Alcohol- and drug-related mortality in Brazil: an ecological and population-based study on changes observed during the COVID-19 pandemic

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Summary

Background The COVID-19 pandemic has disrupted healthcare services and intensified socio-economic vulnerabilities, potentially escalating harmful substance use. In Brazil, pre-pandemic mortality from alcohol and drug use was stable. However, the pandemic introduced new risks that may have triggered a significant increase in related deaths. This study, therefore, aims to assess the impact of the COVID-19 pandemic on alcohol- and drug-related deaths in Brazil from 2020 to 2022.

Methods This population-based ecological study analyzed alcohol- and drug-related mortality across Brazil from 2015 to 2022 using data from the Brazilian Mortality Information System (SIM). Temporal trends were examined using Joinpoint regression, while interrupted time-series analyses assessed deviations post-pandemic onset. Spatial variations were visualized using choropleth maps.

Findings Alcohol- and drug-related mortality increased by 18.3% in 2020, 22.4% in 2021, and 26.0% in 2022. The Northeast (2020 = 24.9%; 2021 = 24.0%; 2022 = 31.8%), Southeast (2020 = 18.2%; 2021 = 24.3%; 2022 = 21.0%), and South (2020 = 13.1%; 2021 = 23.6%; 2022 = 35.2%) regions recorded the highest increases, with most states showing significant growth in deaths. We also observed an increase in mortality associated with the use of Psychoactive substances (PAS) in both sexes (male: average annual percentage changes (AAPCs) = 3.6%; female: AAPC = 4.6%), individuals aged 20 to 39 (AAPC = 2.0%), and those aged 60 and above (AAPC = 1.8%). Interrupted time-series analyses confirmed a marked and statistically significant increase in mortality post-March 2020.

Interpretation The findings suggest a collateral epidemic of substance-related deaths fueled by the COVID-19 pandemic's disruptions to harm reduction services, treatment access, and socio-economic stability. These results underscore the urgent need to enhance healthcare systems, reinforce harm reduction services, and develop intersectoral policies targeting social inequalities to mitigate future crises.

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Keywords: Alcohol; Alcohol-related mortality; Drug-related mortality; Illicit drugs; Psychoactive substances; COVID-19 pandemic; Substance use disorders; Brazil

Research in context

Evidence before this study

We conducted a comprehensive search for evidence on the impact of the COVID-19 pandemic on alcohol- and drug-related mortality in Brazil and globally. The search spanned databases including PubMed, Scopus, and SciELO, and reference lists of relevant studies, covering publications from January 2019 to December 2023, without language restrictions. Search terms included "alcohol-related deaths," "drug-related mortality," "COVID-19," "pandemic," and "Brazil." We identified studies reporting global increases in alcohol and drug use during the pandemic, but few examined population-level mortality trends, particularly in low- and middle-income countries. In Brazil, reports highlighted service disruptions and increased substance dependence but lacked comprehensive mortality data. The identified evidence showed variability in study quality, with some reporting high risks of bias due to self-reported data or limited temporal analysis.

Added value of this study

This study provides the first nationwide assessment of alcohol- and drug-related mortality in Brazil during the COVID-19 pandemic, using robust population-level data and advanced statistical modeling. Our findings reveal significant increases in mortality across all regions, with notable disparities, particularly in socioeconomically vulnerable areas. By linking these trends to pandemic-related disruptions in healthcare services and social determinants, this research adds critical insights to the global understanding of how public health crises exacerbate substance use and its consequences.

Implications of all the available evidence

The evidence underscores the urgent need for targeted harm reduction and mental health strategies, particularly in resource-limited settings. Policymakers must prioritize strengthening substance use treatment services, addressing socioeconomic disparities, and preparing for similar collateral epidemics in future crises. Future research should explore long-term trends and evaluate the effectiveness of interventions implemented during and after the pandemic.

Introduction

Psychoactive substances (PAS) are compounds that can modify central nervous system functions, affecting consciousness, mood, and perception. These include drugs like alcohol, opioids, and cannabis, which, when used continuously and excessively, can lead to significant physical and mental harm, resulting in what is termed "harmful use" and, potentially, PAS dependence.[1] Notably, harmful use and dependence on these substances are major global public health issues, placing a considerable burden on healthcare systems and impacting societies, individuals, and families worldwide.[1]

In 2021, an estimated 296 million people between the ages of 15 and 64 consumed drugs worldwide, representing 5.8% of the global population in this age range and a 23% increase over the previous decade. In the same year, approximately 39.5 million people experienced mental and behavioral disorders related to drug use.[2] Additionally, in 2019, over three million deaths were attributed to drug use, with approximately 2.6 million linked to alcohol consumption.[1]

In Brazil, excessive alcohol and drug consumption presents a substantial public health challenge. In 2021, the Unified Health System (SUS) recorded over 400,000 treatments for people experiencing mental and behavioral disorders linked to PAS use, reflecting a 12% increase from the previous year.[3] Furthermore, the nation has witnessed a rise in deaths related to illicit drugs such as cannabis, cocaine, hallucinogens, and other stimulants.[4]

The societal impact of alcohol and drug use is acknowledged in the United Nations (UN) 2030 Agenda for Sustainable Development Goals (SDGs), which includes goals to strengthen PAS use prevention and treatment.[5] However, a series of global crises, including the COVID-19 pandemic, has posed significant obstacles to achieving these goals.[6]

The COVID-19 pandemic, which caused over seven million deaths globally,[7] led to control measures such as

social distancing and limited access to public spaces,[8] impacting treatment and support services for people with alcohol and drug dependence, thus heightening vulnerability during the emergency.[9–11] Factors like home isolation, COVID-19-related fear and anxiety—especially in developing nations like Brazil—may have intensified alcohol and illicit drug use.[12–14] Prolonged and excessive use of these substances is linked to increased toxic effects, dependence, and worsened mental health outcomes, raising the risk of overdose and mortality.[1] This study, therefore, aims to assess the impact of the COVID-19 pandemic on alcohol- and drug-related deaths in Brazil from 2020 to 2022.

