20], who highlighted that social isolation, loneliness, and lack of a support network can emerge as significant risk factors in relation to suicide. It should be observed, however, that relationships characterized by conflict and violence can also play a prominent role in predisposing to suicidal risk.

Regarding age groups, it is worrying that adolescents and people over 80 have rising suicide rates, exceeding the average suicide mortality rate in Brazil, which is 6 cases/100,000 inhabitants in the years studied, as risk factors for suicides in adolescents are history of mental disorders, substance abuse and exposure to violence. Regarding adolescent women, other factors can be cited: eating disorders, bipolar disorder, post-traumatic stress, exposure to dating violence, depression, interpersonal relationship problems, and history of abortion. Among male adolescents, identified factors include behavioral disorders, feelings of hopelessness, parental separation, suicidal behavior by peers, and access to means for self-harm[21].

Among Brazil's regions, we observed variations in numbers, emphasizing the high rates in the South and Midwest regions, although they present a certain stagnation. These data were also observed by Palma et al.[19]. Such authors suggest that the economic activity in these regions, strongly linked to agriculture, may be an explanation factor for these rates. Factors such as low income, unstable work, debts, limited access to education and health services, social isolation, and exposure to pesticides can explain the high suicide rates

in the South and Midwest region of Brazil. As an aggravating factor in the South, German colonization can reinforce the "expected" social behaviors of these men.

Table 5 — Absolute number and rate of suicides per 100,000 inhabitants according to region and year. Brazil, 2010-2021.

Year	Deaths / Region					Rate / Region				
	North	North East	Southeast	South	Midwest	North	North East	Southeast	South	Midwest
2010	624	2,123	3,735	2,154	812	3.8	3.9	4.5	**7.7**	**5.7**
2011	692	2,297	3,900	2,156	807	4.2	4.2	4.7	**7.7**	**5.5**
2012	694	2,336	4,002	2,357	932	4.1	4.3	4.8	**8.3**	**6.3**
2013	759	2,494	3,959	2,365	956	4.5	4.5	4.7	**8.3**	**6.4**
2014	708	2,393	4,283	2,319	950	4.1	4.3	5.0	**8.0**	**6.2**
2015	881	2,540	4,323	2,494	940	5.0	4.5	5.0	**8.6**	**6.1**
2016	826	2,722	4,249	2,602	1,034	4.7	4.8	4.9	**8.9**	**6.6**
2017	896	2,981	4,635	2,862	1,121	5.0	5.3	5.3	**9.7**	**7.1**
2018	991	2,996	4,675	2,891	1,180	5.5	5.3	5.3	**9.7**	**7.3**
2019	1,058	3,082	4,930	3,167	1,283	5.7	5.4	5.6	**10.6**	**7.9**
2020	1,119	3,239	5,046	3,132	1,299	6.0	5.6	5.7	**10.4**	**7.9**
2021	1,152	3,298	5,400	3,198	1,290	6.1	5.7	6.0	**10.5**	**7.7**

Source: Mortality Information System (SIM).

