Conjecturas

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The Covid-19 pandemic and suicide rates: what we know and what we will know

A pandemia de Covid-19 e taxas de suicídio: o que sabemos e o que saberemos

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ABSTRACT

This study aims to provide estimated data on suicide deaths after the onset of Covid-19 Pandemic, based on a prediction model with SIM data, between the years 2008 to 2019. In the present study was used an evaluation of the "suicide deaths" time series using the SARIMA (Seasonal Autoregressive Integrated Moving Average) model to assess and forecast suicides following the Covid-19 pandemic, through the "Box-Jenkins" methodology. Data of death by suicide between 2008 and 2019 were extracted by DATASUS and used with the objectives of predicting, based on the previous data, future behavior. The expect number of suicides in the years 2020 e 2021, considering a confidence interval of 95% in univariate analysis, could vary from 12.844 to 14.983 and 13.025 to 15.640 respectively, which reflects a suicide death rate of 6,06 to 7,07 in 2020 and 6,09 to 7,31 in 2021. This study has provided estimated data about deaths by suicide after the Covid-19 pandemic has initiated, showing constant increase, in a model that has shown good fit for these data. Since Covid-19 is an external event that may disturb these estimates, we are still to know the effects of the pandemic on suicide rates, which can be compared with the findings presented here.

Keywords: Suicide; Covid-19; Coronavirus; Pandemic; Mental health

RESUMO

Este estudo tem como objetivo fornecer dados estimados de mortes por suicídio após o início da Pandemia de Covid-19, com base em um modelo de previsão com dados do SIM, entre os anos de 2008 a 2019. No presente estudo foi utilizada uma avaliação da série temporal "mortes por suicídio" usando o modelo SARIMA (Seasonal Autoregressive Integrated Moving Average) para avaliar e prever suicídios após a pandemia de Covid-19, por meio da metodologia "Box-Jenkins". Os dados de óbito por suicídio entre 2008 e 2019 foram extraídos pelo DATASUS e utilizados com o objetivo de prever, com base nos dados anteriores, comportamentos futuros. O número esperado de suicídios nos anos de 2020 e 2021, considerando um intervalo de confiança de 95% na análise univariada, poderia variar de 12.844 a 14.983 e 13.025 a 15.640 respectivamente, o que reflete uma taxa de mortalidade por suicídio de 6,06 a 7,07 em 2020 e 6,09 a 7,31 em 2021. Este estudo forneceu dados estimados sobre mortes por suicídio após o início da pandemia de Covid-19, mostrando aumento constante, em um modelo que se mostrou adequado a esses dados. Como o Covid-19 é um evento externo que pode atrapalhar essas estimativas, ainda precisamos conhecer os efeitos da pandemia nas taxas de suicídio, que podem ser comparados com os achados aqui apresentados.

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Palavras-chave: Suicídio; Covid-19; Coronavírus; Pandemia; Saúde Mental

INTRODUÇÃO

Some argue that suicide rates are expected to rise due to the COVID-19 pandemic and its economic contingencies and social distancing, well-known psychosocial stressors, and the secondary consequences of this event to mental health (PERA, 2020; GUNNELL, 2020; REGER; STANLEY; JOINER,2020; KALIL *et al*,2021; JOHN *et al*, 2020). This was already demonstrated in the context of the SARS outbreak (KALIL *et al*,2021). Other factors could be related to the highest risk of suicide, such as decreased access to community and spiritual support, mental health treatment hurdles, higher alcohol consumption, illness, and medical problems, anxiety generated by troubling news coverage, health care professional work, domestic violence, and increased firearm sales (GUNNELL, 2020; REGER; STANLEY; JOINER,2020; KALIL *et al*,2021).

Due to the lag between the availability of mortality data, studies estimating suicide mortality are essential because they could help understand the COVID-19 pandemic impact on mortality, comparing them with actual data available later. This new pandemic is an unprecedented opportunity to improve the understanding of the association of events like this to mental health and its effects on suicide behavior since many researchers affirm that humans will have to address pandemics more frequently (DASZAK et al., 2020).