Methods

Study type and design

This population-based ecological study employed spatiotemporal techniques and data from the Mortality Information System (SIM, from the name in Portuguese) of the Brazilian Ministry of Health, covering the period from 2015 to 2022. It is important to note that, at the time of data collection, alcohol- and drug-related mortality data were available only up to 2022. This methodological approach enabled a comprehensive assessment of the impact of the COVID-19 pandemic on alcohol- and drug-related deaths, considering all regions and states in Brazil.

Study area

Brazil, the largest country in South America, covers 8,515,767.049 km^2 and has an estimated population of 203 million, making it the seventh most populous nation globally. Politically and administratively, Brazil is divided into 27 federative units (26 states and one Federal District, with Brasília as the capital). For organizational and political purposes, these units are grouped into five regions (North, Northeast, Southeast, South, and Central-West), each with distinct geographical and cultural characteristics.[15]

Variables and data sources

Variables for this study included: (i) total number of alcohol- and drug-related deaths; and (ii) mortality rates due to alcohol and drug use. Data for these variables were obtained from SIM, managed by the Brazilian Ministry of Health, responsible for collecting, storing, and managing death records, with death certificates as the standard reporting document completed by medical professionals for all deaths in Brazil.[16] SIM data are publicly accessible on the Unified Health System's Department of Informatics (DATASUS) website. To obtain this data, we selected all deaths where the underlying cause was associated with alcohol and drug use. The codes from the International Classification of Diseases, 10th Revision (ICD-10) were used: F10–F19, K70, X40-X45, X60-X65, X85, Y10–Y15.

Population data were sourced from the Brazilian Institute of Geography and Statistics (IBGE), using census information from 2022 and population estimates for the intercensal years (2015–2021).[15,17] The digital cartographic grid of Brazil (divided by states and regions) based on the Geographic Projection System, in Shapefile format (Geodetic Reference System, SIRGAS/2000), available through the IBGE website.

Data analysis and percentage change calculation

To assess the impact of the COVID-19 pandemic on the total number of deaths related to alcohol and drug use in all Brazilian states, the percentage change was calculated based on SIM data. This approach has been applied in studies on other diseases, such as leprosy,[18] tuberculosis,[19] and HIV/AIDS,[20] to analyze morbidity rates and other indicators. By comparing expected and observed values, it is possible to assess the increase or decrease in the percentage of disease cases and/or mortality rates over time and in different locations.[21] The percentage change was calculated using the difference between the total number of observed deaths and the total number of expected deaths as the numerator, and the total number of expected deaths as the denominator, multiplied by 100.

Expected values for 2020, 2021, and 2022 were calculated based on the average number of deaths recorded in the previous five years (2015–2019 for 2020; 2016 to 2020 for 2021; and 2017 to 2021 for 2022). However, considering that the observed deaths in 2020 and 2021 could distort the expected averages for 2021 (2016–2020) and 2022 (2017–2021), we used the expected values for 2020 and 2021 to obtain a more accurate and reliable estimate of the averages for the periods of 2016–2020 and 2017–2021. Therefore, positive percentage change values indicate an increase, while negative values suggest a decrease in the number of deaths compared to the expected values.[21] This percentage change analysis was performed at regional, state, and national levels, with the results displayed in bar graphs showing annual variations in alcohol- and drug-related deaths in Brazil during 2020, 2021, and 2022.

Temporal trend analysis

To examine temporal trends in alcohol- and drug-related mortality rates by region of Brazil, sex and age group, we applied segmented log-linear regression using a joinpoint regression model. The selection of the best model, based on inflection points, was determined using the Monte Carlo permutation test with 999 permutations. In this analysis, the number of deaths due to alcohol and other drugs were treated as dependent variables, while years were considered as independent variables.[22] Additionally, to describe and quantify these temporal trends, annual percentage changes (APCs) and their respective 95% confidence intervals (CIs)

were calculated. When multiple significant inflection points were identified during the study period, average annual percentage changes (AAPCs) were also calculated. Temporal trends were considered statistically significant if the APCs had a p-value <0.05 and their 95% CIs did not include zero. A positive and significant APC indicated an increasing trend, while a negative and significant APC pointed to a decreasing trend. Trends without statistical significance were described as stable, regardless of the APC values.[22]

Interrupted time-series analyses

To determine if the total number of deaths due to alcohol and drug use in 2020 deviated from pre-pandemic trends (2015–2019), an interrupted time-series analysis was performed, using the pandemic's onset in March 2020 as the intervention point. Initially, residual plots, sample and partial autocorrelation functions (ACF and partial ACF) were used to verify autocorrelation in the residuals and to assess the stationary and normality properties, assisting in the selection of the most appropriate and statistically parsimonious models.[23] Subsequently, ARIMA models of serial dependence were identified. The pre-intervention model selected was an ARIMA (2, 1, 0). The Ljung–Box (Q) test was then applied to assess whether the residuals were white noise, i.e., approximately normally distributed around zero.[24] This test verifies whether the models adequately describe the linear dependence between successive data points.

Spatial analyses and elaboration of choropleth maps

To visualize the spatial distribution of the data, choropleth maps were developed, representing the percentage change values by each Brazilian state for the years 2020, 2021, and 2022. These maps displayed the total number of deaths related to alcohol and drug use, categorized into nine equal-interval ranges based on percentage change values (positive or negative). States were classified according to the following percentage variation intervals: <–75%; –74.99 to –50%; –50 to –25%; –24.99 to –0.1%; 0%; 0.00–25%; 25.01–50%; 50.01–75%; and >75%.

