



Time series of suicide mortality in a municipality in São Paulo according to epidemiological data

Série histórica de mortalidade por suicídio em município paulista segundo dados epidemiológicos

Serie histórica de mortalidad por suicidio del municipio de São Paulo según datos epidemiológicos

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ABSTRACT

Objective: To analyze the trend and epidemiological profile of suicide in a large municipality in the countryside of the state of São Paulo from 2000 to 2018. **Methods:** An ecological time-series study was conducted in 2019 to analyze suicide mortality in the city of Campinas, São Paulo, Brazil, in the period from 2000 to 2018. Data were extracted from the Mortality Information System, with the following variables being investigated: sex, age, race, death category, month, and place of occurrence. The data were analyzed by number of deaths/death rates and by the standardized death rates for age range and sex. Simple linear regression models were estimated for the number of deaths and year. In the analysis of the rate of deaths by suicide for the other study variables, the chi-square test was used with a significance level of 5%. **Results:** In the analyzed period, there were 904 deaths from suicide, with a significant increase over the years and an overall rate of 3.20/100,000 inhabitants (2000) and 5.42/100,000 inhabitants (2018). A significant increase was also observed for males, with 5.30/100,000 inhabitants (2000) and 8.45/100,000 inhabitants (2018), age ranges from 20 to incomplete 40 years, with 3.53/100,000 inhabitants (2000) and 6.84/100,000 inhabitants (2018), and 40 to incomplete 60 years, with 4.69/100,000 inhabitants (2000) and 7.61/100,000 inhabitants (2018). Most deaths occurred among White people (673; 74.9%), by hanging (503; 55.6%), at home (524; 58.0%), in September (93; 10.3%) and December (92; 10.2%). **Conclusion:** There was a growing increase in suicide rates in Campinas in the period analyzed, with the victims being predominantly males, adults, White individuals, and deaths by hanging and occurring at home.

Descriptors: Mortality; Suicide; Time Series Studies; Epidemiology; Public Health.

RESUMO

Objetivo: Analisar a tendência e o perfil epidemiológico do suicídio, em um município de grande porte do interior do estado de São Paulo, no período de 2000 a 2018. **Métodos:** Estudo ecológico de série temporal realizado em 2019 que analisou a mortalidade por suicídio na cidade de Campinas, São Paulo, Brasil, no período de 2000 a 2018. A coleta ocorreu por meio de dados do Sistema de Informação sobre Mortalidade, sendo as variáveis: sexo, idade, raça, categoria do óbito, mês e local de ocorrência, com dados analisados pelo número/taxa de óbitos e taxas de óbitos padronizadas por faixa etária e sexo. Estimaram-se modelos de regressão linear simples para número de óbitos e ano. Na análise da proporção de óbitos por suicídio e demais variáveis estudadas utilizou-se teste de qui-quadrado com significância de 5%. **Resultados:** Ocorreram 904 óbitos por suicídio, com aumento significativo ao longo dos anos e taxa geral de 3,20/100.000 hab. (2000) e 5,42/100.000 hab. (2018). Observou-se aumento no sexo masculino 5,30/100.000 hab. (2000) e 8,45/100.000 hab. (2018), faixas etárias de 20 a 40 incompletos com 3,53/100.000 hab. (2000) e 6,84/100.000 hab. (2018) e de 40 a 60 incompletos com 4,69/100.000 hab. (2000) e 7,61/100.000 hab. (2018). A maioria dos óbitos ocorreu com pessoas brancas (673; 74,9%), por enforcamento (503; 55,6%), em domicílio (524; 58,0%), em setembro (93; 10,3%) e dezembro (92; 10,2%). **Conclusão:** Houve crescente aumento das taxas de suicídios em Campinas no período analisado, sendo as vítimas predominantemente homens, adultos, brancos, por enforcamento e realizado em domicílios.

Descritores: Mortalidade; Suicídio; Estudos de Séries Temporais; Epidemiologia; Saúde Pública.



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RESUMEN

Objetivo: Analizar la tendencia y el perfil epidemiológico del suicidio de un gran municipio del interior del estado de São Paulo en el período entre 2000 y 2018. **Métodos:** Estudio ecológico de serie temporal realizado en 2019 que analizó la mortalidad por suicidio de la ciudad de Campinas, São Paulo, Brasil, en el período entre 2000 y 2018. La recogida de datos se dio a través del Sistema de Información de Mortalidad con las siguientes variables investigadas: sexo, edad, raza, categoría del óbito, mes y sitio de ocurrencia. Se analizaron los datos por el número/ la tasa de óbitos y las tasas de óbitos estandarizadas por la franja de edad y el sexo. Se ha estimado modelos de regresión lineal simple para el número de óbitos y el año. Se utilizó la prueba de chi-cuadrado para el análisis de la proporción de óbitos por suicidio y las demás variables con el nivel de significación del 5%. **Resultados:** En el período analizado ocurrieron 904 óbitos por suicidio con el aumento significativo a lo largo de los años y la tasa general de 3,20/100.000 hab. (2000) y 5,42/100.000 hab. (2018). Se observó también el aumento significativo para el sexo masculino de 5,30/100.000 hab. (2000) y 8,45/100.000 hab. (2018), las franjas de edad entre los 20 y los 40 años incompletos de 3,53/100.000 hab. (2000) y 6,84/100.000 hab. (2018) y entre los 40 y los 60 incompletos de 4,69/100.000 hab. (2000) y 7,61/100.000 hab. (2018). La mayoría de los óbitos se dio de personas del color blanco (673; 74,9%), por ahorcamiento (503; 55,6%), en el domicilio (524; 58,0%), en septiembre (93; 10,3%) y diciembre (92; 10,2%). **Conclusión:** Hubo un creciente aumento de las tasas de suicidios de Campinas en el período analizado de víctimas predominantemente hombres, adultos, blancos, por ahorcamiento y realizado en sus domicilios.

