Excess mortality associated with COVID-19 in Brazil: 2020–2021

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ABSTRACT

Objective To evaluate excess mortality in Brazil from January 2020 to April 2021, according to the primary causes of death registered in the Brazilian Mortality Information System (MIS).

Methods Cross-sectional study with data extracted from the MIS. Excess deaths were examined by the primary cause of death according to 11 grouped causes. Autoregressive models used mortality data from 2015 to 2019 to predict expected deaths from January 2020 to April 2021. Excess deaths were calculated as the difference between the observed and the expected number of deaths.

Results Total excess deaths of 370 055 were observed in the studied period, corresponding to a ratio of observed to expected of 1.14 in 2020 and 1.40 in 2021. Excess deaths were seen in three groups: symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified; other diseases of the respiratory system and coronavirus infection, unspecified site.

Conclusions The excess mortality in Brazil in these 16 months was 1.20 times greater than the previous year. The increase in not elsewhere classified causes and causes of death associated to COVID-19 indicate caution about the negative balance for some causes. Furthermore, the inequalities of mortality reporting systems in low- and middle-income countries in relation to underestimation of mortality still need to be addressed.

Keywords Brazil, coronavirus, epidemiology, mortality

Introduction

In Brazil, since the beginning of the pandemic in March 2020, there have been 21 644 464 confirmed cases and 603 282 deaths, up to 17 October 2021, due to COVID-19 infection.[1] Currently, Brazil has the second highest number of deaths and the third highest number of confirmed infections.[2]

Monitoring the evolution of the pandemic has been a challenge around the world, especially in low- and middle-income countries such as Brazil, where underreporting is a reality.[3]

Given the uncertainties surrounding mortality statistics related to COVID-19, excess mortality may be used as an alternative to assess the real impact of the pandemic. This information includes, in addition to the deaths directly associated with COVID-19, those that are indirectly related to the infection due to the overcrowding of hospitals and health services, people with chronic or acute diseases who fear becoming infected when seeking medical care or do not seek health care services due to circulation restrictions.

Although more specific indicators are essential for good monitoring, overall excess mortality is an objective, relatively simple and robust parameter, allowing the number of deaths to be counted regardless of the accuracy of the cause of death data.[4,5] The excess mortality indicator has not been widely explored in the past, especially in developing countries. Thus, the aim of this study was to evaluate excess deaths in Brazil from January 2020 to April 2021, according to the

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primary causes of death registered in the Brazilian Mortality Information System (MIS).

Methods

Data from 2015 to 2019 were extracted from the Brazilian MIS, which is the official source of data that combines information from hospitals and the mortality Registry Office. Data for 2020 and the first quarter of 2021 are provisional and may be subjected to revision due to the lag in time between when the death occurred and when the data were submitted to MIS and processed for reporting purposes.[6]

We examined the primary cause of death according to the 11 grouped causes in the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) provided by the Centers for Disease Control and Prevention[7]: (i). Alzheimer disease (G30); (ii) cerebrovascular diseases (I60-I69); (iii) symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99); (iv) diseases of heart (I00–I09, I11, I13, I20–I51); (v) influenza and pneumonia (J09–J18); (vi) chronic lower respiratory diseases (J40–J47); (vii) nephritis, nephrotic syndrome and nephrosis (N00–N07, N17–N19, N25–N27); (viii) other diseases of the respiratory system (J00–J06, J30–J39, J67, J70–J98); (ix) diabetes mellitus (E10–E14); (x) malignant neoplasms (C00–C97); (xi) septicemia (A40–A41). Furthermore, we included three other categories: (i) external causes of morbidity and mortality (V01–Y98); (ii) coronavirus infection, unspecified site (B-34.2) and (iii) all other classifications. No death has been recorded as ICD U07.1 (COVID-19) yet.

Autoregressive models used mortality data from 2015 to 2019 to predict expected deaths in Brazil for 2020 and the first quarter of 2021. To diagnose autocorrelation the generalized Durbin–Watson test was applied. Excess deaths were calculated as the difference between the observed and the expected number of deaths for 2020 and the first quarter of 2021. Statistical significance was evaluated by the 95% confidence interval (CI) of these estimates.

Epidemiological weeks were used as the time variable. Autoregressive error models for each grouped cause were tested, and the order of the autoregressive model was selected by stepwise autoregression. The model with lower Akaike Index Criterion was selected. The analyses were done using SAS OnDemand for Academics (SAS Institute, Cary, NC) software.