Software

Microsoft Office Excel 2019 was used to analyze the percentage variation and create graphs. The Joinpoint Regression Program v. 5.0.2 was used to calculate temporal trends. Interrupted time series analyses were conducted using IBM SPSS Statistics 22 software. Finally, QGIS 3.20.4 (QGIS Development Team-Open Source Geospatial Foundation Project) was used to generate choropleth maps.

Ethical considerations

The data used in this study are publicly available and do not contain any personally identifiable information. Consequently, individual consent forms were not required, and Research Ethics Committee approval was unnecessary. However, the principles of the Helsinki Convention were followed throughout the entire study.

Role of the funding source

This study received no external funding. All authors contributed through institutional support and declare no conflicts of interest.

Results

This study included all deaths associated with alcohol and other drug use in Brazil between 2015 and 2022. No deaths were excluded based on age, sex, or region, ensuring a complete population-level analysis. According to the analyses performed, there was a significant increase in alcohol- and drug-related mortality rates in the country over the three years of the pandemic. The results revealed a significant percentage change in deaths for 2020 (18.3%; expected = 20,537; observed = 24,303), 2021 (22.4%; expected = 20,536; observed = 25,138), and 2022 (26.0%; expected = 20,563; observed = 25,914) (Fig. 1). All Brazilian regions showed an increase in the absolute number of deaths (Supplementary Material S1), with the Northeast (2020: 24.9%; expected = 6417; observed = 8018; 2021: 24.0%; expected = 6389; observed = 7920; 2022: 31.8%; expected = 6378; observed = 8408), Southeast (2021: 24.3%; expected = 7946; observed = 9878; 2022: 21.0%; expected = 7942; observed = 9607), and South (2021: 23.6%; expected = 3399; observed = 4200; 2022: 35.2%; expected = 3417; observed = 4621) regions recording the highest increases in mortality rates, with percentages above 20% (Fig. 1). Additionally, almost all Brazilian states recorded an increase in the percentage of alcohol- and drug-related deaths during the pandemic, particularly the states of Amapá (2020: 94.7%; expected = 26; observed = 51; 2021: 58.7%; expected = 26; observed = 41; 2022: 61.7%; expected = 27; observed = 44), Pernambuco (2020: 51.5%; expected = 1260; observed = 1909), and Tocantins (2022: 50.6%; expected = 165; observed = 249), which exhibited percentage variations greater than 50% (Fig. 1). It is important to highlight that the highest percentages of deaths were caused by conditions attributed to alcohol (Table 1).

Table 2 illustrates the temporal trends of mortality rates due to alcohol and drug use for the regions of Brazil, sex, and age groups over two periods: the five years prior to the COVID-19 pandemic (2015–2019) and the pandemic years (2020–2022). A stable trend in the national mortality rate was observed during the pre-pandemic period. Stable trends were also observed in the North, South, and Central-West regions. Additionally, before the pandemic, decreasing trends were noted in the Northeast (APC = –1.5%; p-value <0.0001) and Southeast (APC = –0.9%; p-value <0.0001) regions.

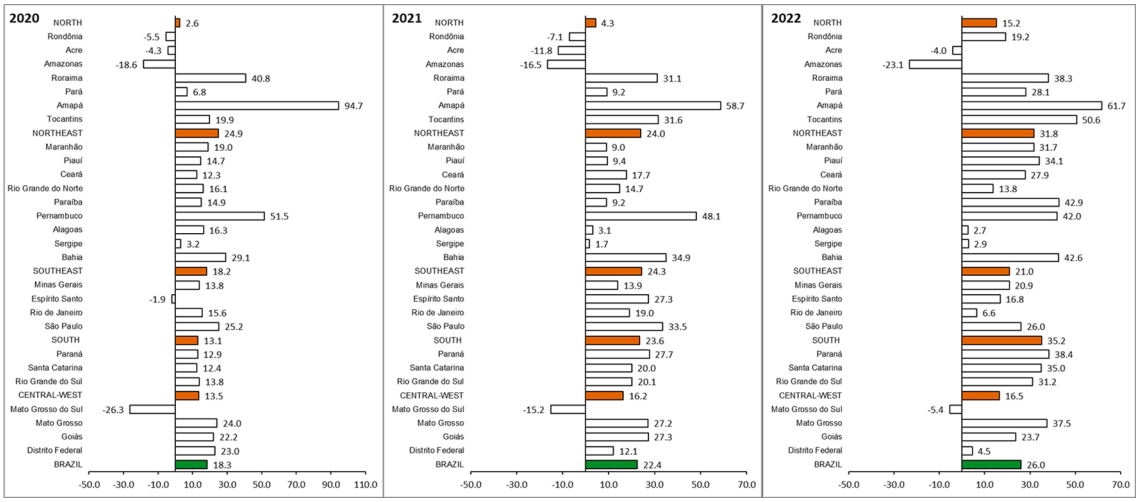

Fig. 1: **Percentage change in deaths due to the use of alcohol and other drugs in Brazil, its regions and states during the years of 2020, 2021 and 2022.**

However, when data from 2020 to 2022 were included, temporal trends began to increase in Brazil (AAPC = 3.8%; p-value <0.0001) and in all regions, except for the North region, which maintained stable mortality rates. Similarly, stable trends were identified in both sexes before the pandemic. However, when analyzing the data from 2020 to 2022, an increase in mortality rates was observed for both males (AAPC = 3.6%; p-value <0.0001) and females (AAPC = 4.6%; p-value <0.0001), with the growth being more pronounced for females. When analyzing age groups, an increase in trends was observed after the pandemic for the 20–39 years age group (AAPC = 2.0%; p-value <0.0001), as well as for those aged 60 years or older (AAPC = 1.8%; p-value = 0.009).

