High discrepancies in the mortality of hospitalized patients with COVID-19 in the two most economically important states in Brazil

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ARTIGO ESPECIAL

High discrepancies in the mortality of hospitalized patients with COVID-19 in the two most economically important states in Brazil

Alta discrepância na mortalidade de pacientes hospitalizados por COVID-19 nos dois estados mais importantes economicamente do Brasil

Running head: COVID-19 mortality in hospitalized patients in Rio and São Paulo

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Abstract

Objective: To compare the proportion of deaths among hospitalized cases of COVID-19 in São Paulo and Rio de Janeiro, stratified by private and public services. **Methods:** Hospitalization data for Severe Acute Respiratory Syndrome (SARS) was obtained by the SIVEP-Gripe Database. All hospitalized adults who were diagnosed as COVID-19 or unspecified SARS, between January and December 2020, were included in the analysis. Logistic regression models were fitted to evaluate the risk of death between Rio de Janeiro and São Paulo, adjusted for age, sex, and comorbidities. **Results:** A total of 388,657 hospital registers for Rio de Janeiro and São Paulo (91,532 and 297,125, respectively) were analyzed. Missing data is frequent in the database and it was greater in Rio de Janeiro, at the state and capital levels. Adjusting for confounders, the odds ratio of dying by Covid-19, comparing the state of Rio de Janeiro with São Paulo, was 2.51 in the private hospitals and 2.29 in the public ones. For the capitals, the scenario is worse. The lethality among hospitalized patients with COVID-19 in Rio de Janeiro is at least twice compared to São Paulo, both at the states and capitals. The public or private services showed important differences, with odds ratios of 2.74 and 3.46, respectively. **Conclusion:** It appears that the worst governance in the health sector in Rio the Janeiro, more than lack of resources, explains the excess mortality of hospitalized Covid-19 patients in Rio de Janeiro.

Keywords: Covid-19, Hospital mortality, Delivery of Health Care, Brazil

Resumo

Objetivo: Comparar a proporção de óbitos entre os casos de COVID-19 hospitalizados em São Paulo e Rio de Janeiro, estratificados por serviços públicos e privados. **Métodos:** Os dados de hospitalização por Síndrome Respiratória Aguda Grave (SRAG) foram obtidos pelo banco de dados SIVEP-Gripe. Todos os adultos hospitalizados com diagnóstico de COVID-19 ou SRAG não-especificado, entre janeiro e dezembro de 2020, foram incluídos na análise. Modelos de regressão logística foram usados para avaliar o risco de morte entre Rio de Janeiro e São Paulo, ajustados para idade, sexo e comorbidades. **Resultados:** Foram analisados 388.657 registros hospitalares do Rio de Janeiro e São Paulo (91.532 e 297.125, respectivamente). Os dados faltantes no banco são frequentes e maior no Rio de Janeiro (estado e capital). Ajustando para fatores de confusão, a razão de chance de morrer por Covid-19, comparando o estado do Rio de Janeiro com São Paulo, foi de 2,51 nos hospitais privados e 2,29 nos públicos. Para as capitais, o cenário é pior. A letalidade entre pacientes internados com COVID-19 no Rio de Janeiro é pelo menos o dobro em relação a São Paulo, tanto para os estados quanto para as capitais. Os serviços públicos ou privados apresentaram diferenças importantes, com razão de chance de 2,74 e 3,46, respetivamente. **Conclusão:** Parece que a pior governança do setor da saúde no Rio de Janeiro, mais do que falta de recursos, explica o excesso de mortalidade de pacientes internados com Covid-19 no Rio de Janeiro.

Palavras-chave: Covid-19, Mortalidade hospitalar, Atenção à saúde, Brasil

Introduction

At the end of June 2021, more than 504,000 deaths of COVID-19 have been reported in Brazil and the number is increasing at a fast rate. At this point, the state of Rio de Janeiro has the second-highest COVID-19 mortality rate (329 per 100,000 inhabitants) in Brazil[1]. Rio de Janeiro is the second-largest economy in the country, second only to São Paulo, which makes the high mortality rates observed in the state, in comparison to other states, inexplicable.

