

Estimates of the impact of COVID-19 on mortality of institutionalized elderly in Brazil

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Abstract *The COVID-19 pandemic poses difficulties for long-term care institutions for the elderly, with increased mortality rates for the residents. This study aims to estimate the impact of COVID-19 on mortality of institutionalized elderly in Brazil. Estimates of the percentage of elderly deaths occurring in care homes were calculated for Brazil, States and Regions using estimates for the total number of deaths. The estimation was based upon information available for other countries. The weighted percentage was 44.7% and 107,538 COVID-19 deaths were estimated for the elderly in these institutions in Brazil in 2020. Higher numbers of deaths were expected in the Southeast Region (48,779 deaths), followed by the Northeast Region (28,451 deaths); São Paulo was the most affected State (24,500 deaths). The strong impact of COVID-19 on the elderly population living in long-term care facilities is clear. Estimates for the country exceeded 100,000 elderly people, potentially the most fragile and vulnerable, and are based upon a conservative number of total deaths, in view of other estimates and the alarming situation of death growth in Brazil from COVID-19.*

Key words *Coronavirus infections, Simulation, Health of institutionalized elderly, Frail elderly, Cross-sectional studies*

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Introduction

High fatality rates due to SARS-CoV-2 have been associated with elderly patients or with the presence of comorbidities in these patients¹⁻³. Among those infected (who are above 80 years), more than one fifth die: these percentages are 21.9% in China and 20.2% in Italy³. The COVID-19 pandemic is a challenge for long-term care institutions for the elderly (care homes), given that their institutionalized members belong to the COVID-19 most susceptible groups⁴.

Care homes concentrate people who have adverse outcome risks for COVID-19 that are above the average risks and, also, the fact that they live very close together can act as a worsening factor in the spread of SARS-CoV-2 infections^{2,3}. Although there are estimates of the total deaths of residents of care homes in some countries^{5,6}, estimates of fatality rates of COVID-19 in elderly persons in care homes were only found for the United States and Singapore. In the United States (King County, Washington State)⁴, the fatality rate was 33.7% and, in Singapore⁷, the estimate was indirect, but indicated that deaths by COVID-19 of institutionalized elderly people accounted for about 14% of the general fatality rate⁷.

A few of countries have attempted to estimate the impact of mortality at care homes^{5,6}, however, in Brazil, the number of elderly residents in long-term care facilities is not known, nor to what extent COVID-19 has affected the mortality of residents. Thus, the present study aims to estimate the impact of COVID-19 on the mortality of institutionalized elderly in Brazil.

Methods

This is a cross-sectional and simulation study. The estimates were calculated in two stages. In the first stage, total COVID-19 deaths were estimated for the elderly; in the second stage, a weighted percentage, which was obtained based on proportional mortality indicators from official death data in care homes, were applied to these deaths.

In the first stage of the estimation process, the total COVID-19 deaths for the elderly were adopted from the lowest estimated values suggested by Martinez et al.⁸, who used the Corona-older platform⁹. This platform made it possible to estimate the number of deaths expected by COVID-19, by age, for Brazil, States and the

Federal District, based on population estimates for 2020. It also allows researchers to work with variable rates of infection and case fatality based on what happened in countries like China, Italy or South Korea. In this study we based our estimates on Martinez et al.⁸, who selected an infection rate of 10.0% and fatality rates by age groups as observed in China, thus obtaining a total number of deaths of 240,281. These estimates may be considered reasonable and conservative as compared to the estimate of 452,694 by Dowd et al.¹⁰, who studied, in detail, not only the behavior of the epidemic, but also the Brazilian age structure.

In relation to the second stage of the estimation approach, COVID-19 death estimates for elderly living in care homes, using data from recent international research on COVID-19: official data came from eleven different countries as published by Comas-Herrera et al.⁵. Estimates, as well as their temporal and geographical location⁵, are shown in Table 1.

Table 1 indicates: (i) whenever possible, for each country, we used estimates of confirmed deaths by COVID-19 - this choice was made in order to avoid including false positive individuals for COVID-19 who subsequently died (Belgium and Ireland would have, if the data on probable COVID-19 deaths were used, respectively, figures of 100.0% and 56.9%); (ii) information was obtained for the United States based on data from 38 of the 50 US States⁶; finally, information for Spain was obtained based on six of the 17 autonomous communities and the percentage was calculated directly by the authors of this article based on the information provided in Comas-Herrera et al.⁵.