To corroborate the results of the time trend analysis, an interrupted time series analysis was conducted to determine whether the onset of the COVID-19 pandemic significantly impacted the total number of alcohol- and drug-related deaths in Brazil (Fig. 2). Notably, from March 2020, when the WHO declared the onset of the pandemic, Brazil exhibited a non-stationary trend, with a significant increase in deaths from that month onwards (stationary R2 = 0.795; normalized BIC = 9.06; significance = 0.13; ARIMA estimate = 231.69; p-value <0.0001). This pattern was also observed in all Brazilian regions, with significant increases in total deaths in the Northeast (stationary R2 = 0.838; normalized BIC = 7.63; significance = 0.32; ARIMA estimate = 69.01; p-value <0.0001) and Southeast (stationary R2 = 0.536; normalized BIC = 6.82; significance = 0.27; ARIMA estimate = 104.97; p-value = 0.001) regions (Fig. 2).

Finally, the spatial distribution of percentage changes in alcohol- and drug-related mortality indicates that most Brazilian states experienced increases ranging from 25% to 75% over the three years of the COVID-19 pandemic (Fig. 3A–C). The states of Amazonas, Acer, and Mato Grosso do Sul showed a percentage reduction throughout the entire period analyzed. In contrast, the states of Amapá, Pernambuco, and Tocantins experienced increases greater than 50% during the study period, with Amapá maintaining this level throughout the three years assessed (Fig. 3A–C).

Discussion

To our knowledge, this is one of the first studies to evaluate the impact of COVID-19 on mortality from alcohol and drug use across all Brazilian regions during the first three years of the pandemic (2020–2022). Our analyses revealed significant increases in deaths due to PAS use in Brazil (18.3% in 2020, 22.4% in 2021, and 26.0% in 2022) across all regions, with particular emphasis on the Northeast, Southeast and South. Most states showed a rise in deaths, some exceeding 50%. Time trend and interrupted time series analyses corroborated the increase in deaths and mortality rates in almost all regions (except the North) following the pandemic's onset. These results underscore COVID-19's severe impact on harm reduction, prevention, and treatment for harmful alcohol and drug use in Brazil, highlighting a concerning collateral epidemic.

Our findings align with studies reporting similar increases in alcohol- and drug-related mortality globally. In the USA, alcohol-related mortality rates increased by 24.79% in 2020 and 21.85% in 2021.[25] Drug overdose deaths also saw a significant rise, with an increase of 16.9% in 2020 and 26.4% in 2021.[26] Additionally, Cartus and colleagues[27] identified an excess number of overdose deaths during the last 43 weeks of 2020. In