METHODS

This study evaluated the "suicide deaths" time series using the SARIMA (Seasonal Autoregressive Integrated Moving Average) model to assess and estimate suicides following the COVID-19 pandemic through the "Box-Jenkins" methodology. Data of death by suicide between 2008 and 2019 were extracted from the SUS Informatics Department (DATASUS) and used to predict future behavior based on the previous data. The SARIMA model is known as the seasonal ARIMA model, which is an extension of the ARIMA model that considers seasonality in the time series, represented as SARIMA (p, d, q) (P, D, Q), where:

p - Order of the autoregressive component (LAG);

d - Number of differences taken in the series;

q - Moving Averages component order (associated with LAG)

The “moving average” is the average of the values observed at a given moment, and for each successive moment, this data is added and the last value removed. Items P, D, and Q have the same definitions for p, d, and q. However, they refer only to the seasonal part of the time series.

This research did not require approval by the Ethics Committee since it was based on publicly available data.

RESULTS

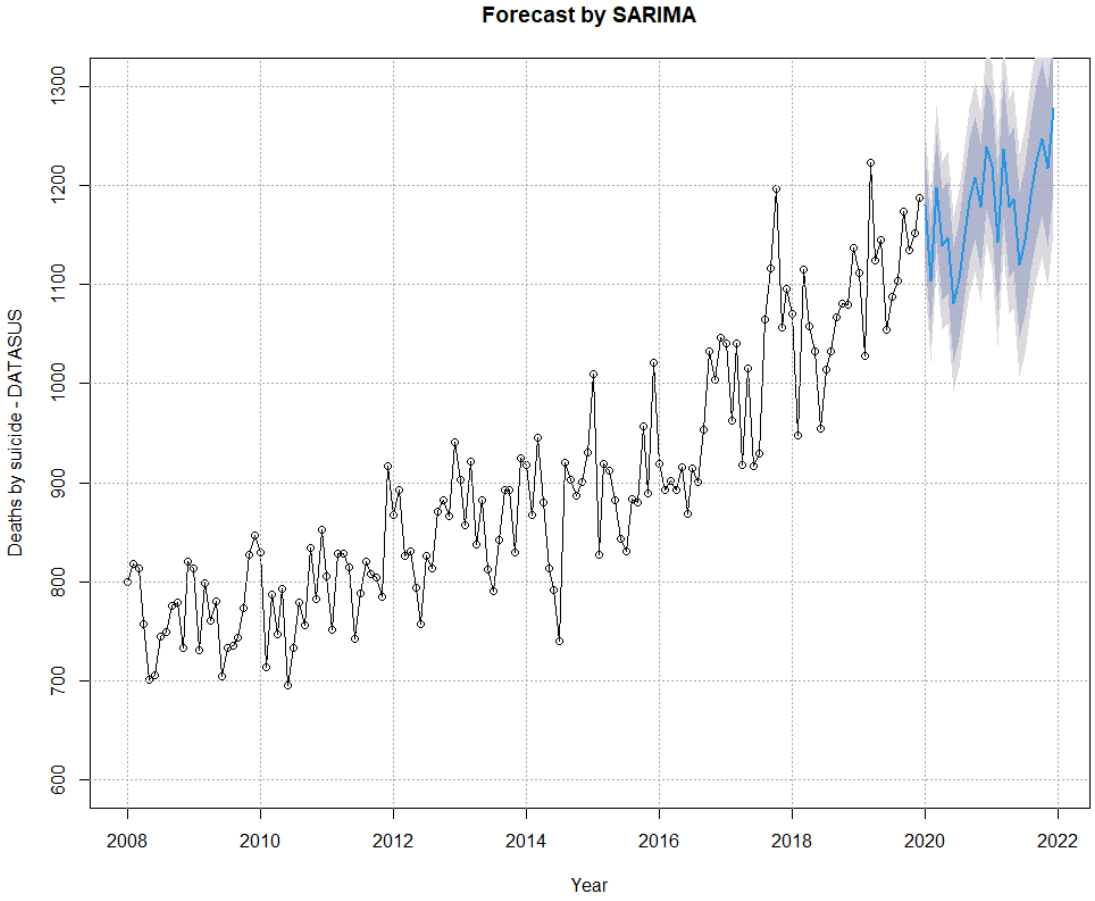
Figure 1 shows the number of monthly deaths in Brazil from 2008 to 2019, with 129.042 deaths by suicide in the entire period. A growing trend in the number of deaths is observed over the years. It should also be noted that the death rate per 100 thousand inhabitants also increased from 5.17 to 6.43 in the period.