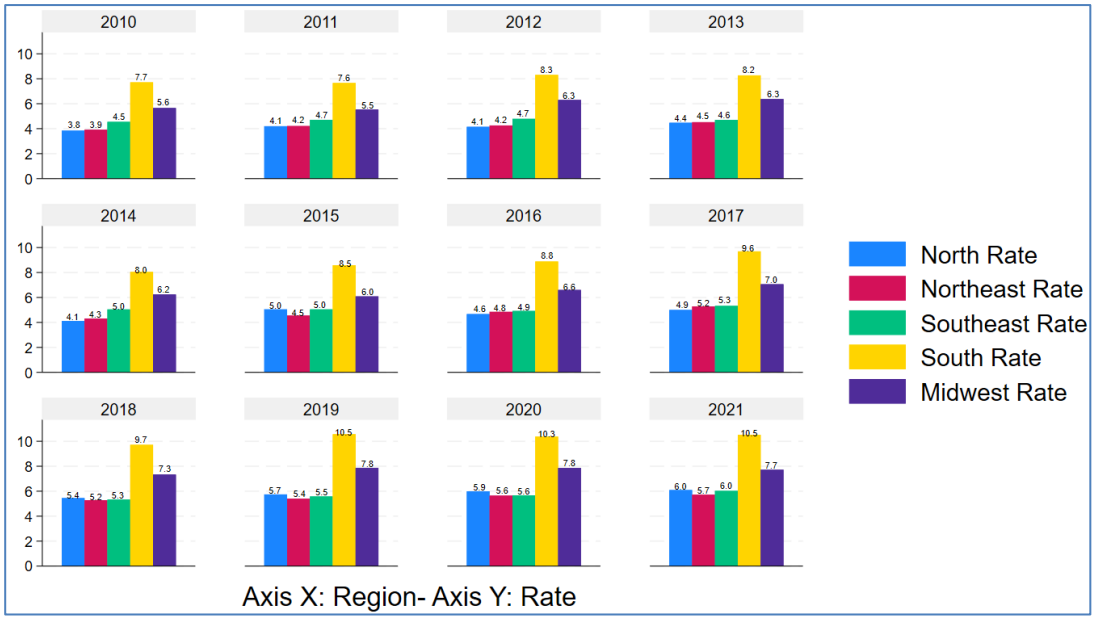

Figure 1 — Suicide rates in Brazil, according to region and year (2010-2021).

Table 6 — Poisson regression for suicides from 2010 to 2021 according to the region of Brazil.

Regions	Coefficient	Standard Error	z	P > |z|	95%CI	
North	0.0201769	0.0141573	1.43	0.154	-0.0075709	0.0479247
North East	0.0876706	0.0226087	3.88	0.000	0.0433583	0.1319828
Southeast	0.0784289	0.0190209	4.12	0.000	0.0411485	0.1157092
South	0.0170669	0.0186023	0.92	0.359	-0.0193931	0.0535268
Midwest	0.021237	0.0175248	1.21	0.226	-0.0131109	0.0555849
Constant	8.136006	0.0464319	175.22	0.000	8.045002	8.227011

95%CI: 95% confidence interval. Source: Mortality Information System (SIM).

Table 7 — Prais-Winsten regression for suicides from 2010 to 2021 in Brazil, according to gender.

Source	SS	df	MS			
Model	12742.2328	two	6371,1164			
Residual	2.35059156	9	0.26117684			
Total	12744.5834	11	1158.59849			
Rate vs. Year	**Coefficient**	**Standard Error**	**t**	**P > |t|**	**95%CI**	
Men	5.065234	0.8300204	6.1	0.000	3.187598	6.942871
Women	-5.801305	3.029466	-1.91	0.088	-12.65443	1.051823
Constant	1982,973	1.483141	1337.01	0.000	1979,618	1986,328
rho			0.0632713			

SS: sum of squares; df: degrees of freedom; MS: mean sum of squares; 95% CI: 95% confidence interval.

For Machado and Santos[18] there are still critical gaps regarding Brazilian regional differences and the numbers of suicides, such as socioeconomic and demographic issues, access to health resources, and how societies organize themselves to care for each other.

The results obtained from the Poisson regression indicate the expected increase in suicide rates by region compared to the total number of deaths in the country. The analysis identified significant associations in some regions, whereas others did not show statistical evidence of differences in suicide rates. This suggests that selective analysis of regions can be a valid approach to direct attention to areas with indications of variations in the evaluated cases.

Some of the factors mentioned above are similar to those observed during the COVID-19 pandemic, which stood out as risk factors for mental health problems and suicide itself, such as economic crisis, unemployment, social isolation, fear of death, limited access to health services, interruption of therapies, and use of psychoactive substances. In addition, Rocha et al.[22] identified symptoms of depression, anxiety, hopelessness, delirium, and hallucinations as potential for ideation and suicide attempts.

