ORIGINAL ARTICLE

Effects of the economic recession on suicide mortality in Brazil: interrupted time series analysis

Efeitos da recessão econômica na mortalidade por suicídio no Brasil: análise com séries temporais interrompidas.

Efectos de la recesión económica en la mortalidad por suicidio en Brasil: análisis de series de tiempo interrumpido

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ABSTRACT
Objectives: to analyze trends in suicide rates in Brazil in the period before and after the start of the economic recession. **Methods:** interrupted time series research using national suicide data recorded in the period between 2012 and 2017 with socioeconomic subgroups analyses. Quasi-Poisson regression model was employed to analyze trends in seasonally adjusted data. **Results:** there was an abrupt increase in the risk of suicide after economic recession in the population with less education (12.5%; RR = 1.125; 95%CI: 1.027; 1.232) and in the South Region (17.7%; 1.044; 1.328). After an abrupt reduction, there was a progressive increase in risk for the black and brown population and for those with higher education. In most other population strata, there was a progressive increase in the risk of suicide. **Conclusions:** the Brazilian economic recession caused different effects on suicide rates, considering social strata, which requires health strategies and policies that are sensitive to the most vulnerable populations.
Descriptors: Suicide; Economic Recession; Interrupted Time Series Analysis; Public Health; Social Determinants of Health.

RESUMO
Objetivos: analisar as tendências nas taxas de suicídio no Brasil, no período antes e depois do início da recessão econômica. **Métodos:** estudo de séries temporais interrompidas utilizando dados nacionais de suicídio registrados no período entre 2012 e 2017 com análises por subgrupos socioeconômicos. Modelo de regressão quasi-Poisson foi empregado para analisar as tendências dos dados ajustados sazonalmente. **Resultados:** observou-se aumento abrupto no risco de suicídio após recessão econômica na população com menor escolaridade (12,5%; RR = 1,125; IC95%:1,027; 1,232) e na Região Sul (17,7%; 1,044; 1,328). Após redução abrupta, ocorreu aumento progressivo no risco para a população de pretos e pardos e na de maior escolaridade. Na maioria dos demais estratos populacionais, verificou-se aumento progressivo no risco de suicídio. **Conclusões:** a recessão econômica brasileira produziu efeitos diferentes nas taxas de suicídio, considerando os estratos sociais, o que demanda estratégias de saúde e políticas sensíveis às populações mais vulneráveis.
Descritores: Suicídio; Recessão Econômica; Séries Temporais Interrompidas; Saúde Pública; Determinantes Sociais de Saúde.

RESUMEN
Objetivos: analizar tendencias de tasas de suicidio en Brasil, antes y después del inicio de la recesión económica. **Métodos:** estudio de series de tiempo interrumpido utilizando datos nacionales de suicidio registrados entre 2012 y 2017 con análisis por subgrupos socioeconómicos. Modelo de regresión quasi-Poisson empleado para analizar tendencias de datos ajustados estacionalmente. **Resultados:** observado aumento abrupto en el riesgo de suicidio pos recesión económica en la población con menor escolaridad (12,5%; RR = 1,125; IC95%:1,027; 1,232) y en la Región Sur (17,7%; 1,044; 1,328). Pos reducción abrupta, ocurrió aumento progresivo en el riesgo para la población de negros y pardos y de mayor escolaridad. En la mayoría de los demás estratos poblacionales, verificado aumento progresivo en el riesgo de suicidio. **Conclusiones:** la recesión económica brasileña produzco efectos diferentes en las tasas de suicidio, considerando los estratos sociales, lo que demanda estrategias de salud y políticas sensibles a poblaciones más vulnerables.
Descriptores: Suicidio; Recesión Económica; Análisis de Series de Tiempo Interrumpido; Salud Pública; Determinantes Sociales de la Salud.