Table 1 shows the values of the point forecast based on the SARIMA model (0,1,1) (0,1,1) and the actual values of deaths by suicide in 2019 for each month and the estimated number of deaths per month in 2020 and 2021. All data on deaths by suicide in 2019, except for March, are within the confidence margin estimated by the SARIMA model, thereby suggesting a good fit for these data.

The result shows that the average monthly error for the number of deaths by suicide in 2019 was 44 cases, the lowest (-44 cases, therefore, 44 deaths less when compared to the actual data), and the average percentage of monthly error was 3.8% below the actual number of deaths by suicide. Therefore, the SARIMA model had an average error for the total number of suicide deaths below 5% in the 2019 estimates.

Considering a confidence interval of 95% in the univariate analysis, the expected number of suicides in 2020 and 2021 could range from 12.844 to 14.983 and 13.025 to 15.640, respectively. This reflects a suicide death rate of 6.06 to 7.07 in 2020 and 6.09 to 7.31 in 2021. As expected, a growing trend is observed in these years.

Figure 1 Original series with the values of deaths by suicide provided by SARIMA (0,1,1) (0,1,1) with BoxCox. 2008-2021.



NOTE: The light blue line refers to the forecast by the SARIMA model for the 12 subsequent measurements. The dark and light gray bands refer to the 80% and 95% confidence intervals for the estimated values, respectively.

Table 1 Point forecast and Confidence Interval for the predicted values of suicide deaths for the SARIMA model (0,1,1) (1,0,1) with BoxCox. 2019-2021.

Month	**Year**	**Timely forecast**	**Real Number**	**95% CI**
Jan	2019	1.112	1.112	(1.034 – 1.191)
Feb	2019	1.040	1.028	(960 – 1.120)
Mar	2019	1.108	1.223	(1.026 – 1.190)
Apr	2019	1.060	1.124	(977 – 1.144)
May	2019	1.064	1.145	(979 – 1.149)
Jun	2019	1.004	1.054	(917 – 1.090)
Jul	2019	1.027	1.087	(938 – 1.115)
Aug	2019	1.076	1.103	(987 – 1.166)
Sep	2019	1.101	1.174	(1.010 – 1.192)
Oct	2019	1.137	1.134	(1.045 – 1.230)
Nov	2019	1.099	1.152	(1.005 – 1.193)
Dec	2019	1.167	1.187	(1.071 – 1.262)
Jan	2020	1.180	?	(1.101 – 1.260)
Feb	2020	1.104	?	(1.022 – 1.185)
Mar	2020	1.197	?	(1.114 – 1.281)
Apr	2020	1.139	?	(1.055 – 1.224)
May	2020	1.147	?	(1.060 – 1.234)
Jun	2020	1.080	?	(992 – 1.169)
Jul	2020	1.105	?	(1.015 – 1.195)
Aug	2020	1.150	?	(1.058 – 1.242)
Sep	2020	1.184	?	(1.091 – 1.278)
Oct	2020	1.208	?	(1.113 – 1.303)
Nov	2020	1.178	?	(1.082 – 1.275)
Dec	2020	1.239	?	(1.141 – 1.337)
Jan	2021	1.219	?	(1.117 – 1.322)
Feb	2021	1.143	?	(1.038 – 1.248)
Mar	2021	1.236	?	(1.130 – 1.343)
Apr	2021	1.179	?	(1.070 – 1.287)
May	2021	1.186	?	(1.076 – 1.297)
Jun	2021	1.120	?	(1.007 – 1.232)
Jul	2021	1.144	?	(1.030 – 1.259)
Aug	2021	1.189	?	(1.073 – 1.305)
Sep	2021	1.223	?	(1.106 – 1.341)
Oct	2021	1.247	?	(1.127 – 1.366)
Nov	2021	1.217	?	(1.096 – 1.339)
Dec	2021	1.278	?	(1.155 – 1.401)