The weighted percentage of care home resident-deaths in relation to the total was estimated as the sum of the number of COVID-19 deaths in countries with available information, multiplied by the proportion of COVID-19 deaths of care homes residents by (N1) in relation to the number of total deaths by COVID-19, for all countries (N3), divided by the sum of (N1) for all countries:

$$\text{Weighted Percentage} = [(80) \times (19.0) + (3,685) \times (10.0) + (2,465) \times (72.0) + (22,614) \times (51.0) + (172) \times (19.0) + (829) \times (55.0) + (200) \times (33.0) + (193) \times (63.0) + (820) \times (40.0) + (10) \times (20.0) + (19,580) \times (50.0) + (10,378) \times (27.0)] / (80 + 3,685 + 2,465 + 22,614 + 172 + 829 + 200 + 193 + 820 + 10 + 19,580 + 10,378) = 44.7$$

For care home elderly COVID-19 deaths, we used 95.0% confidence intervals for the averages.

Table 1. Information used to estimate the weighted percentage of elderly in care homes in Brazil, based on studies by Comas-Herrera et al.⁵ and Chidambaram⁶.

Country	Dates referring to death occurrence (day/month/year)	(N1) Number of COVID-19 deaths (total population)	(N2) Number of COVID-19 deaths for elderly care home residents	(N3) = (N2)/(N1) (%) Proportion of COVID-19 deaths for elderly care home residents in relation to the number of total COVID-19 deaths*
Australia	25/april/2020	80	15	19.0%
Belgium	26/april/2020	3,685	373	10.0%
Canada	25/april/2020	2,465	1,769	72.0%
France	25/april/2020	22,614	8,564	51.0%
Hungria	18/april/2020	172	33	19.0%
Ireland	24/april/2020	829	452	55.0%
Israel	26/april/2020	200	65	33.0%
Norway	25/april/2020	193	122	63.0%
Portugal	23/april/2020	820	327	40.0%
Singapore	16/april/2020	10	2	20.0%
Spain ⁽²⁾	22 ou 23/april/20	19,580	9,789	50.0%
United States of America	23/april/2020	10,378	2,386	27.0%
Total and estimates for Brazil	----	61,026	23,897*	44.7%*

Note: *for (N2) and (N3) weighted averages by (N1) were calculated.

Results

Estimates by States, Federal District, Regions and Brazil are in Table 2. Out of the 240,287 COVID-19 deaths considered, a total of 107,528 deaths would occur in care homes (95.0% confidence interval from 107,269 to 107,788). These deaths make up 61.9% of all 175,435 COVID-19 related deaths for the elderly. The Southeast Region would concentrate the majority of deaths in Brazil, equivalent to 48,779 deaths (95.0% confidence interval of 48,661 to 48,898), followed by the Northeast Region (28,451 deaths; 95.0% confidence interval of 28,382 to 28,520), according to Figure 1.

Regarding States (Figure 2), São Paulo, Minas Gerais, Rio de Janeiro, Bahia and Rio Grande do Sul, would be those with the highest number of COVID-19 deaths (at all ages and in care homes).

Discussion

Findings of the present study indicated that almost half (44.7%) of COVID-19 will take place among elderly who live in care homes. More than

100,000 elderly people in care homes (107,528 deaths) are expected to die from the disease.

Limitations of the present study may have affected the results, since the estimate of COVID-19 deaths among the elderly in care homes did not consider age structure or the number of beds in these institutions, which vary among Regions in Brazil. Thus, a higher number of elderly deaths due to COVID-19 are expected to come from care homes in the Southeast Region due to its larger population, a high proportion of the elderly (16.1%) in relation to the total population¹¹, the higher percentage of institutionalized elderly people and, finally, due to the number of total deaths due to COVID-19 that has been observed in the last epidemiological weeks in this region¹². Hence, adjustments in the estimates will be needed to assess whether these initial estimates agreed with what actually happened. Also, studies to assess COVID-19 case fatality rates in care homes in Brazil are also necessary.

Another limitation refers to the unavailability of data on the number of elderly residents in institutions as well as official statistics on mortality in care homes. In fact, accurate data on care home elderly residents are scarce: other places,

Table 2. Estimated number of COVID-19 deaths for the elderly living in care homes, for Brazil, Regions, States and Federal District, 2020.