ICD-10 Code	2015	2016	2017	2018	2019	2020	2021	2022	Entire period
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Alcohol-related deaths									
F10	6421 (31.25)	6287 (30.81)	6257 (30.36)	6428 (30.98)	6445 (31.61)	8530 (35.10)	8830 (35.13)	8479 (32.72)	57,677 (32.39)
K70	10,513 (51.17)	10,482 (51.37)	10,479 (50.85)	10,242 (49.37)	9799 (48.06)	10,583 (43.55)	10,868 (43.23)	11,566 (44.63)	84,532 (47.48)
X45	105 (0.51)	83 (0.41)	70 (0.34)	65 (0.31)	47 (0.23)	64 (0.26)	69 (0.27)	64 (0.25)	567 (0.32)
X65	47 (0.23)	36 (0.18)	48 (0.23)	60 (0.29)	64 (0.31)	77 (0.32)	71 (0.28)	85 (0.33)	488 (0.27)
Y15	74 (0.36)	105 (0.51)	144 (0.70)	122 (0.59)	95 (0.47)	92 (0.38)	83 (0.33)	54 (0.21)	769 (0.43)
Total	17,160 (83.53)	16,993 (83.28)	16,998 (82.48)	16,917 (81.54)	16,450 (80.69)	19,346 (79.60)	19,921 (79.25)	20,248 (78.14)	144,033 (80.90)
Drug-related deaths									
F11	15 (0.07)	14 (0.07)	15 (0.07)	14 (0.07)	10 (0.05)	12 (0.05)	16 (0.06)	15 (0.06)	111 (0.06)
F12	18 (0.09)	22 (0.11)	9 (0.04)	24 (0.12)	16 (0.08)	26 (0.11)	28 (0.11)	26 (0.10)	169 (0.09)
F13	3 (0.01)	5 (0.02)	6 (0.03)	9 (0.04)	9 (0.04)	10 (0.04)	19 (0.08)	13 (0.05)	74 (0.04)
F14	132 (0.64)	147 (0.72)	165 (0.80)	168 (0.81)	160 (0.78)	218 (0.90)	238 (0.95)	266 (1.03)	1494 (0.84)
F15	4 (0.02)	3 (0.01)	9 (0.04)	2 (0.01)	1 (0.01)	11 (0.05)	2 (0.01)	3 (0.01)	35 (0.02)
F16	15 (0.07)	12 (0.06)	12 (0.06)	15 (0.07)	21 (0.10)	10 (0.04)	13 (0.05)	7 (0.03)	105 (0.06)
F17	1547 (7.53)	1593 (7.81)	1639 (7.95)	1689 (8.14)	1825 (8.96)	2407 (9.90)	2481 (9.87)	2805 (10.82)	15,986 (8.98)
F18	12 (0.06)	12 (0.06)	9 (0.04)	10 (0.05)	14 (0.07)	19 (0.08)	16 (0.06)	12 (0.05)	104 (0.06)
F19	300 (1.46)	311 (1.52)	379 (1.84)	408 (1.97)	416 (2.04)	551 (2.27)	590 (2.35)	637 (2.46)	3592 (2.02)
X40	7 (0.03)	6 (0.03)	7 (0.03)	6 (0.03)	13 (0.06)	7 (0.03)	6 (0.02)	8 (0.03)	60 (0.03)
X41	40 (0.19)	46 (0.23)	40 (0.19)	52 (0.25)	29 (0.14)	31 (0.13)	48 (0.19)	49 (0.19)	335 (0.19)
X42	488 (2.38)	486 (2.38)	431 (2.09)	430 (2.07)	375 (1.84)	402 (1.65)	335 (1.33)	335 (1.29)	3282 (1.84)
X43	7 (0.03)	0 (0.00)	2 (0.01)	9 (0.04)	5 (0.02)	6 (0.02)	5 (0.02)	6 (0.02)	40 (0.02)
X44	70 (0.34)	62 (0.30)	74 (0.36)	81 (0.39)	72 (0.35)	108 (0.44)	100 (0.40)	104 (0.40)	671 (0.38)
X60	9 (0.04)	21 (0.10)	9 (0.04)	11 (0.05)	14 (0.07)	14 (0.06)	17 (0.07)	14 (0.05)	109 (0.06)
X61	196 (0.95)	211 (1.03)	244 (1.18)	246 (1.19)	260 (1.28)	235 (0.97)	268 (1.07)	302 (1.17)	1962 (1.10)
X62	60 (0.29)	51 (0.25)	75 (0.36)	87 (0.42)	77 (0.38)	108 (0.44)	112 (0.45)	136 (0.52)	706 (0.40)
X63	9 (0.04)	13 (0.06)	17 (0.08)	14 (0.07)	15 (0.07)	13 (0.05)	13 (0.05)	15 (0.06)	109 (0.06)
X64	210 (1.02)	214 (1.06)	257 (1.25)	308 (1.48)	366 (1.80)	447 (1.84)	593 (2.36)	591 (2.28)	2986 (1.68)
X85	8 (0.04)	14 (0.07)	9 (0.04)	9 (0.04)	11 (0.05)	9 (0.04)	7 (0.03)	2 (0.01)	69 (0.04)
Y10	5 (0.02)	5 (0.02)	6 (0.03)	2 (0.01)	6 (0.03)	7 (0.03)	7 (0.03)	5 (0.02)	43 (0.02)
Y11	57 (0.28)	44 (0.22)	43 (0.21)	58 (0.28)	40 (0.20)	74 (0.30)	62 (0.25)	66 (0.25)	444 (0.25)
Y12	71 (0.35)	47 (0.23)	63 (0.31)	89 (0.43)	87 (0.43)	112 (0.46)	118 (0.47)	145 (0.56)	732 (0.41)
Y13	5 (0.02)	1 (0.01)	6 (0.03)	4 (0.02)	5 (0.02)	8 (0.03)	6 (0.02)	7 (0.03)	42 (0.02)
Y14	96 (0.47)	71 (0.35)	84 (0.41)	84 (0.40)	90 (0.44)	112 (0.46)	117 (0.47)	97 (0.37)	751 (0.42)
Total	3384 (16.47)	3411 (16.72)	3610 (17.52)	3829 (18.46)	3937 (19.31)	4957 (20.40)	5217 (20.75)	5666 (21.86)	34,011 (19.10)
Alcohol- and drug-related deaths	20,544 (100)	20,404 (100)	20,608 (100)	20,746 (100)	20,387 (100)	24,303 (100)	25,138 (100)	25,914 (100)	178,044 (100)

F10: Mental and behavioral disorders due to use of alcohol; F11: Mental and behavioral disorders due to use of opioid; F12: Mental and behavioral disorders due to use of cannabinoid; F13: Mental and behavioral disorders due to use of sedatives and hypnotics; F14: Mental and behavioral disorders due to use of cocaine; F15: Mental and behavioral disorders due to use of stimulants, including caffeine; F16: Mental and behavioral disorders due to use of hallucinogens; F17: Mental and behavioral disorders due to use of tobacco; F18: Mental and behavioral disorders due to use of volatile solvents; F19: Mental and behavioral disorders due to use of multiple drugs and other psychoactive substances; K70: Alcoholic liver disease; X40: Accidental poisoning (intoxication) by and exposure to non-opioid analgesics, antipyretics, and anti-rheumatic drugs; X41: Accidental poisoning (intoxication) by and exposure to anticonvulsants (antiepileptics), sedatives, hypnotics, antiparkinsonian drugs, and psychotropic substances not classified elsewhere; X42: Accidental poisoning (intoxication) by and exposure to narcotics and psychodysleptics (hallucinogens) not classified elsewhere; X43: Accidental poisoning (intoxication) by and exposure to other pharmacological substances acting on the autonomic nervous system; X44: Accidental poisoning (intoxication) by and exposure to other drugs, medications, and unspecified biological substances; X45: Accidental poisoning (intoxication) by and exposure to alcohol; X60: Intentional self-poisoning by and exposure to non-opioid analgesics, antipyretics, and anti-rheumatic drugs; X61: Intentional self-poisoning by and exposure to anticonvulsants (antiepileptics), sedatives, hypnotics, antiparkinsonian drugs, and psychotropic substances not classified elsewhere; X62: Intentional self-poisoning by and exposure to narcotics and psychodysleptics (hallucinogens) not classified elsewhere; X63: Intentional self-poisoning by and exposure to other pharmacological substances acting on the autonomic nervous system; X64: Intentional self-poisoning by and exposure to other drugs, medications, biological substances, and unspecified substances; X65: Voluntary self-poisoning by alcohol; X85: Assault by means of drugs, medications, and biological substances; Y10: Poisoning (intoxication) by and exposure to non-opioid analgesics, antipyretics, and anti-rheumatic drugs, intention undetermined; Y11: Poisoning (intoxication) by and exposure to anticonvulsants (antiepileptics), sedatives, hypnotics, antiparkinsonian drugs, and psychotropic substances not classified elsewhere, intention undetermined; Y12: Poisoning (intoxication) by and exposure to narcotics and psychodysleptics (hallucinogens) not classified elsewhere, intention undetermined; Y13: Poisoning (intoxication) by and exposure to other pharmacological substances acting on the autonomic nervous system, intention undetermined; Y14: Poisoning (intoxication) by and exposure to other drugs, medications, biological substances, and unspecified substances, intention undetermined; Y15: Poisoning (intoxication) by and exposure to alcohol, intention undetermined; n: Absolute number %: Percentage.