Regarding the means of perpetration of suicide, the data presented corroborate the findings by Machado and Santos[18], emphasizing hanging, strangulation or suffocation, use of firearms and intoxication. The WHO launched the Live Life guide, which suggests limiting access to firearms and pesticides, barriers at heights, and medication control as ways to combat suicide[8].

It is also worth reflecting on the quality of data available on suicide in Brazil. Even though the SIM is national and publicly accessible, it is questionable whether the filling in of the data made by the professionals is actually complete and faithful to the facts that occurred; otherwise, they could reduce the accurate dimension of this problem. The need to confirm the intention to die can confuse the data and pressure families to omit the nature of death[8,20].

Several studies in Brazil have examined suicide from epidemiological, psychological and social perspectives. In a study published in 2005[23], data related to suicide in Brazil between 1980 and 2002 were analyzed. The results show that the suicide rate had increased significantly during the study period and that most cases were related to mental health problems, especially depression and substance abuse. Furthermore, the study suggests that social factors, such as unemployment and poverty, impact suicide rates in Brazil.

An additional investigation conducted in 2009 revealed geographic disparities in suicide rates in Brazil, outlining higher values in the South and Southeast regions. These areas, notably more urbanized and characterized by higher economic development, showed higher suicide rates. The researchers suggest that this phenomenon may be intrinsically linked to higher mental health problems and the burden resulting from social and economic pressures prevailing in these locations[24].

This study has limitations, such as only having data from the first two years of the pandemic and not having differentiated the rural and urban populations. In addition, limitations that could affect this study that address the increase in suicide rates in Brazil based on public information systems include:

- Unreported or underreported cases of suicide in public systems may not be reflected in the results of this study, leading to an underestimation of the true magnitude of the increase in rates.
- Changes over time in the criteria for recording, classifying, or reporting suicides can affect the comparability of data over the years, making it difficult to identify consistent trends.
- The underlying causes of suicide can be multifaceted and not fully reflected in death records, limiting our understanding of the reasons behind rising rates.
- Specific population groups may be more or less likely to be reported in information systems, creating a selection bias that distorts the analysis of rate increases.

Strategies to reduce suicide in Brazil should involve governments, health and mental health professionals, and society as a whole. The Brazilian public health system must assist in this fight, being able to accommodate patients prone to suicide.

Future studies on the diseases and sociodemographic characteristics that lead people to suicide are crucial, especially in Brazil, where the mortality rate from this cause has increased over the years.

Finally, this study lacks more data that could determine the relationship between COVID-19 cases and

the increase or decrease in suicides. Based on these results, it is essential to conduct studies with more recent variables (year 2022) to identify differences with data from new population censuses developed by the Brazilian government.

CONCLUSION

Within the scope of this study, which sought to analyze the increase in suicide rates between 2010 and 2021, a set of scientific conclusions is discernible. Over the period investigated, a notable increase in suicide rates was observed, considering the study variables, outlining a trend that raises questions about the factors underlying such an increase. The statistical analyzes including applying regression methods to measure the variables of interest, corroborated the statistical significance of the observed increase.

However, although the first two years of the pandemic have often been postulated as a potential driver of increased suicide rates, the results obtained in this study did not corroborate this hypothesis. Through in-depth and rigorous analyzes it was discerned that the first two years of the pandemic did not show a direct or statistically significant relationship with the increase in suicide cases. Therefore, although the pandemic context has generated substantial concerns about the possible impact on suicide rates, the findings of this study attest to the underlying complexity of such a relationship and the need for a more multifaceted analysis of the phenomenon's determinants.

The findings of this research highlight the importance of a holistic understanding of the dynamics that influence suicide rates, involving not only specific events but also socioeconomic, cultural, and mental health factors. Furthermore, this investigation underlines the relevance of robust and rigorous methodological approaches in analyzing complex phenomena and the need for a careful assessment of public health policy implications and preventive interventions related to suicide.

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