Descriptor: Mortalidad; Suicidio; Estudios de Series Temporales; Epidemiología; Salud Pública.

INTRODUCTION

Suicide is defined as one's act of intentionally and voluntarily taking one's own life, that is, the act of deliberately killing oneself⁽¹⁻³⁾. Suicide is, unfortunately, a worldwide phenomenon, and data from the World Health Organization (WHO) reveal that about 800,000 people die due to suicide every year, resulting in a global average rate of 10.6 per 100,000 inhabitants (15.0 for men and 8.0 for women)⁽⁴⁾, with an expected increase in the coming decades⁽⁵⁾.

According to WHO, 78% of global suicides occur in low- and middle-income countries⁽¹⁾, with Brazil ranking eighth in absolute number of suicides⁽⁴⁾. The last bulletin released by the Ministry of Health for the years 2011 through 2017 recorded 80,352 deaths by suicide in the population aged 10 years and over, with 21,790 (27.3%) occurring in people aged 15-29 years and 17,221 (79.0%) among men⁽⁶⁾. Thus, comparing the rates presented in the 2017 epidemiological bulletin⁽⁶⁾ and the latest data available in the Mortality Information System (*Sistema de Informação sobre Mortalidade – SIM*), the rates for 2011, 2015 and 2019 were, respectively, 5.3/100 thousand inhabitants, 5.7/100 thousand inhabitants, and 6.4/100 thousand inhabitants⁽⁷⁾.

Brazil and other countries, guided by the WHO Mental Health Action Plan⁽⁸⁾, committed to a 10% reduction in their suicide rates by 2020 (considering suicide rates in 2012 or 2013 as baseline). A study carried out with the aim of analyzing the time series of suicide rates in Brazil and its regions (1997–2015) and comparing the estimated suicide rates projected for 2020 with the goal of the World Health Organization's (WHO) Mental Health Health Action Plan concluded that most Brazilian states showed a stable or increasing trend in rates and that they would not reach the reduction recommended by the WHO until 2020⁽⁹⁾.

The epidemiological distribution of suicide depends on a complex set of factors, including sociodemographic, genetic, psychological, cultural, social and economic factors^(1,2,8,10). People who committed suicide, most of the time, had diagnosable mental disorders, and suicidal behavior and suicide are more frequent in individuals with depression, personality disorder, alcoholics and individuals with schizophrenia^(2,11). There are also physical illnesses that are associated with suicide, such as neurological ones (epilepsy, spinal or brain injury, and stroke), cancer, HIV and AIDS⁽¹¹⁾.

Risk factors for suicide go beyond individual issues, such as those associated with the health system and society, where difficulties in accessing health care and receiving necessary care stand out; the easy availability of means used to commit suicide; the sensationalism of the media in relation to the theme, increasing the risk of imitating suicidal acts; in addition to the difficulty generated by stigma for those who want to seek help⁽¹⁾. However, suicide can be avoided – at least partially – by restricting access to means of suicide, training physicians and primary care professionals to identify people at risk, assess and manage crises, and provide adequate follow-up^(11,12), and addressing how the phenomenon is reported by the media⁽¹²⁾.

For national responses to be effective, a comprehensive multisectoral suicide prevention strategy focused on mental health promotion is needed. This action requires collaboration from various public and private sectors of

society, including the health, education, work, justice, and other sectors, as well as those responsible for laws, media and politics⁽¹⁾. Brazil, concerned with the growth of suicide, launched in 2006 the 1st Ordinance that deals with the subject, establishing the National Guidelines for the Prevention of Suicide and thus guiding the Ministry of Health's strategies for acting towards and tackling the phenomenon⁽¹³⁾. After the issuance of this Ordinance, other initiatives were developed to systematize the conduct to be taken by health services, the improvement of access and user embracement, and the monitoring of individuals at all levels of health care⁽⁴⁾. In 2006, there was the creation of a manual aimed at professionals from mental health teams, with guidelines on how to carry out early detection of conditions associated with suicidal behavior, initial management of people at risk, and preventive measures. In 2011, Ordinance No. 3.088/2011 was issued to establish the Psychosocial Care Network (*Rede de Atenção Psicossocial – RAPS*), which aims at the creation, expansion and articulation of mental health care facilities for population groups with greater vulnerability to the disease, with services ranging from monitoring and guidance within primary care to urgent and emergency care under the coordination of the Psychosocial Care Centers (*Centros de Atenção Psicossocial – CAPS*). In 2017, an agenda of strategic actions was created for the Surveillance and Prevention of Suicide and Health Promotion in Brazil between 2017 and 2020, with the aim of expanding and strengthening health promotion, surveillance, disease prevention and comprehensive care initiatives related to suicide. Also in 2017, Ordinance No. 3,479 established the committee for the preparation and operationalization of the National Plan for the Prevention of Suicide in Brazil in line with the National Guidelines for the Prevention of Suicide and the Organizational Guidelines for Health Care Networks, which had as some of its objectives the situational diagnosis of the situation in the country regarding suicide and its outcomes, the articulation of the implementation of the National Plan for the Prevention of Suicide in Brazil, and the monitoring and evaluation of the plan⁽⁴⁾.

Carrying out situational diagnosis of suicide and establishing hypotheses about the problem, such as the most vulnerable population group, place of greatest occurrence, and behavior in relation to time, is essential to support the planning of preventive actions in the various facilities of the health care network, especially within primary care.

Thus, this study aimed to analyze the trend and epidemiological profile of suicide in a large city in the countryside of the state of São Paulo from 2000 to 2018.