INTRODUCTION

Economic recessions are responsible for social transformations and influence the health indicators of populations in several ways. In the last decade, several countries experienced periods of economic recession and developed studies to analyze their impact on health, considering the morbidity and mortality of populations[1-2]. Some of these studies have associated suicide mortality with economic crises, especially among male populations[3] and in countries with relatively low levels of unemployment prior to periods of recession[4-5].

In addition to unemployment, other aspects may be related to the effects of economic recessions and the increase in suicide rates. Some factors include job insecurity and salary reductions and their effects on family life associated with social isolation[6]. Few studies have explored the effects of economic recessions on suicide in developing countries after periods of economic growth, especially in Latin America. Another aspect seldom explored in the literature is how economic crises affect different population groups in societies with a high degree of inequality.

Between 2002 and 2015, Brazil developed policies aimed at reducing poverty and social inequality[7]. As of 2007, the country's economy showed an upward trajectory, with slight interruption in 2009, when it was negatively impacted by the international economic crisis. This process of increasing income and reducing inequalities lasted until the mid-2010s. In 2014, the economy showed two consecutive quarters of deceleration; however, this reduction was reversed in the second half of the year and did not impact employment and income levels[8]. In 2015 and 2016, Brazil had a slowdown in its Gross Domestic Product (GDP) in all quarters, representing a long period of economic recession, with a reduction in the average worker's income and in the level of employment[8].

A study carried out with national data suggested that, between 2012 and 2017, the average mortality rate in adults increased by 8%, associated with an increase in the unemployment rate and an increase in all-cause mortality, especially those related to cancer and cardiovascular diseases, reinforcing that the economic recession contributed to the increase in mortality[9]. Another study revealed that there was an increase in suicide rates from 2014 onwards, especially in some regions of the country[10], but did not describe differences in different social strata. Considering the period that includes the beginning of the economic recession in Brazil, our objective was to analyze the trend of suicide rates through an interrupted time series. The hypothesis was that, in addition to a change in the trend of the suicide mortality rate after the economic recession, there are different effects on populations according to their socioeconomic characteristics.

OBJECTIVES

To analyze the trend in suicide rates in Brazil considering the effects of the economic recession on different subgroups.

METHODS

Ethical aspects

The research project was submitted to the local ethics committee and received a favorable opinion.

Study design, period, and location

This is an interrupted time series (ITS) study, observing the behavior of suicide rates in Brazil before (2012 to 2014) and after the beginning of the economic recession (2015 to 2017), based on a similar research methodology carried out in Spain in 2013[11]. The guidelines and recommendations of the STROBE tool[12] were followed in the writing of the manuscript.

Population, inclusion and exclusion criteria

Deaths by suicide in the population over 25 years old were considered for the study, also considering the variables sex, race/color, and education. This age group was defined considering the age expected to complete higher education, so as not to bias the analysis of subgroups by educational level.

Study protocol

In an ITS analysis, we seek to observe the longitudinal effect of an intervention on a given outcome, considering an already expected trend in the data (counterfactual trend), which is interrupted by an intervention in a known period. In this study, we want to observe whether the economic recession changed the counterfactual trend of suicide mortality, so that the monthly rate increases or decreases considering the period before the economic recession (if this event had not occurred). For the purposes of this study, the years 2012 to 2014 were considered as the period before the economic recession. In this interval, the annual GDP was positive, there was an increase in the average workers' income and the average expenditure of families, as well as low unemployment rates[13].

The period from January 2015 to December 2017 was considered the comparison period in this study, aiming to identify the early and late effects of the economic recession, as recommended by the literature[14]. The years 2015 and 2016 showed a GDP contraction in all quarters, an increase in unemployment, and a drop in worker income. In 2017, despite an increase in the GDP, reduction in worker income, low family spending, and high unemployment rates remained[13]. The quarterly changes in the real GDP in Brazil during the study period were analyzed, as well as the quarterly unemployment rate (percentage of people in the workforce who were unemployed), and the quarterly discouraged rate (percentage of people who gave up looking for a job because of no expectations of succeeding), and the denominator of both was the economically active population for the year of analysis. Data was obtained from the *Pesquisa Nacional por Amostra de Domicílios* (National Household Sample Survey) - PNAD and from the *Sistema de Contas Nacionais Trimestrais* (Quarterly System of National Accounts) - SCNT (https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9300-contas-nacionais-trimestrais.html?=&t=what-is).