DISCUSSION

This study has estimated data about deaths by suicide after the onset of the COVID-19 pandemic, pointing to a constant increase, as in the past years, in a model that has shown a good fit for these data.

In this study, the model applied by this method to predict future values considered that its characteristics remained constant over time, that is, there were no external factors that disrupted the estimated values. This was not the case since COVID-19 is an external event that can affect these estimates.

Since the unemployment rate has risen in Brazil in the past year due to the necessary social distancing policies, this well-known risk factor for suicide may influence the actual data yet to be available.

A study that evaluated the excess number of suicides related to unemployment concludes that an elevation of 1.0% in unemployment increases 1.0% the suicide rates and that suicide cases in Canada could increase at 27.7% per year in 2020 and 2021 in the worst scenario compared to 2018 (MCINTYRE; LEE,2020). Others discuss that these numbers underestimate the range of the relationship between suicide and COVID-19, mainly among men(SAMSON;SHERRY,2020). In the U.S., according to the methodology used, excess annual deaths associated with U.S. COVID-19 could vary from 9,786 to 66,115 per year when unemployment is considered (BHATIA, 2020).

Other research found increased search for suicide topics on the internet after some countries decreed lockdown (KNIPE *et al*, 2020), and escalating search on the internet by terms correlated to suicide and its association with daily COVID-19 deaths (RANA, 2020). Many others expect increases in the suicide rate, especially among those already facing a psychiatric disorder (BHATIA, 2020; KAWOHL; NORDT, 2020; PERA, 2020, GUNNELL, 2020).

During April and May 2020, Brazilian population surveys have shown higher alcohol consumption and feelings of sadness and loneliness during the pandemic, which can contribute to depression and suicide (MALTA, 2020). Despite that, some mention that suicide rates could decline, because of a pulling together effect, life appreciation, or even by facilitating access to health treatment through the advanced use of technologies like virtual appointments (REGER; STANLEY; JOINER, 2020).

In the same vein, some research has already investigated the volume for the internet search for terms related to suicidal behavior, and interestingly some noted an abrupt reduction in the search for terms related to the suicide act and increased search for terms associated with resilience, at least at the onset of the pandemic crisis. This could suggest a reduction in suicide cases in U.S. (SINYOR; SPITTAL; NIEDERKROTENTHALER,2020), corroborated by Smalley et al., who reported a decrease in suicidal ideas in U.S. emergency departments (SMALLEY, 2021). Therefore, the actual effects of the COVID-19 pandemic on suicide rates are yet to be uncovered.

Gunnel et al. highlight strategies to curb the suicide risk in the context of the COVID-19 pandemic, which includes providing mental care services broadly, facilitating its access, providing financial safety networks, ensuring better responses to domestic violence, monitoring alcohol consumption, providing support to people living alone, restricting access to suicide methods and enhancing media report about suicide according to guidelines.

At this time in Brazil, we are seeing society and political clamor to the government to go forward on financial help, which, in association with the strengthening of online services that could be accessed by people in suffering and at risk for mental illness, could minimize the cases of suicide in our country.

It is important to note that data from the Mortality Information System (SIM) during the pandemic may be underestimated, as the Forensic Medicine Institute has not performed autopsies, including regarding external causes, to minimize COVID-19 infection.

Therefore, the data of suicide deaths that we expect will soon be available, have to be analyzed with caution and based on a system that was tested and taken to the limit during this pandemic.

DISCLOSURE

The authors report no conflicts of interest.

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