METHODS

This is an ecological time-series study carried out in 2019 to analyze the mortality from suicide in Campinas, São Paulo, Brazil, from 2000 to 2018. Data on suicide cases in the municipality were selected from the Mortality Information System (*Informação sobre Mortalidade – SIM*) provided by the data tabulator (TABNET-DATASUS) of the Campinas Municipal Health Secretariat⁽¹⁴⁾. The municipality was selected because the researchers are affiliated with a Medical School in the city of Campinas and have roles in the municipal health care network. The municipality's data tabulator generates disaggregated data per health centers of residence; hence, in addition to knowing the epidemiological profile of this problem, it is also possible to identify areas of greater vulnerability and that deserve greater attention from researchers for the development of health promotion actions. According to data from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*), Campinas is located 99 kilometers northwest of the capital of the state of São Paulo and has an estimated population (2020) of 1,213,792 inhabitants, a territorial area of 794,571 km², and demographic density of 1,359.60 inhabitants/km²⁽¹⁵⁾.

The determination of the time series (2000 – 2018) was based on the years for which data were available on SIM at the time of data collection (full year), in July 2019. We decided to collect data in this month because we thought there would be enough time for potential corrections in the data already entered. The database on TABNET – DATASUS Campinas is updated monthly, and corrections can be made to the data already entered. It is also possible to enter new records. Therefore, information obtained from the database is subject to review and may be modified and updated.

For the study, we selected deaths whose underlying cause was “intentionally self-inflicted injuries” (X60–X84), as per the International Statistical Classification of Diseases and Related Health Problems – 10th Revision (ICD 10)⁽¹⁶⁾. We also collected data on the following variables: sex, age, race/skin color, death category (ICD 10), month and place of occurrence.

The variable age was stratified by age groups, namely: adolescence (< 20 years), young adulthood (20 to incomplete 40 years), middle age (40 to incomplete 60 years) and older adults/old age (≥60 years). These classifications take into account the phases of the life cycle and characteristics of each phase⁽¹⁷⁾.

The data on the variables selected for this study were collected by one of the researchers, with experience in research using secondary data and, in particular, with data generated by information from the Department of

Informatics of the Unified Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS*). In addition, there was a second verification of the data to check their veracity carried out by the researcher herself, which was later stored in an Excel spreadsheet until statistical analysis.

Initially, we analyzed the data on the absolute number of deaths extracted from SIM and the crude mortality rates per 100,000 inhabitants. These were calculated taking into account the number of deaths in the residing population at a given time divided by the total residing population in the same period of time⁽¹⁸⁾.

The quantification of the residing population (denominator of the rates) was done using data extracted from TABNET-DATASUS Campinas under the item “Demographics”. These census estimates were provided by the State Data Analysis System Foundation (*Fundação Sistema Estadual de Análises de Dados – SEADE*)⁽¹⁴⁾, which provides data on the population grouped by sex and age range.

Next, the death rates by age range and sex were standardized by the direct or fixed-base method⁽¹⁹⁾, considering the population of Brazil in 2010 (Census) as a reference⁽²⁰⁾. Adjusting the mortality rate allows to minimize the effect of age and sex differences between population groups (or in the same population group at different periods), so that time differences cannot be attributed to these characteristics.

After that, a simple linear regression analysis was performed for the number of deaths and rates per year⁽²¹⁾. Regression models were estimated as $Y = \alpha + \beta X$, where Y is the response variable (deaths), X is the year, α is the linear coefficient, the intercept, that is, the point where the line cuts the ordinate axis (vertical axis), and β is the slope of the line. The null hypotheses $\beta=0$ were tested considering that a statistically significant and positive β indicates a trend of increasing death over time and a statistically significant and negative β indicates a decreasing trend of death over time. The coefficients of determination of the models were also calculated, that is, we measured how much of the variation in the number of deaths is explained by the estimated regression model. This measure can vary from zero to one and is used as an indication of the adequacy of the regression model. Thus, models were estimated for the general population and by age range and sex.

To analyze whether the proportion of deaths from suicide differs across months of the year, race/color, category of death (ICD10) and place of occurrence, the chi-square test for adherence was used⁽²¹⁾. The tested null hypotheses were presented as $H_0: p_1 = p_2, \dots, p_k$, where p is the probability of each category i , $i = 1, \dots, k$. This analysis compared the proportions of deaths in different months of the year, different races/skin colors, ICD10 and place of occurrence throughout the time series, with the null hypotheses tested for each variable: H_0 the proportion of deaths per month of the year does not vary by year; H_0 the proportion of deaths by race/skin color does not vary by year; H_0 the proportion of deaths by ICD10 does not vary by year; H_0 the proportion of deaths by place of occurrence does not vary by year. These data were analyzed on R^{*}⁽²²⁾ software, with a significance level set at 5%.

It is known that SIM data are disclosed and made available on TABNET-DATASUS. Hence, they are in the public domain and the identities of the victims whose records are in the analyzed databases cannot be accessed. In addition, and in conclusion, consent for this project was waived by the Research Ethics Committee of the São Leopoldo Mandic College (*Faculdade São Leopoldo Mandic*) (Approval No. 2018/009).

RESULTS

Between 2000 and 2018, 904 deaths by suicide were registered in Campinas, with a significant increase over the years, both in absolute numbers and in the rate of deaths. The increase can be observed in Table I by the p value ($p < 0.000$) and the slopes that are positive, that is, the null hypotheses that these coefficients are equal to zero are rejected. In addition, they are positive when indicative of a significant increase in deaths from suicide over time.