This study used monthly suicide rates[15], analyzing a total of 72 months. Data on suicide were extracted from the Mortality Information System (MIS), records of deaths due to external causes, available at the Unified Health System's Computing Department (DATASUS) (http://datasus.saude.gov.br/). In the International Classification of Diseases (ICD-10), 10th revision, deaths by suicide are coded as X60-X84 (self-inflicted injuries). In Brazil, it is determined

after judicial review when the possible cause of death is considered accidental or violent.

Interrupted time series analyses were performed for the general population and subgroups to identify variations in the impact of the economic crisis in populations with different socioeconomic characteristics. The analyses were performed by comparing the suicide rates of subgroups categorized according to education level, sex, race/color, and different age groups. In addition, suicide rates were also observed for the regions of the country. Education was defined as follows: 1) no formal schooling or even elementary school (complete or incomplete); 2) middle/high school (complete or incomplete); and 3) graduation or higher. The level of education was chosen as an indirect indicator of the socioeconomic level[16].

The death records use Brazilian skin color classification to record color/race. However, for the purposes of this study, only blacks, browns, and whites were considered, as they represented 96.22% of the records in the information system. Black and brown individuals were grouped into the same category to minimize classification errors in the death records for these two groups, the same pattern used for population estimation in the Brazilian database[13]. The denominator referred to the estimated population, considering each year of the study (2012 to 2017), for each variable, based on data obtained from the PNAD[13]. To allow comparison over time, the values were converted into rates per 100,000 inhabitants and standardized using the direct method.

Analysis of results and statistics

The suicide mortality rate was analyzed by adjusting the segmented regression model, including time as covariates, the variable of interest equal to 1 (after the beginning of the recession) and 0 (before the recession), and the interaction between these two variables (time and economic recession), in order to assess the effects of changes in data trends considering the period before and after the beginning of the recession. To verify the autocorrelation of the residuals and select the most suitable models, the sample and partial autocorrelation function graphs (ACF and partial ACF) were used[17].

A quasi-Poisson regression model was employed. The choice is justified because the quasi-Poisson allows the adjustment of data so that the variation is proportional rather than equal to the mean[18]. The Level and slope change model[19] was used to simultaneously analyze the abrupt level change, after the intervention, in suicide rates, and the gradual change in the trend of the rates with the interaction between time and economic recession, according to mathematical notation (I):

$$Y_t = \beta_0 + \beta_1 T + \beta_2 X_t + \beta_3 (T - T_0) \cdot X_t \ (\mathrm{I})$$

T represents the time in months elapsed since the beginning of the study (January 2012 to December 2017), it is related to the intervention, being a *dummy* variable, referring to the period before the economic recession (t = 0) or after the beginning of the economic recession (t = 1) — in this case, as of month 36 (January 2015). Yt refers to suicide mortality rates in month t. β_0 represents the reference level at $T = 0$; β_1 deals with the change in observations associated with an increase in the unit of time (counterfactual trend), and β_2 concerns the change in level, considering suicide rates, after the intervention (economic recession). β_3 indicates the

change in slope after the intervention (with T_0 as the intervention start time)[18-19]. Adjustments were made for the duration of the month and considering seasonal effects, using Fourier terms (in this case, two pairs of sine and cosine) and a duration of 12 months[17].

To calculate the Relative Risk (RR) considering the significance level of $p < 0.05$ and the confidence intervals (95%CI), the quasi-Poisson regression model was initially used in order to obtain the coefficients for the two models; and, afterwards, the calculations considering the two models analyzed. The analyses were performed using the tsModel and Epi statistical packages of R-3.6.1.