States/Federal District/Regions/Brazil	(N1) Total number of COVID-19 deaths (all ages)	(N2) = (N1)*0.447 Estimated number of COVID-19 deaths for elderly living in care homes	95% Confidence Interval	
			Inferior limit	Upper limit
Rondônia	1.516	678	677	680
Acre	640	286	286	287
Amazonas	2.917	1.305	1.302	1.309
Roraima	366	164	163	164
Pará	7.092	3.174	3.166	3.181
Amapá	522	234	233	234
Tocantins	1.481	663	661	664
Maranhão	6.921	3.097	3.090	3.105
Piauí	3.897	1.743	1.740	1.748
Ceará	10.636	4.760	4.748	4.771
Rio Grande do Norte	4.022	1.800	1.796	1.804
Paraíba	4.969	2.224	2.218	2.229
Pernambuco	10.530	4.712	4.701	4.723
Alagoas	3.316	1.484	1.480	1.487
Sergipe	2.275	1.018	1.016	1.021
Bahia	17.012	7.613	7.595	7.631
Minas Gerais	27.024	12.093	12.064	12.122
Espírito Santo	4.471	2.001	1.996	2.006
Rio de Janeiro	22.912	10.253	10.228	10.278
São Paulo	54.748	24.500	24.441	24.556
Paraná	13.384	5.990	5.975	6.004
Santa Catarina	8.040	3.598	3.589	3.607
Rio Grande do Sul	15.960	7.142	7.125	7.159
Mato Grosso do Sul	2.928	1.310	1.307	1.313
Mato Grosso	3.206	1.434	1.431	1.438
Goiás	6.947	3.109	3.101	3.116
Distrito Federal	2.556	1.143	1.141	1.147
Regions				
North	14.533	6.504	6.488	6.519
Northeast	63.578	28.451	28.382	28.520
Southeast	109.156	48.779	48.661	48.898
South	37.384	16.729	16.689	16.790
Midwest	15.636	6.997	6.980	7.014
Brazil	240.287	107.528	107.269	107.788

such as the United Kingdom, also consider estimates instead of a more precise figure¹³. Considering this drawback, our option, therefore, was to estimate only the number of deaths.

Our simulation indicates the devastating impact of COVID-19 on institutionalized elderly people, as has occurred in other countries such as in Italy¹⁴ and in United States⁴.

Cabrero¹⁵, based on Spain experience, points out that there are causes for the impact of the COVID-19 pandemic on institutionalized elderly, namely negligence and discrimination caused in part by the overload of the pandemic in health services; insufficient human and material resources; lack of control and legislation aimed at the elderly people living in care homes at the be-

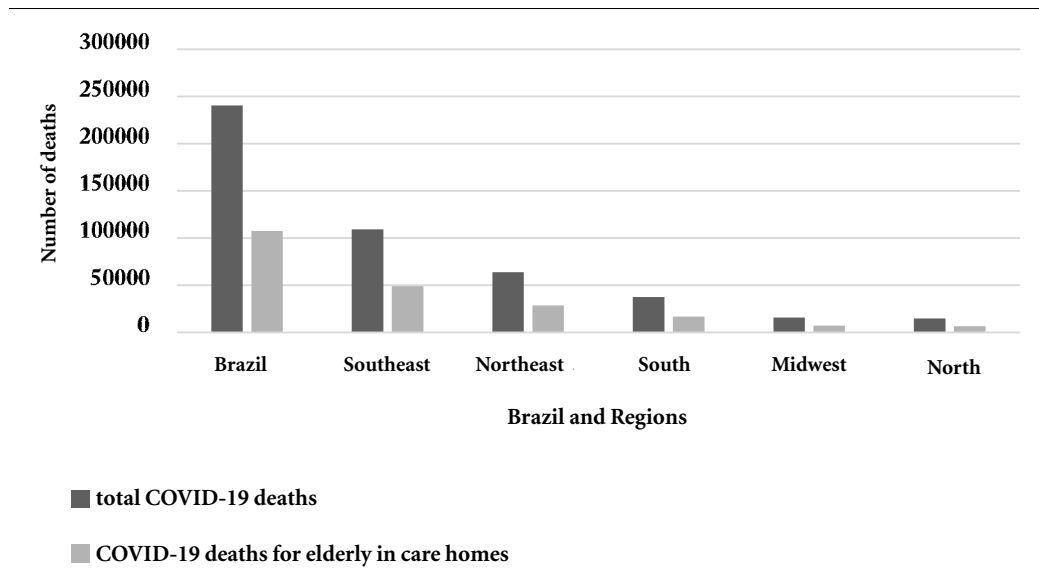


Figure 1. Number of COVID-19 deaths for all ages and for elderly in care homes, Brazil and Regions, 2020.