Comparing the beginning (2000), middle (2009) and end (2018) of the analyzed time series in relation to the absolute number of deaths and death rates (crude mortality rates), we observed, respectively: 31, 40 and 65 ($p < 0.000$); 3.20/100,000 inhabitants, 3.73/100,000 inhabitants, and 5.42 in 100,000 inhabitants ($p < 0.0001$). There was also a relevant increase in standardized mortality rates over time, with overall sex-standardized suicide rates of 3.18/100,000 inhabitants in 2000, 3.69/100,000 inhabitants in 2009 and 5.41/100,000 inhabitants in 2018 ($p < 0.0001$); when standardized by age range, the rates were 3.54/100,000 inhabitants in 2000, 4.26/100,000 inhabitants in 2009 and 5.46/100,000 inhabitants in 2018 ($p = 0.0008$). And when standardized by sex and age range, the rates were 3.53/100,000 inhabitants in 2000, 4.21/100,000 inhabitants in 2009 and 5.45/100,000 inhabitants in 2018 ($p = 0.0007$). (Table I).

Table I - Number of deaths and death rates by suicide (deaths per 100,000 inhabitants) in the city of Campinas per year (2000 to 2018). Campinas, São Paulo, 2019.

Year	Number of deaths	Rates (deaths per 100,000 inhabitants)			
		Not standardized	Standardized by sex	Standardized by age range	Standardized by sex and age range
2000	31	3.20	3.18	3.54	3.53
2001	34	3.47	3.45	3.71	3.69
2002	36	3.63	3.61	3.81	3.79
2003	36	3.59	3.56	3.84	3.82
2004	31	3.05	3.02	3.40	3.37
2005	35	3.40	3.39	3.83	3.82
2006	42	4.04	4.02	4.51	4.49
2007	52	4.95	4.92	5.56	5.52
2008	57	5.37	5.35	5.96	5.94
2009	40	3.73	3.69	4.26	4.21
2010	53	4.91	4.91	4.91	4.91
2011	52	4.77	4.77	4.77	4.77
2012	46	4.17	4.17	4.18	4.18
2013	49	4.40	4.40	4.41	4.41
2014	58	5.16	5.16	5.17	5.17
2015	64	5.64	5.63	5.66	5.66
2016	58	4.94	4.94	4.96	4.96
2017	65	5.47	5.47	5.50	5.50
2018	65	5.42	5.41	5.46	5.45
Linear regression:					
Linear coefficient (α)	-3741.32	-247.87	-250.84	-200.24	-202.97
Slope coefficient (β)	1.89	0.12	0.13	0.10	0.10
R²	0.81	0.66	0.68	0.51	0.52
p-value	<0.000	<0.0001	<0.0001	0.0008	0.0007

Source: SIM: Sistema de Informação sobre Mortalidade (Mortality Information System); TABNET-SMS. Campinas, São Paulo. *deaths per 100,000 inhabitants

Linear regression models Y (deaths) = $\alpha + \beta \times \text{year}$ and R^2 : Coefficient of determination of the regression model (ranging from 0 to 1, the closer to 1, the better the model fit) were estimated, and the null hypotheses $H_0: \beta=0$ were tested.

The analysis of standardized death rates for each sex and age range is presented in Table II. In view of the large volume of data, we decided to present in a table only the standardized rates, but the crude mortality rates by sex and age range were also analyzed. The analyses showed a significant increase in the rate over time for males, with 5.30/100,000 inhabitants in 2000, 6.66/100,000 inhabitants in 2009 and 8.45/100,000 inhabitants in 2018 ($p < 0.0001$). This increase of 1.21/100,000 inhabitants in 2000, 0.91/100,000 inhabitants in 2009 and 2.58/100,000 inhabitants in 2018 ($p = 0.4758$) is not relevant for females.

As for age range, although the highest rates were observed in older adults (7.55/100,000 inhabitants in 2000, 8.36/100,000 inhabitants in 2009 and 8.26/100,000 inhabitants in 2018), these variations were expressive over time ($p = 0.1188$). In the age ranges of 20 to incomplete 40 years old (3.53/100,000 inhabitants in 2000, 4.76/100,000 inhabitants in 2009 and 6.84/100,000 inhabitants in 2018, $p = 0.0091$) and in the age ranges of 40 to incomplete 60 years (4.69/100,000 inhabitants in 2000, 6.08/100,000 inhabitants in 2009 and 7.61/100,000 inhabitants in 2018, $p = 0.0335$), there was a significant growth in the period of the time series. In adolescents (<20 years), there was also no considerable variation over time, with crude mortality rates of 0.62/100,000 inhabitants in 2000, no records in 2009 and 0.31/100,000 inhabitants in 2018 ($p = 0.7746$). (Table II).

In the analysis of standardized death rates, considering sex and age range, we found that the significant increase over the years occurred among men aged between 20 and 40 years old (5.97/100,000 inhabitants in 2000, 8.55/100,000 inhabitants in 2009 and 11.03/100,000 inhabitants in 2018, $p=0.0027$) and from 40 to 60 years old (6.89/100,000 inhabitants in 2000, 11.75/100,000 inhabitants in 2009, and 10.51/100,000 inhabitants in 2018, $p=0.0110$) (Table II). These significant increases are observed by the p values that are below the established level of significance ($p<0.05$) and by the positive slopes.