Table 1: **Number of annual deaths by substance (ICD-10 code) in Brazil, during the 5-year period (2015–2019) prior to the COVID-19 pandemic and during the pandemic period (2020–2022).**

Indicator	Period	2015–2019				2015–2022				
		Segment period APC (CI95%)	Trend	Entire period AAPC (CI95%)	Trend	Period	Segment period APC (CI95%)	Trend	Entire period AAPC (CI95%)	Trend
Brazil	2015–2019	−0.6 (−2.0 to 0.8)	Stable	–	–	2015–2019	0.1 (−2.2 to 2.0)	Stable	3.8[a] (2.9–4.8)	Increasing
						2019–2022	8.9[a] (6.3–12.2)	Increasing		
Region										
North	2015–2019	−1.7 (−8.0 to 5.0)	Stable	–	–	2015–2020	−1.6 (−9.3 to 2.0)	Stable	1.7 (−0.8 to 3.5)	Stable
						2020–2022	10.3[a] (0.6–18.0)	Increasing		
Northeast	2015–2019	−1.5[a] (−2.7 to −0.4)	Decreasing	–	–	2015–2022	4.5[a] (0.5–8.9)	Increasing	–	–
Southeast	2015–2019	−0.9[a] (−1.6 to −0.1)	Decreasing	–	–	2015–2018	−1.4 (−6.9 to 2.3)	Stable	3.1[a] (1.9–4.5)	Increasing
						2018–2022	6.6[a] (4.2–11.9)	Increasing		
South	2015–2019	1.3 (−1.5 to 4.2)	Stable	–	–	2015–2019	1.1 (−1.0 to 2.7)	Stable	4.7[a] (3.9–5.4)	Increasing
						2019–2022	9.6[a] (7.3–12.8)	Increasing		
Midewst	2015–2019	0.8 (−5.2 to 7.3)	Stable	–	–	2015–2022	2.4[a] (1.0–3.9)	Increasing	–	–
Sex										
Male	2015–2019	−1.0 (−2.4 to 0.4)	Stable	–	–	2015–2019	−0.2 (−2.6 to 1.7)	Stable	3.6[a] (2.7–4.6)	Increasing
						2019–2022	9.0[a] (6.2–12.4)	Increasing		
Female	2015–2019	0.7 (−0.2 to 1.5)	Stable	–	–	2015–2019	1.1 (−0.9 to 2.5)	Stable	4.6[a] (4.0–5.3)	Increasing
						2019–2022	9.5[a] (7.5–12.4)	Increasing		
Age group										
0 to 9	2015–2019	−2.6 (−42.4 to 68.2)	Stable	–	–	2015–2022	−0.6 (−16.4 to 19.1)	Stable	–	–
10 to 19	2015–2019	−5.8[a] (−8.7 to −3.0)	Decreasing	–	–	2015–2022	−2.5 (−5.4 to 0.3)	Stable	–	–
20 to 39	2015–2019	−3.6[a] (−4.7 to −2.5)	Decreasing	–	–	2015–2018	−4.8[a] (−10.2 to −0.9)	Decreasing	2.0[a] (0.7–3.3)	Increasing
						2018–2022	7.4[a] (4.8–12.2)	Increasing		
40 to 59	2015–2019	−2.8 (−4.9 to −0.6)	Decreasing	–	–	2015–2022	1.5 (−0.6 to 3.7)	Stable	–	–
≥60	2015–2019	0.7 (−1.4 to 0.0)	Stable	–	–	2015–2019	−0.8 (−3.4 to 0.6)	Stable	1.8[a] (1.1–2.4)	Increasing
						2019–2022	5.3[a] (3.3–8.4)	Increasing		

APC: Annual Percentage Changes; AAPC: Average Annual Percentage Changes. [a]p-value <0.05.

***Table 2*: Temporal trend of deaths due to the use of alcohol and other drugs by region, sex, and age group in Brazil during the 5-year period (2015–2019) prior to the COVID-19 pandemic and during the pandeic period (2020–2022).**

Norway, overdose mortality increased 16.5% in 2020,[28] and in Poland, alcohol-related deaths rose by 13%.[29] Other countries, including Australia,[30] Scotland,[31] and Germany,[32] have also reported increased PAS-related deaths, underlining the pandemic's serious consequences for people who use drugs.