RESULTS

There was a reduction in the growth speed of Brazil's quarterly GDP in 2014, a decrease that intensified in 2015 (Figure 1), starting a period of contraction that lasted until the third quarter of 2016. The reversal of the downward trend happened gradually, and the GDP only showed positive variation in 2017.
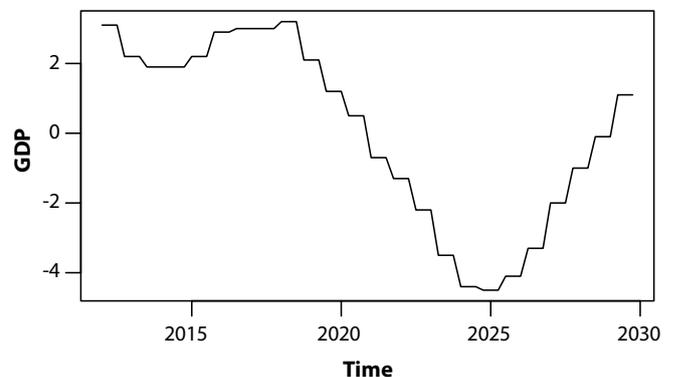

Figure 1 – Quarterly change in Gross Domestic Product, Brazil, 2012 to 2017

In line with these results, it was found: an increase in the unemployment rate (percentage of unemployed people in the workforce) as of the first quarter of 2015, which only started to drop in the second quarter of 2017 (Figure 2); and the increase in the rate of discouraged people from the third quarter of 2015 (Figure 2), revealing the late effects of the economic recession.
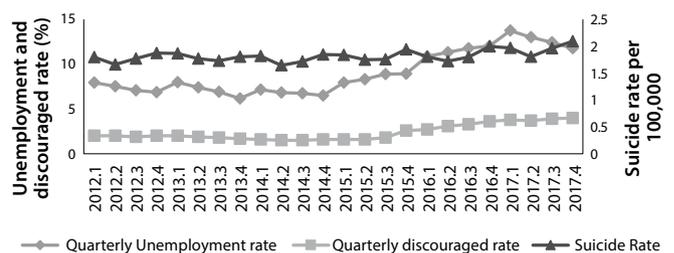

Figure 2 – Quarterly unemployment, discouragement, and suicide rate, Brazil, 2012 to 2017

Table 1 presents the mortality rates for every 100 thousand inhabitants, considering the time frame of the study, in the general population and in the different subgroups. There were 55,040 deaths from suicide in the population aged 25 years and over between 2012 and 2017. Regarding the completeness of the data obtained from the information system, compared to the study variables, information about sex was available in 55,028 of the records (99.98%);

information about race/color, in 53,460 (97.13%); and education, in 41,681 (75.73%). The suicide mortality rate in the general population showed small variations in the pre-crisis period and then an increasing trend between 2015 and 2017 (Table 1). This behavior was similar in the populations: male, white, black, and brown, over 46 years old and with higher education. The female population and those with high school education maintained nearly stable annual suicide mortality rates. Populations with up to elementary education, over 64 years of age, and those in the southern region of the country were the ones that showed a downward trend in annual mortality rates from suicide in the period before the crisis (Table 1). The population aged between 24 and 45 years was the only subgroup in which there was a slight increase in the annual suicide rate (Table 1).

The results of the model used in the study (Table 2) show that, after the onset of the economic recession, there was a progressive increase, over time, in the risk of suicide of 0.3% in the general population (RR = 1.003; 95%CI: 1.002; 1.006), 1.10% in the population of the Southeast Region (RR = 1.011; 95%CI: 1.000; 1.031), 0.4% in the male population (RR = 1.004; 95%CI: 1.000; 1.008), and 0.4% in the white population (RR = 1.004; 95%CI: 1.000; 1.008). There was also a progressive increase in the subgroup with an elementary school education level (RR = 1.004; 95%CI: 0.997; 1.011), as well as in the subgroup aged between 46 and 64 years (RR = 1.004; 95%CI: 1.000; 1.008), and in the subgroup with incomplete or complete graduation (RR = 1.007; 95%CI: 1.001; 1.013).