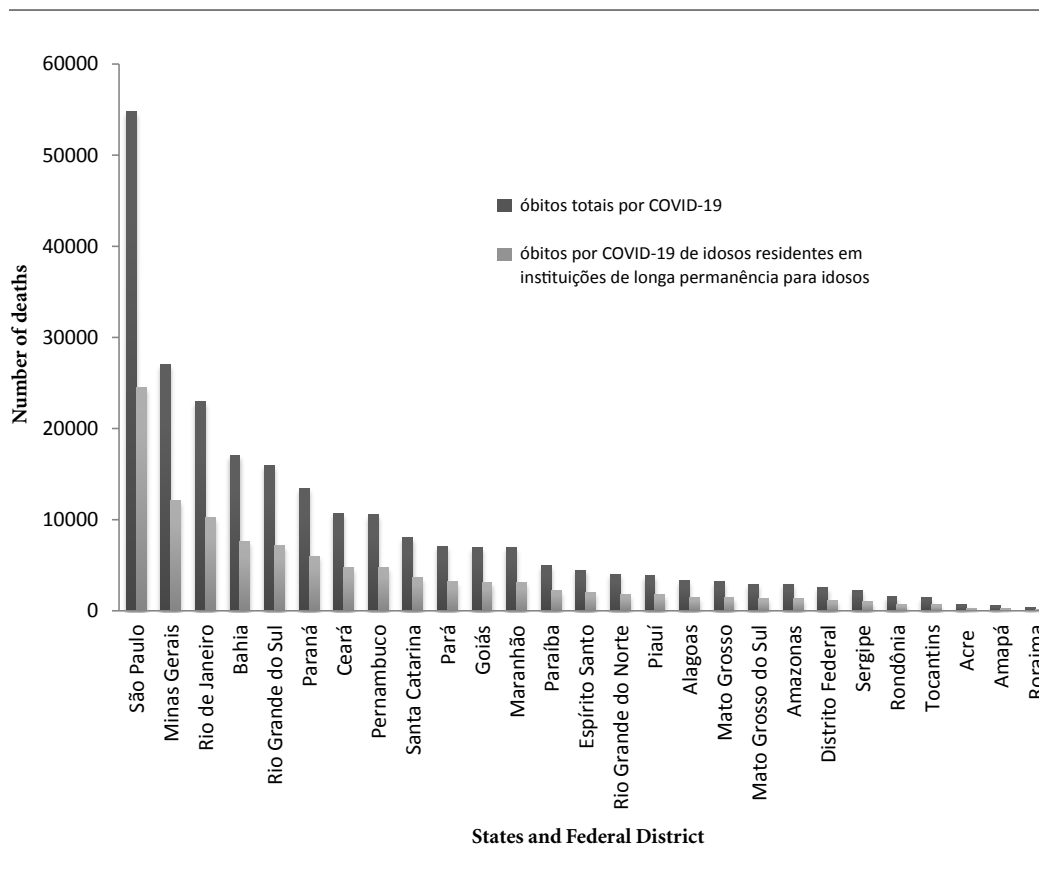


Figure 2. Number of COVID-19 deaths for all ages and for elderly in care homes, States and Federal District, Brazil 2020.

ginning of the crisis. Thus, measures are recommended to promote risk reduction as restriction of visitors to institutions; screening to identify symptoms in any individual who needs to go inside care homes; use of personal protective equipment and, finally, increase testing in these institutions. These measures were implemented in Singapore⁷, a country that was successful in containing COVID-19 outbreaks in care homes⁷.

Discrimination and stigma of institutionalized elderly people are likely to happen and this should also be a concern of policy makers. United Nations report from May 2020¹⁶ draws attention to public discourse and social media, emphasizing that in these times of the COVID-19 pandemic, expressions of intergenerational resentment have occurred. Policies, programs and

communication should provide a differentiated, but not distorted, picture of the pandemic impact on the elderly, promoting broader community involvement with elderly issues, their differentiated risks, and, especially, drawing attention to those who live in care homes. This programmatic attitude can promote intergenerational solidarity, which is fundamental for unity among people, especially in times of crisis¹⁶.

The findings of the present study can be used by other researchers so that they can make estimates of the number of deaths due to COVID-19 in elderly people in other countries. Simulation and projections are extremely important in critical moments, where there is data shortage, thus, allowing for planning of public policy, guidance and actions.

Collaborations

CJ Machado and CCA Pereira: conception of the article; data analysis; wrote the article; read and approved the final version. BM Viana: conception of the article; assistance with data analysis; wrote the article; read and approved the final version. GL Oliveira and DC Melo: assistance with data analysis; wrote the article; read and approved the final version. JFMG Carvalho and FL Moraes: wrote the article; read and approved the final version. EM Moraes: coordinator of the main study with institutionalized elderly; conception of the article; wrote the article; read and approved the final version.

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