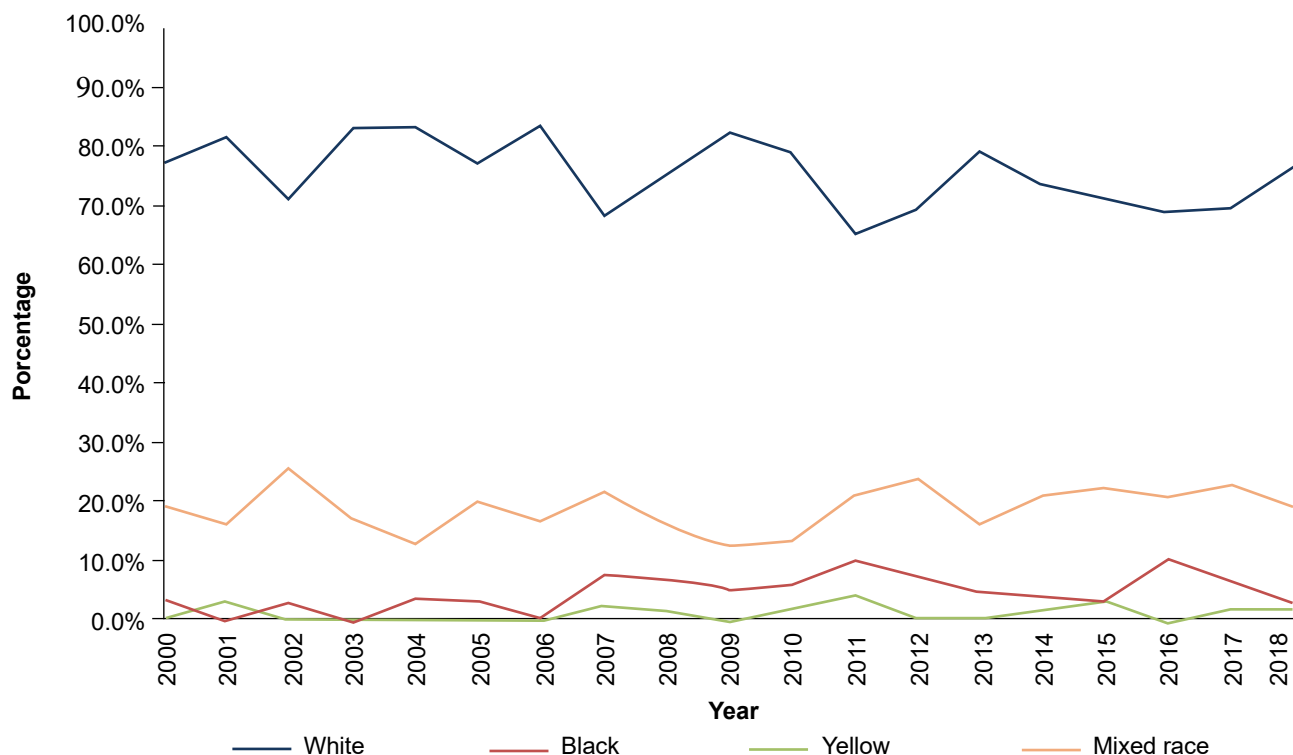
Table II - Standardized rate of deaths by suicide (deaths per 100,000 inhabitants) in the city of Campinas, São Paulo, per year (2000 to 2018) by sex and age range. Campinas, São Paulo, 2019.

Year	Males				Females			
	< 20 years	20-40 years	40-60 years	≥ 60 years	< 20 years	20-40 years	40-60 years	≥ 60 years
2000	1.23	5.97	6.89	15.06	0.00	1.16	2.69	1.89
2001	1.21	7.66	7.80	7.50	0.62	2.29	1.78	1.88
2002	2.38	6.39	7.73	9.95	1.21	2.83	1.76	0.00
2003	2.34	6.30	6.67	9.85	0.60	2.80	1.76	3.76
2004	0.58	4.53	12.31	9.87	0.00	2.21	0.87	0.00
2005	0.57	5.59	9.38	4.91	0.00	1.64	5.16	5.59
2006	0.56	7.18	9.30	7.34	0.00	3.24	5.13	5.58
2007	0.55	8.74	11.98	19.49	0.56	3.21	5.09	1.85
2008	0.55	10.26	7.27	16.86	0.56	4.24	10.10	1.85
2009	0.00	8.55	11.75	14.48	0.00	1.05	0.83	3.69
2010	1.36	12.27	7.74	12.33	0.00	3.09	3.44	0.00
2011	0.67	11.08	5.37	17.50	0.69	3.57	2.04	2.58
2012	1.99	3.13	11.39	15.64	0.68	2.52	4.05	1.28
2013	1.31	10.86	10.53	6.90	0.68	1.50	1.34	2.54
2014	0.65	10.75	10.43	18.84	0.67	2.97	1.99	1.26
2015	1.28	10.64	14.02	17.01	0.00	2.94	1.31	5.02
2016	1.23	10.29	12.16	11.61	1.27	1.89	2.55	1.23
2017	1.22	11.64	14.16	11.37	0.63	0.94	4.42	2.41
2018	0.60	11.03	10.51	16.16	0.00	2.78	5.01	2.40
Linear regression:								
Linear coefficient (α)	41.07	-616.83	-509.27	-567.51	-16.17	7.08	-64.27	-18.12
Slope coefficient (β)	-0.02	0.31	0.26	0.29	0.01	-0.01	0.03	0.01
R²	0.0303	0.42	0.32	0.14	0.01	0.01	0.01	0.01
p-value	0.5180	0.0027	0.0110	0.1166	0.6561	0.9526	0.7328	0.8869