No significant variations of progressive change in trend were observed in the female population, in the populations of the North, South, Northeast, and Midwest regions, nor in the populations aged between 25 and 45 years and over 64 years of age, nor in the population with middle/high-school education.

Considering abrupt increase, the populations with up to elementary education and in the southern region of the country showed, respectively, an increase of 12.5% (RR = 1.125; 95%CI: 1.027; 1.232) and 17.7% (RR = 1.177; 95%CI: 1.044; 1.328) on the risk of suicide mortality after the onset of the economic recession. Two populations (black or brown race/color and population with higher education) initially had an abrupt reduction in suicide rates, which were reverted to a progressive increase over time and an increase in relative risk (Table 2).

Table 1 - Annual suicide rates per 100,000 inhabitants, Brazil, 2012 to 2017

Population	2012		2013		2014		2015		2016		2017	
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
Brazil	8,504	7.11	8,733	7.17	8,778	7.02	9,258	7.29	9,489	7.31	10,278	7.84
Regions												
North	474	5.67	496	5.72	449	5.02	594	6.48	541	5.71	605	6.20
Northeast	1,885	6.07	2,025	6.40	1,942	5.97	2,080	6.28	2,205	6.51	2,424	7.07
Southeast	3,386	6.33	3,385	6.24	3,696	6.64	3,686	6.56	3,648	6.36	3,941	6.84
South	2,037	11.31	2,066	11.29	1,946	10.41	2,182	11.47	2,286	11.84	2,443	12.48
Midwest	722	8.29	761	8.53	747	8.08	719	7.61	810	8.36	865	8.78
Sex												
Female	1,833	2.89	1,812	2.8	1,800	2.71	1,944	2.9	1,914	2.78	2,074	2.97
Male	6,669	11.9	6,920	12.12	6,978	11.9	7,312	12.22	7,573	12.43	8,199	13.36
Race/color												
White	4,452	7.59	4,566	7.75	4,595	7.6	4,889	8.11	4,983	8.31	5,320	8.91
Black or Brown	3,672	6.29	3,774	5.94	3,814	6.01	4,019	6.12	4,175	6.10	4,698	6.71
Age range (in years)												
Between 25 and 45	4,620	7.44	4,703	7.48	4,761	7.49	4,798	7.48	4,828	7.45	5,227	8.00
Between 46 and 64	2,699	6.85	2,835	7.01	2,801	6.76	3,090	7.29	3,218	7.42	3,511	7.94
Above 64	1,154	7.54	1,170	7.37	1,188	7.21	1,347	7.87	1,415	7.96	1,514	8.19
Education												
Elementary	2,567	3.84	1,993	2.99	1,874	2.82	1,931	2.94	1,989	3.06	2,107	3.27
Middle/High School (complete or incomplete)	1,892	5.6	1,985	5.64	1,984	5.39	2,248	5.91	2,278	5.71	2,438	5.93
Higher Education (complete or incomplete)	2,149	13.2	2,366	10.75	2,509	10.9	2,742	11.78	3,102	12.49	3,527	13.76

Table 2 - Effect of economic recession on suicide mortality rates and Relative Risks estimated through the analysis of interrupted time series and by comparison of the 2012-2014 and 2015-2017 periods, Brazil, 2012 to 2017