Several factors may explain the increase in Brazil. Emergency measures to contain SARS-CoV-2 virus and prevent the healthcare collapse affected numerous health services, especially those targeting vulnerable population groups.[20,33,34] Harm reduction and alcohol and drug treatment services were drastically reduced in several countries, limiting access to crucial support like social support, drug treatment, shelter, and supervised consumption sites.[9–11]

In Brazil, Psychosocial Care Centers (CAPS), incorporated into the Psychosocial Care Network (RAPS), provide essential care for severe PAS disorders,[35] were also impacted, with reduced consultations and group therapy.[36] This diminished care likely contributed to worsening consumption,[37] increased overdose risk, and health deterioration, ultimately leading to death.[38,39]

People who use alcohol and drugs in many countries, including Brazil, often live in socioeconomic instability and face barriers like homelessness, incarceration, and discrimination,[40–42] which the COVID-19 crisis likely exacerbated. Precarious living conditions and limited harm reduction services likely increased their risk of adverse outcomes,[39,40] particularly in low and middle-income countries, such as Brazil.

The pandemic altered societal structures globally, disrupting communities and causing significant economic repercussions due to social distancing measures and restriction on non-essential services.[43,44] These factors likely worsened mental health, driving people to use PAS as a coping mechanism.[14,45] Studies have shown increased alcohol and drug use as a response to pandemic stress, linked to symptoms like loneliness, anxiety, and depression.[13,14,45] A review observed rising trends in PAS use from December 2019 to November 2020, often linked to these mental health challenges.[12]

PAS use also rose in Brazil during the COVID-19 crisis. Studies observed an increase in alcohol consumption during the pandemic,[46,47] while hospital-based treatments for people with substance dependence rose by 54% in 2020.[48] Such increases may worsen substance dependence and mental health, potentially contributing to drug-related deaths.[1]

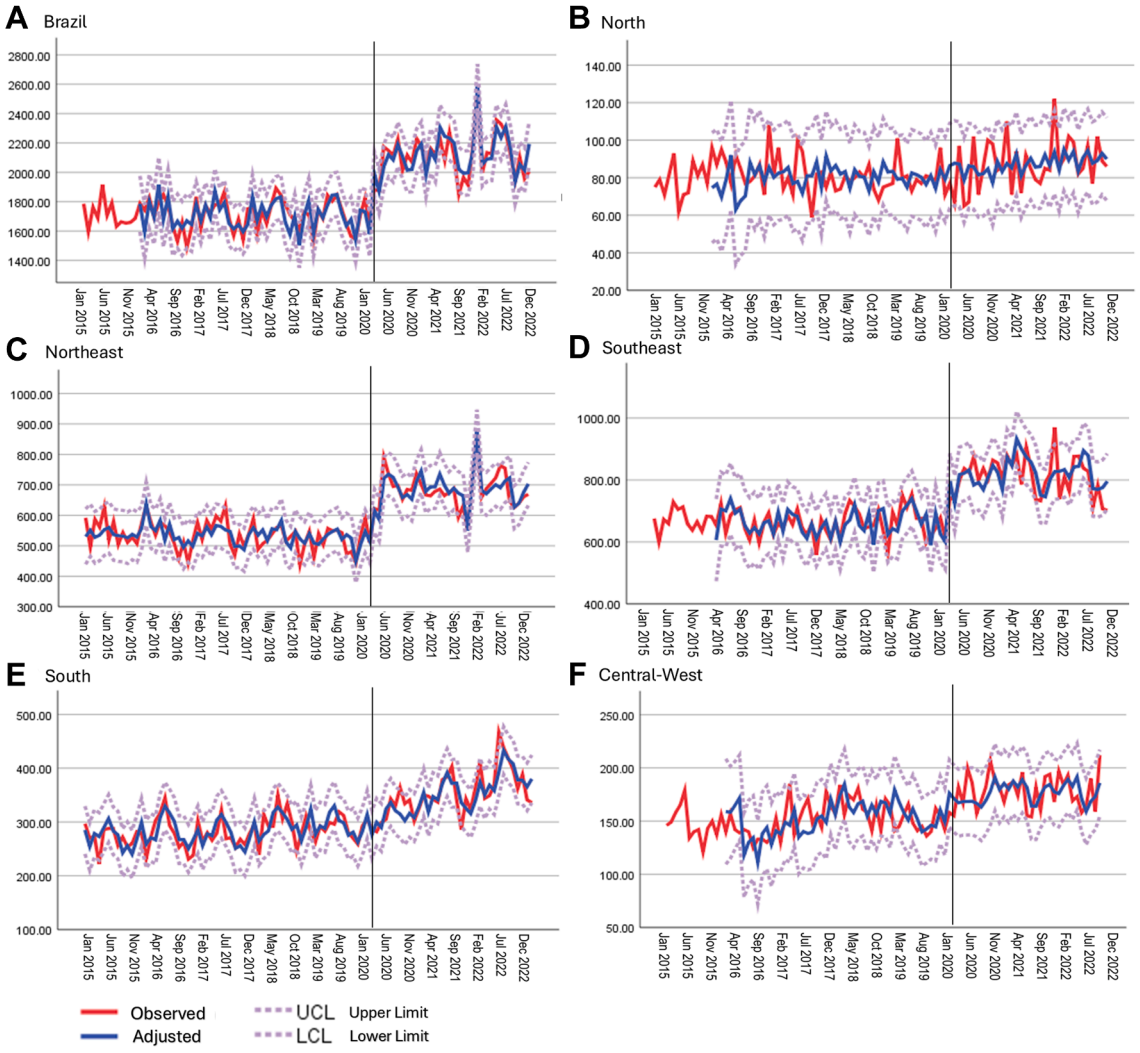

Fig. 2: **Interrupted time series graphs of deaths by alcohol and other drugs in Brazil (A) and in the North (B), Northeast (C), Southeast (D), South (E), and Central-West regions (F).** The line parallel to the Y axis represents the month of March 2020, when the WHO declared the global COVID-19 outbreak a pandemic.