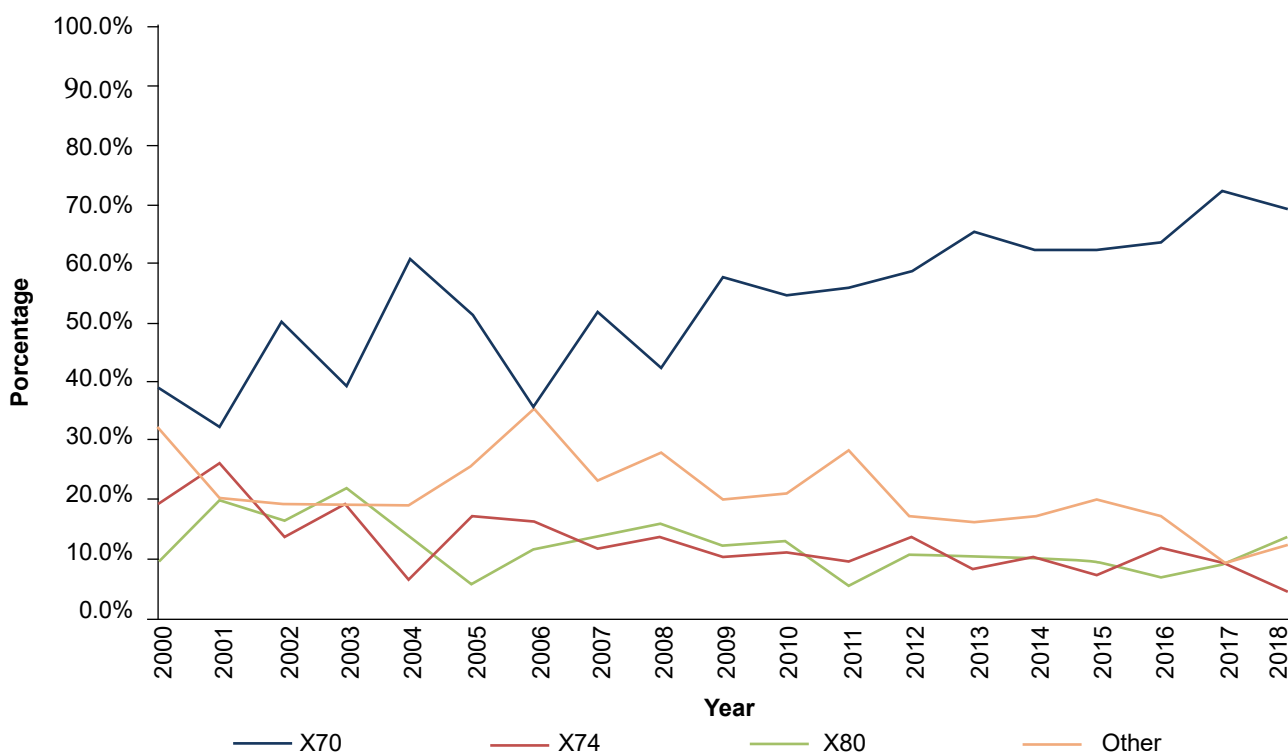
Source: SIM: Sistema de Informação sobre Mortalidade (Mortality Information System); TABNET-SMS. Campinas, São Paulo. Linear regression models Y (death rate) $=\alpha + \beta \times \text{year}$ were estimated and R^2 : Coefficient of determination of the regression model (ranging from 0 to 1, the closer to 1, the better the model fit) were estimated. Null hypotheses $H: \beta=0$ were tested

With regard to the sociodemographic variable "race/skin color", the results are presented as a proportion (chi-square test), since in the Demographic Census there is only stratification of the population by sex and age; hence, there is no availability of the denominator for the calculation of rates.

The highest percentage of deaths by suicide occurred in the White race/skin color, representing 77.4% of all cases in 2000, 82.5% in 2009 and 76.6% in 2018. Mixed race accounted for 19.4% of all cases in 2000, 12.5% in 2009 and 18.8% in 2018. As for Black individuals, figures were 3.2% in 2000, 5.0% in 2009 and 3.1% in 2018. With regard to the Yellow, there were no cases in 2000 and 2009, with 1.6% of all cases in 2018. Of the total (between the years 2000-2018), 74.9% of deaths occurred in the White race/skin color, with the proportion of deaths for mixed race, Black and Yellow respectively being 19.0%, 4.8% and 1.2% (Figure 1).



Source: SIM: Sistema de Informação sobre Mortalidade (Mortality Information System), TABNET- SMS. Campinas, São Paulo. Figure 1 - Percentage of deaths by suicide in the city of Campinas, São Paulo, by race/skin color and year (2000 to 2018). Campinas, São Paulo, 2019.