Variables	Post-intervention Behavior	Interpretation	RR	95% CI	p
Brazil	Level change	Not detected	1.002	0.953;1.054	0.928
	Change in trend	Progressive elevation	**1.003**	**1.002;1.006**	**0.001***
North	Level change	Not detected	1.102	0.939; 1.293	0.236
	Change in trend	Not detected	1.006	0.978; 1.034	0.995
Northeast	Level change	Not detected	1.019	0.938; 1.106	0.658
	Change in trend	Not detected	1.008	0.996; 1.021	0.105
Southeast	Level change	Not detected	1.021	0.928; 1.123	0.174
	Change in trend	Progressive elevation	**1.011**	**1.000; 1.031**	**< 0.05***
South	Level change	Abrupt elevation	**1.177**	**1.044; 1.32**8	**< 0.01***
	Change in trend	Not detected	1.007	0.992; 1.023	0.972
Midwest	Level change	Not detected	0.857	0.722; 1.017	0.078
	Change in trend	Not detected	1.014	0.992; 1.037	0.615
Male	Level change	Not detected	0.985	0.935;1.038	0.576
	Change in trend	Progressive elevation	**1.004**	1.000;1.008	**0.001***
Female	Level change	Not detected	1.054	0.962;1.155	0.260
	Change in trend	Not detected	0.997	0.994;1.001	0.085

Table 2 (concluded)

Variables	Post-intervention Behavior	Interpretation	RR	95% CI	p
Whites	Level change	Not detected	1.019	0.967;1.076	0.482
	Change in trend	Progressive elevation	**1.004**	**1.000;1.008**	**< 0.01***
Blacks and Browns	Level change	Abrupt reduction	**0.807**	**0.706;0.922**	**< 0.01***
	Change in trend	Progressive elevation	**1.004**	**0.999;1.010**	**0.001***
Between 25 and 45	Level change	Not detected	0.962	0.902; 1.027	0.247
	Change in trend	Not detected	1.003	1.000; 1.006	0.052
Between 46 and 64	Level change	Not detected	1.033	0.970; 1.101	0.307
	Change in trend	Progressive elevation	**1.004**	**1.000; 1.008**	**0.001***
Above 64	Level change	Not detected	1.087	0.983; 1.200	0.182
	Change in trend	Not detected	1.001	0.994; 1.010	0.296
Elementary School	Level change	Abrupt elevation	**1.125**	**1.027;1.232**	**< 0.05***
	Change in trend	Progressive elevation	**1.004**	**0.997;1.011**	**< 0.001***
Middle/High School (complete or incomplete)	Level change	Not detected	0.992	0.847;1.161	0.917
	Change in trend	Not detected	1.001	0.993;1.007	0.251
Higher Education (complete or incomplete)	Level change	Abrupt reduction	**0.763**	**0.670; 0.868**	**< 0.001***
	Change in trend	Progressive elevation	**1.007**	**1.001;1.013**	**< 0.001***