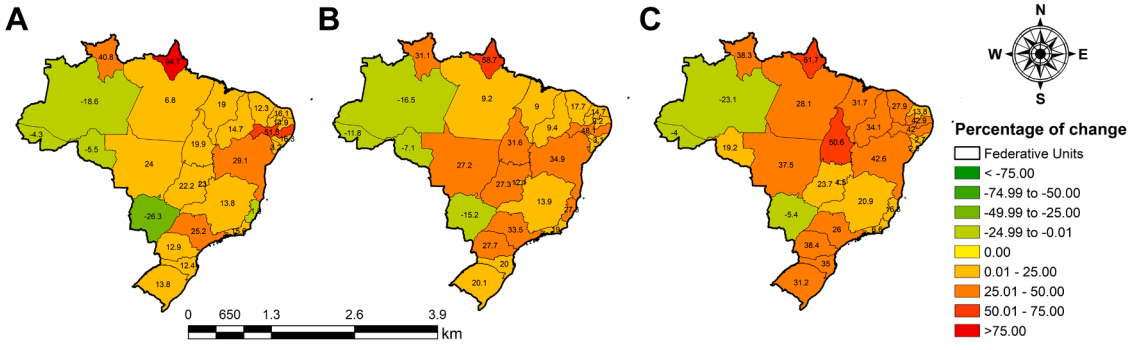

Fig. 3: **Spatial distribution maps of the percentage change values in deaths due to alcohol and other drugs use by state in Brazil, during the year of 2020 (A), 2021 (B) and 2022 (C).**

Surprisingly, we found that the highest percentage of deaths was associated with alcohol use in all the years analyzed herein. This finding may be related to the pattern of drug use in Brazil, where alcohol is the most widely consumed legal drug.[4] In addition, alcohol is one of the main risk factors for illness and mortality from various etiologies, including non-communicable diseases.[49] Additionally, studies already indicated an increase in the consumption of alcoholic beverages in Brazil even before COVID-19,[50,51] which was intensified during the pandemic.[46,47] As a result, this scenario may have contributed to the higher number of fatal outcomes associated with alcohol identified in our study.

We also observed an increase in mortality associated with the use of PAS in both sexes, with a more pronounced growth among females, individuals aged 20 to 39, and those aged 60 and above. In Brazil, young men have a higher propensity for drug use and related conditions,[51,52] and the pandemic may have intensified this vulnerability, worsening the situation and contributing to the rise in deaths. On the other hand, women showed a higher incidence of symptoms such as anxiety, depression, and stress during the pandemic,[53] which may have amplified the harmful use of substances as a coping strategy,[12–14] resulting in more severe complications and unfavorable outcomes. Additionally, older individuals are particularly vulnerable to the effects of substance use, including the exacerbation of underlying clinical and mental conditions,[54] which may be linked to the increase in deaths within this group.

Our study highlights regional disparities in mortality rates in Brazil, focusing on the Northeast, Southeast, and South regions. In the Northeast, some states face deep social inequalities, characterized by high levels of poverty and unemployment, with a significant portion of the population living in unfavorable socioeconomic conditions.[55] In the Southeast, although it is a developed region, large urban centers host a considerable number of people who use drugs who also face precarious living conditions.[56,57] The pandemic may have intensified social and economic inequalities, exacerbating the marginalization of vulnerable groups,[57,58] such as people who use alcohol and drugs in many countries, and increasing their risk of adverse outcomes and mortality in these regions. In the South, a study that analyzed pre-pandemic data had already indicated an increase in mortality rates associated with substance use,[59] and it is likely that this situation has worsened with the health crisis.

The scenario outlined here is alarming and poses a significant challenge to achieving the 2030 Agenda's goals related to strengthening PAS use prevention and treatment. Therefore, urgent action must be taken to mitigate COVID-19's negative impacts on healthcare for people who use alcohol and drugs in many countries, demanding substantial investments to improve existing services and develop intersectoral strategies to reinforce RAPS' initiatives.

This study has limitations that should be acknowledged. The ecological analysis of secondary data from the SIM may introduce potential biases, such as underreporting or overreporting in specific regions or states. In addition, delays in data recording within the system, as well as inaccuracies in the coding of deaths related to the use of certain PAS, may occur. It is likely that many deaths associated with the use of multiple substances are recorded solely as alcohol-related, since alcohol is often considered the underlying cause. Although SIM contains data on associated causes, these are not always standardized or complete in the public database. Furthermore, this study did not use information on gender or race/ethnicity, which limits the analysis of potential differences or disparities among these groups. Despite these limitations, the findings provide important insights into the impact of the pandemic on decision-making processes related to the prevention and treatment of alcohol and drug use in Brazil.

Conclusion

Our analysis revealed a significant increase in alcohol- and drug-related deaths in Brazil during the first three years of the pandemic. These findings underscore the severe impact of the COVID-19 health crisis on prevention, treatment, and recovery efforts for people who use alcohol and drugs, exposing a collateral epidemic, and presenting a concerning outlook for achieving goals related to reducing harmful drug use and dependence in the country. The development of intersectoral public policies is essential to reduce the vulnerability of these groups and help prevent unfavorable outcomes in future crises.

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Data sharing statement

The data used in this study were obtained from publicly accessible sources, specifically the Mortality Information System (SIM) of the

Brazilian Ministry of Health, which is available online on the DATASUS website. As these data are collected and managed by a public health system, they are freely accessible to researchers and the general public. However, specific documents related to data processing, analysis scripts, or additional details of the methodology may be shared upon reasonable request and with proper justification, subject to approval by the corresponding author.

Editor's note

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Declaration of interests

The authors report no conflict of interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2025.101371.

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