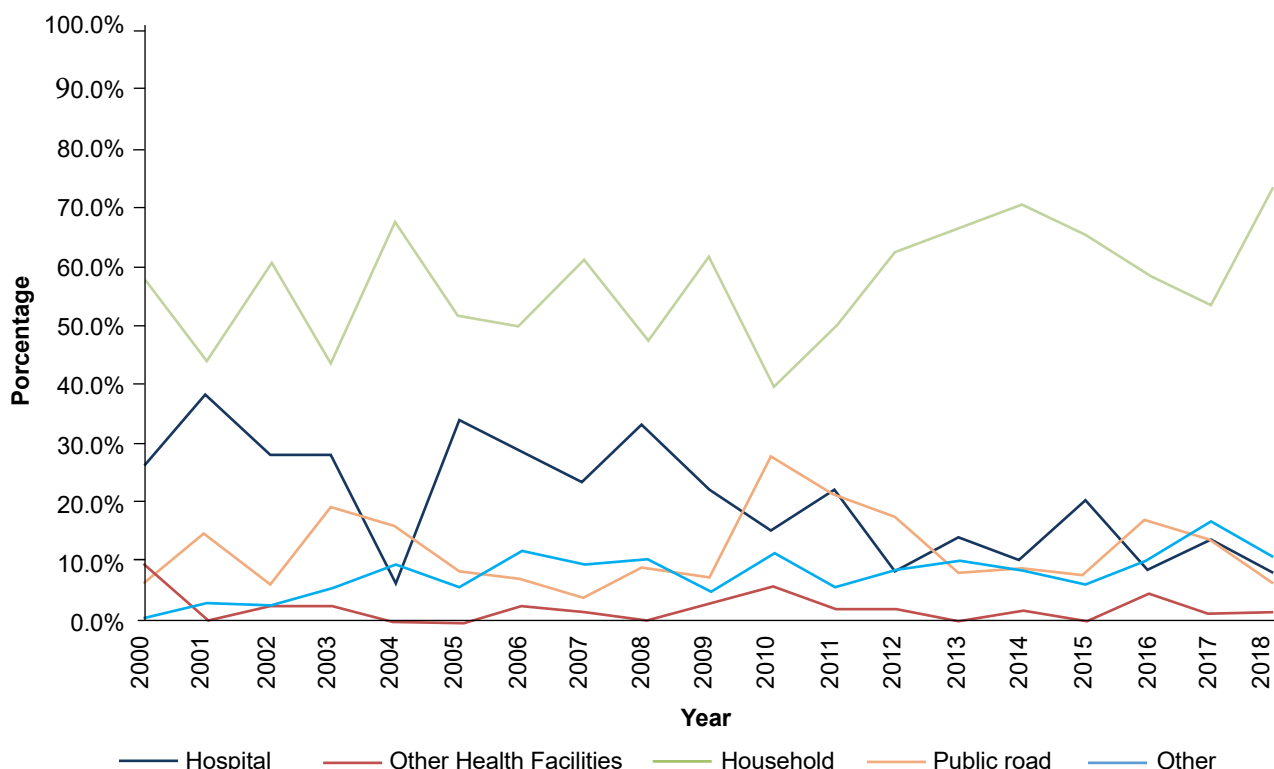


Source: SIM: Sistema de Informação sobre Mortalidade (Mortality Information System), TABNET- SMS. Campinas, São Paulo. *: X70: Intentional self-harm by hanging, strangulation and suffocation; X74: Intentional self-harm by other and unspecified firearm and gun discharge; X80: Intentional self-harm by jumping from a high place

Figure 2 - Percentage of deaths by suicide in the city of Campinas-São Paulo per the most frequent ICD 10 categories* and year (2000 to 2018). Campinas, São Paulo, 2019.

As for the category of deaths (ICD 10), Figure 2 shows the most frequent ones. “Intentional self-harm by hanging, strangulation and suffocation” (X70) ranked first, with 38.7% in 2000, 57.5% in 2009 and 69.2% in 2018. The item “other” grouped the different ICD 10 categories with very small numbers, with rates being 32.3% in 2000, 20.0% in 2009 and 12.3% in 2018. Next, there were the “intentional self-harm by other and unspecified firearm and gun discharge” (X74), with 19.4% in 2000, 10.0% in 2009 and 4.6% in 2018 and deaths from “intentional self-harm by jumping from a high place” (X80), with 9.7% in 2000, 12.5% in 2009 and 13.8% in 2018. Of the total (2000-2018), 55.6% were “intentional self-harm by hanging, strangulation and suffocation”, 20.6% were “other”, 11.9% were “intentional self-harm by other and unspecified firearm and gun discharge” and 11.8% were “intentional self-harm by jumping from a high place” (Figure 2).

As for the places where deaths occurred, the household was the most common, with 58.1% of cases in 2000, 62.5% in 2009 and 73.8% in 2018. Hospitals ranked second, with 25.8% in 2000, 22.5% in 2009 and 7.7% in 2018. In total (between the years 2000-2018), 58.0% of the deaths occurred in households, 19.4% in hospitals, 11.9% on public roads (Figure 3).



Source: SIM: Sistema de Informação sobre Mortalidade (Mortality Information System), TABNET- SMS. Campinas, São Paulo. Figure 3 - Percentage of deaths by suicide in the city of Campinas, São Paulo, per place of occurrence and year (2000 to 2018). Campinas, São Paulo, 2019.

In the total years of the study (2000-2018), the months with the highest number of deaths occurred between September (10.3%) and December (10.2%), and those the lowest occurred between April (5.5%) and June (6.7%), but this is not uniform for all years. Taking the beginning (2000), the middle (2009) and the end (2018) of the time series, the months with the highest numbers June (22.6%) and May (16.1%) for the year 2000; January (17.5%) and December (15.0%) for 2009; September (13.8%) and October (13.8%) for 2018. The months with the lowest numbers were April (no cases), July (3.2%), August (3.2%) and November (3.2%) for 2000, July (no cases) and March (5.0%), May (5.0%) and August (5.0%) for 2009, and March (4.6%), May (4.6%) and June (4.6%) for 2018.

DISCUSSION

Among the external causes of self-inflicted violence, suicide is one the three main causes of mortality⁽¹⁾. In the city of Campinas, in São Paulo, the present study observed a significant increase in suicide rates in the period from 2000 (3.20/100,000 inhabitants) to 2018 (5.42/100,000 inhabitants), with victims being predominantly males, adults and White individuals who chose hanging as a means of suicide at home.

Suicide is a global public health problem. Worldwide data show an increase of 60% in the last 45 years with a growth trend in the next decades⁽⁶⁾. According to WHO estimates, the global age-standardized suicide rate for 2016 was 10.5 per 100,000 people, varying widely across countries, from five suicide deaths per 100,000 to more than 30/100,000⁽³⁾.

In the current study, we observed a significant increase in suicide over time for males, with a rate of 5.30/100,000 inhabitants in 2000 and 8.45/100,000 inhabitants in 2018; this finding was also described in the WHO estimates in 2019, which reported 1.8 times more suicide in men compared to women⁽³⁾. In Brazil, several studies indicate a higher percentage of deaths among the male population, for example: Bahia: 85.4%(23); Roraima: 74.1%(24); Sergipe: 74.4%(25); Espírito Santo: 73.5%(26); Rio Grande do Sul: 79.4%(27); Morada Nova, Ceará: 76.1%(28); São Luís, Maranhão: 81.8%(29). When analyzing the rates by region of Brazil, we have: North: 78.7%, Northeast: 78.7%, Midwest: 78.1%, Southeast: 78.7% and South: 80.3%(30). The same was observed in other continents such as: Asia (Iran: 61.0%(31)); Europe (Sweden: 73.9%(32); England: 70.0%(33)) and North America (Mexico: 81.0%(34)).