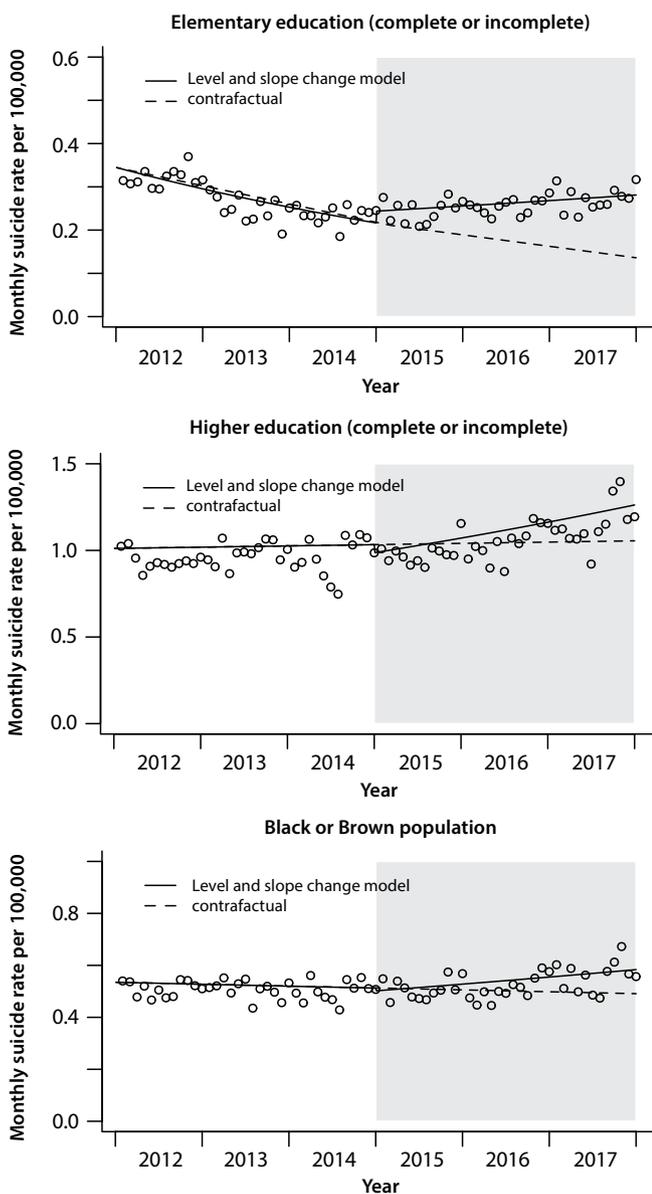*RR – Relative Risks; CI - Confidence Intervals; *p<0,05.*

Figure 3 – Monthly trend of suicide rates for populations with up to elementary school, higher education, and population of black or brown race/color, considering a level and slope change model, Brazil, 2012-2017

Figure 3 shows the graphical representation of the abrupt and progressive change analysis for the population with lower and higher educational levels, as well as for the black or brown race/color population.

DISCUSSION

The results show that, from 2015 onwards, there has been an increase in suicide rates in the general population and in several of the subgroups. For these, the variations in suicide mortality were distinct, suggesting that the effects of the economic recession were different for these groups. The increase in suicide mortality in the male population after the onset of the recession is consistent with the findings of other studies[11,20]. The absence of an association between the economic recession and the increase in suicide mortality in the female population can be attributed to differences in the social roles of men and women. Patriarchy attributes to men the role of economically supporting the family, which leads to an increase in social pressure on men in times of economic crisis[20-21]. In addition, in contexts of important changes in the social order, such as sudden growth or recessions and even unexpected catastrophes, men are more inclined to self-destruction[22-23].

Considering gender inequality and its effects on morbidity and mortality, a survey of data from 20 European Union countries, including information on recent economic crises in Europe[24], showed that, in countries with greater gender equality, the consequences of suicide in the context of economic recession has declined, especially among the male population, but not at the expense of the female population. There were no deleterious effects of gender equality standards on female suicide rates, reinforcing the need to reduce gender disparity as a form of social regulation and protection against suicide.

The results of this study indicate that the population of whites, blacks, and browns had an increase in suicide rates in the analyzed period, with the mortality rate among whites being higher than that found among blacks and browns, a finding similar to that of another historical series of previous years[25]. In the case of the black and brown population, when analyzing the model, it can be seen that initially there was an abrupt reduction in suicide rates and a trend inversion with a progressive increase over time. A possible

justification for this behavior may be related to the delayed effects of the economic recession. It appears that the greatest increase in annual suicide rates occurs from 2016 onwards, a period characterized by a deterioration in unemployment rates and an increase in the quarterly rates of discouraged people. A study carried out in Spain[14] revealed something similar, in which suicide rates initially fell, reversing this trend with an increase in the second period of the economic recession, possibly relating the delayed effect of the greater economic impact due to the initial social protection policies. In addition, data from the PNAD[13] highlight that the largest population of discouraged people in the country is composed of blacks and browns, with an increase in the percentage of discouraged blacks after the last economic recession. A study carried out in Florianópolis identified suicide as the third cause of death in the brown population in 2016[26]. Our results are relevant, as few studies have sought to analyze data related to suicide in the black/brown population at a national level[27].