Results

The data in Table 1 show 370 055 total excess deaths and 387 226 excess deaths from natural causes in the study period. Considering 2020 and the first quarter of 2021 separately, we found that the number of total excess deaths were 195 813 in 2020 and 174 242 in 2021, corresponding to a ratio of observed to expected of 1.14 and 1.40, respectively. Excess deaths were seen in three groups: (i) symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified; (ii) other diseases of the respiratory system and (iii) coronavirus infection, unspecified site. In contrast, the grouped causes of diseases of heart, influenza and pneumonia, chronic lower respiratory diseases and malignant neoplasms presented less deaths than expected. The other groups did not present a statistically significant difference compared with what was expected.

Discussion

Our analysis highlights the rise in mortality observed in Brazil for natural causes, symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified, other diseases of respiratory system and coronavirus infection. Conversely, the reduction in mortality attributable to diseases of heart, influenza and pneumonia, chronic lower respiratory diseases and malignant neoplasm causes may be associated to COVID-19 mortality as these causes share many risk factors. The total balance of mortality in Brazil, in these 16 months (January 2020 to April 2021) was 1.20 times greater than the previous year, being much higher in the first quarter of 2021.

The increase in ‘not elsewhere classified causes’ indicates caution about the negative balance for some causes. This effect may be due to the action of COVID-19 overburdening the classification system regarding mortality from multiple causes without determining the primary cause. COVID-19 may challenge the classification system in dealing with multiple cause mortality data.

The increase in excess mortality from other diseases of the respiratory system agrees with international studies demonstrating the displacement of COVID-19 cases to other unidentified respiratory causes.[8] Also, limitations of studies involving excess mortality, in scenarios of compromised notification, are the delays and incompleteness of data.

Comparative parameters of socioeconomic spheres provide evidence on the burden of excess mortality for health and notification systems that face different realities. The excess mortality in Bolivia, Paraguay, Uruguay and Brazil reached the marks of 243%, 141%, 73% and 82%, respectively. While in developed countries such as the USA, Japan, UK and Germany the highest *P*-score values of excess mortality were, 46%, 6%, 107% and 36%, respectively.[9]

Table 1 Excess deaths by selected underlying causes, Brazil, from January 2020 to April 2021

Cause	*Expected deaths (95% CI)*	*Observed deaths (ratio of observed to expected)*	*Excess deaths (95% CI)*
Total	1820 294 (1,700 750–1939 839)	2190 349 (1.20)	370 055 (250 510–489 599)
Natural causes	1622 304 (1498 081–1746 527)	2009 530 (1.24)	387 226 (263 003–511 449)
Alzheimer disease	33 024 (27 895–38 154)	29 179 (0.88)	−3845 (−8,975 to 1,284)
Cerebrovascular diseases	133 606 (121 091–146 121)	124 170 (0.93)	−9436 (−21 951 to 3079)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	102 312 (89 753–114,872)	136 824 (1.34)	34 512 (21 952–47 071)
Diseases of heart	244 548 (222 293–266 803)	213 210 (0.87)	−31 338 (−53 593 to −9083)
Influenza and pneumonia	110 041 (93 714–126 368)	9159 (0.83)	−18 443 (−34 770 to −2116)
Chronic lower respiratory diseases	66 372 (58 197–74 548)	47 779 (0.72)	−18 593 (−26 769 to −10,418)
Nephritis, nephrotic syndrome and nephrosis	26 120 (22 389–29 851)	24 672 (0.94)	−1448 (−5179–2283)
Other diseases of respiratory system	27 556 (22 973–32 139)	45 202 (1.64)	17 646 (13 063–22 229)
Diabetes mellitus	91 766 (83 031–100 502)	93 394 (1.02)	1628 (−7108 to 10 363)
Malignant neoplasms	319 833 (304 736–334 929)	285 840 (0.89)	−33 993 (−49 089 to −18 896)
Septicemia	29 177 (24 873–33 481)	29 561 (1.01)	384 (−3920 to 4688)
All others	448 209 (419 638–476 781)	464 563 (1.04)	16 354 (−12 218 to 44 925)
External causes of morbidity and mortality	191 700 (171 292–212 108)	180 819 (0.94)	−10 881 (−31 289 to 9527)
Coronavirus infection, unspecified site	0	423 538	423 538

In this context, we still face, for comparative purposes, the inequalities of mortality reporting systems in low- and middle-income countries regarding the underestimation of mortality.

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