Situations of economic crisis and unemployment, and the idea of men as family providers can lead to situations of family vulnerability, isolation, increased consumption of alcohol and drugs and impulsivity, and other factors that can contribute to make men more exposed to the risk of suicide^(1,35). The lower occurrence of suicide among women has been attributed to a greater search for spiritual support⁽¹⁾ and the early recognition of signs of risk for suicidal behavior, especially during acute episodes of psychiatric disorders, and the search for support in health care networks⁽²⁸⁾.

Although older adults are the most affected by suicide^(2,6), there was a significant increase in deaths from suicide among individuals aged 20 to 60 years. Studies show that young adults and middle-aged individuals are the groups most exposed to the problem. Thus we have the data for: Roraima (median age of 29 years – non-indigenous and 24 years – indigenous)⁽²⁴⁾; Sergipe (76.6% in individuals aged 20-59 years)⁽²⁵⁾; Rio Grande do Sul (10.3% in individuals aged 50-59 years)⁽²⁷⁾; Morada Nova, Ceará (32.8% in individuals aged 40-49 years)⁽²⁸⁾; Iran (mean age of 32 years⁽³¹⁾; Mexico (37.2% in individuals aged 30-49 years)⁽³⁴⁾.

In the present study, the highest percentage of deaths was observed among the White population (74.9%), a characteristic that was also reported in a study carried out in the south of the country, in Santa Catarina: 90%(36). On the other hand, the epidemiological bulletin published in 2017⁽⁶⁾ indicates the indigenous population as the one with the highest suicide rate in Brazil (15.2/100,000 inhabitants), and 2019⁽⁵⁾ (Mixed race/Black – 54%). Another important finding is that 63.9% of the population of the state of São Paulo is comprised of White people according to a survey carried out by the 2010 Census. That is, this variable should be carefully analyzed as there are important differences between races across regions.

Most of the deaths by suicide in the current investigation occurred at home (58.0%), with hanging being the most used method (55.6%), followed by other gunfire discharge and jumping from a high place. Suicide by hanging was also reported as the main means in national and international studies with the rates being: Bahia (64.3%)(23); Roraima (86.9%)(24); Sergipe (54.7%)(25); Rio Grande do Sul (72.5%)(27); Morada Nova, Ceará (49.2%)(28); São Luís, Maranhão (41.2%)(29); Santa Catarina (76% for men and 63% for women 63%)(36); England (63.0%)(33) and Mexico (78.8%)(34). It is understood that because it is an easily accessible means of self-harm, control of hanging is difficult. Therefore, it is important to identify people at risk early and guide family members and close friends for a more constant vigil to identify emergency moments in order to prevent such harm⁽³⁷⁾.

There was also a significant variation in the percentages of death according to the month of the year in this research, with an increase in cases (2000 - 2018) in September and December. However, these data differ from those presented in a study carried out in two regions of the state of São Paulo, with a lower prevalence of deaths by suicide in the Spring months (15.6%) (September and December)⁽³⁸⁾.

For each death by suicide, there is an estimated 20 other attempts, with the history of a previous attempt being a predictor of death from the harm^(8,12). Therefore, it is understood that this is an event that can be preventable, provided that it is detected early and receives appropriate immediate intervention (it should be noted that efforts to promote health and prevent suicidal behavior go beyond the knowledge of the health field⁽²⁾). Thus, as it is a complex and multifactorial phenomenon, these actions must be based on risk and protection factors, as well as on the knowledge produced by professionals from different fields of knowledge⁽²⁾.

Currently, the issue of suicide is more present and new challenges will be imposed on everyone involved with the promotion of mental health in the population, leading to discussions about the nature and determinants of mental health promotion at the population and institutional level. The COVID-19 pandemic caused by the new coronavirus SARS-COV-2 caused psychological and social disturbances that affect the ability to cope of society as a whole. These disturbances can favor the emergence or worsening of psychiatric symptoms, especially in people with

specific vulnerability to mental disorders, increased substance use and alcohol addiction⁽³⁹⁾, for example, which are risk factors for suicide^(2,11). Although the impact of the COVID-19 pandemic on mental illness is still being measured, there are worrying signs of increased psychological suffering, psychological symptoms, mental disorders and psychological trauma directly caused by the infection or its secondary consequences. Therefore, immediate efforts must be made, at all levels and by the different fields of knowledge, in order to minimize even more negative results in the population's mental health⁽³⁹⁾. Health promotion actions will have a central role to play in the empowerment of communities and individuals in the adoption of effective responses and in managing the psychosocial impacts of the multifaceted consequences of the pandemic⁽³⁹⁾.

Notwithstanding the contributions made in this research, some limitations should be considered, such as data obtained from secondary sources that may be subject to a lack of standardization in data collection in addition to information gaps that may be important for the analysis of interest and the coverage variation according to time and space⁽⁴⁰⁾. When it comes to suicide, underreporting is another limitation; as a result of the social stigma related to the harm, it is often hidden and recorded as, for example, deaths of undetermined intent, accidents, homicides, unknown causes, drownings, and accidental poisonings. This impairs the recognition of the real panorama of the magnitude of the phenomenon^(2,28). Despite the aforementioned limitations, it should be emphasized that time series studies can be important epidemiological tools for the formulation of explanatory hypotheses and indirect assessment of the effectiveness of public policies.

CONCLUSION

The results of the present study documented not only the growing increase in suicide rates in the city of Campinas, São Paulo, in the period analyzed (2000 - 2018), but also the profile of its victims, who were predominantly males, adults and White individuals who chose hanging at home in September and December.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTIONS

Natalia Cristina da Silva Freire contributed to the study conception and design; the acquisition, analysis and interpretation of data. **Taís Daiene Russo Hortencio** contributed to the writing and revision of the manuscript. **Márcia Regina Campos Costa da Fonseca** contributed to the study conception and design; the acquisition, analysis and interpretation of data; and to the writing and revision of the manuscript. All authors approved the final version to be published.

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