The abrupt increase in the mortality rate and the risk of suicide after the recession was found in the population with less education, corroborating other studies that demonstrated the greater impact of recessions in populations of lower socioeconomic status[28-29] and an association between economic difficulties and instability related to suicidal behavior[30]. It is important to note that, in Brazil, the average income of workers with less education is much lower than that of workers with more education, which may justify a more intense and earlier effect on suicide rates. In addition to this population, an abrupt increase was also identified in the population of the southern region of the country, where, before the economic recession, there was a reduction in suicide rates. Although it has lower rates of discouragement compared to other regions of the country, the South Region was on a downward trend, which was reversed in the first quarter of 2015. The highest suicide rates in the South of the country can be explained by the combination of social, economic, cultural, psychological, and biological determinants and conditions, especially in the population of agricultural workers: there are, for example, the demanding patterns of social behavior arising from European colonization, low schooling, the use of pesticides, patriarchal relationships, in addition to the incidence of mental disorders and family history of suicide[31]. In this region, there is also evidence of a relationship between higher suicide rates and periods of difficulties in the countryside, the process of rural wage work, leasing, loss of agricultural properties, impoverishment and loss of autonomy[32].

In addition, macroeconomic measures applied (or not) by governments and other institutions, and the interruption of social protection policies, can influence the trend of the mortality rate from various causes, including suicide. Evidence of this is that countries that adopted fiscal austerity measures as political and economic reactions to the economic recession had immediate effects in increasing suicide rates[10,33-34].

The population with higher education showed an increase in suicide mortality after the beginning of the recession and continued to report the highest suicide rates by level of education over the period. Higher expectations of people with higher educational levels, potentially greater losses of income, loss of social status, and loss of long-term economic well-being may justify this finding[35].

It is important to mention that the economic recession in Brazil increased social inequalities and consisted of a moment in which policies to combat inequalities were weakened[36-37]. In addition, it can be pointed out that a period of important economic slowdown occurred in 2020, driven by the COVID-19 pandemic. There are projections of a 3% contraction in global GDP, 5.3% in Latin America, and 5.2% in Brazil[38]. As a comparison, in the Great Depression of 1929, this contraction was 5%. In this context, it is projected that, in Latin America, the number of people living in poverty will increase to 29 million; and in extreme poverty, 16 million[39]. For all these reasons, social protection policies must cover vulnerable populations against the increased risk of suicide and other health problems, also because the COVID-19 pandemic is likely to generate changes in the world of work that will penalize less educated workers, widening existing inequalities.

Study limitations

One of the limitations of this study is its methodological design, as it is difficult to objectively establish the initial period of the economic crisis, even after following the recommendations for imperfectly identifiable events[38]. Another limitation is that the economic crisis generates different impacts over time on groups with different socioeconomic characteristics, which makes it difficult to use a single period for the onset of the crisis. It is noteworthy that this is a study with aggregated data, so causality cannot be determined. Finally, future studies should analyze differences between population subgroups, identifying inflection points of the specific time series for each of these groups.

Contributions to Public Policies

This study points out important elements for vigilance considering the problem of suicide in the country. Therefore, it can assist decision-makers in planning and implementing more effective policies that consider the different vulnerabilities, needs, and intervention opportunities for different social groups.

CONCLUSIONS

The use of interrupted time series in this study made it possible to assess the immediate and longitudinal impact of the economic downturn by accounting for random monthly fluctuations and counterfactual trends, including adjustments to account for seasonality and minimizing some of the confounding factors. Suicide is a complex and multifactorial phenomenon, and the economic aspect represents only one of these dimensions. However, our results raise a warning about the need for health strategies and policies that include the expansion of mental health care in times of economic recession, especially among the most vulnerable groups.

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