Although the proportion of the elderly population is higher in Rio de Janeiro compared to São Paulo (18,9% and 13,3%, respectively), after age-standardization, the rates indicate that other factors besides age may influence the disparities in the risk of death (195 per 100,000 inhabitants in Rio de Janeiro versus 125 per 100,000 in the capital of São Paulo)[2].

The overall number of reported cases of COVID-19 by June 2021 in the state of São Paulo is five times the number notified by the state of Rio de Janeiro, whereas the respective population is 2.6 times greater (about 44 million compared to 17 million inhabitants). Therefore, comparing the two states and their capitals in relation to the characteristics and evolution of hospitalized patients and deaths by COVID-19 may clarify the high mortality rates observed in the state of Rio de Janeiro.

This study aims to compare the proportion of deaths among hospitalized cases of COVID-19 in São Paulo e Rio de Janeiro states and capitals, stratified by private and public services.

Methods

Hospitalization data for Severe Acute Respiratory Syndrome (SARS) was obtained by the SIVEP-Gripe Database, available and freely accessible at https://dados.gov.br/dataset/bd-srag-2020, and no approval by the ethics committee is required. To classify the service as public or private, we used the CNES Database, available at http://tabnet.fiocruz.br/dash/menu_dash.htm.

All hospitalized adults (age ≥ 18 years) who were diagnosed as COVID-19 or unspecified SARS, between 01 January 2020 and 31 December 2020 were included in the analysis. Cases of SARS for other causes (influenza, another respiratory virus, and another etiologic agent) as well as Down Syndrome, pregnant or postpartum women, were excluded.

Age, sex, race, schooling, and comorbidities history data (obesity, diabetes mellitus, cardiovascular disease, neurologic disease, and kidney disease) were also collected.

Data analysis

For descriptive analysis, absolute and percentage values for patient's characteristics were presented. The risk of death between Rio de Janeiro and São Paulo was estimated using logistic regression models adjusted for age, sex, and comorbidities. The analyses were performed for the state and capital levels. Missing information for all comorbidities was assumed as a lack of morbidity. Two sensitivity analyses were performed. One to evaluate possible differences in the rate of the notification process, by removing November and December data from analysis. The other one evaluated the impact of outcome missing data, assuming all missing as a cure.

Results

The number of registers from Rio de Janeiro and São Paulo included in the analyses was 388,657 (91,532 and 297,125, respectively). The SIVEP-GRIPE Surveillance System has many variables beyond the diagnostic. However, except for age with no missing, and sex with very few missing, the other variables (race, years of education, and comorbidities) show large percentages of non-response. In addition, the quality of data shows greater disparities. Thus, missing information on race was 13% in the public service of the interior of São Paulo and 54% in the private sector of the capital of Rio de Janeiro. Race information was always worst in the private compared to public services. For schooling, there was almost 80% of missingness for all comparisons, except for the public and private services in the interior of São Paulo, which, despite being high, it is around 50% (**Table 1**).

The classification of the type of service (public or private) has also unidentified ones with a greater percentage in Rio (capital and interior) compared to São Paulo, with values around 22% in Rio and 14% in São Paulo, for both private and public services. Missingness for all variables is greater in Rio compared to São Paulo.

The crude death rate (**Table 2**) of hospitalized patients with COVID-19 was greater in the state of Rio de Janeiro, compared to São Paulo for all age-group and in both private and public hospitals. From **table 2**, the crude risk of mortality in the age group 18 to 40 years, comparing Rio with São Paulo, was 2.9 in the private hospitals and 2.1 in the public ones. These values for the age group 90 years or more were 1.6 and 1.4, respectively.

For all ages, the overall adjusted odds ratio is shown in **table 3**. The same pattern observed in the crude rates is observed for age-sex adjusted analysis. Models, further adjusted for all comorbidities reported, had an odds ratio of 2.51, comparing the

state of Rio de Janeiro with São Paulo in the private hospitals, and 2.29 in the public ones. For the capitals, the scenario is worse, with Rio de Janeiro presenting the triple of the risk of São Paulo, and the public or private services showing important differences, with odds ratios of 2.74 and 3.46, respectively. In both Rio de Janeiro and São Paulo, mortality rates in public hospitals are approximately twice as high as in the private sector (**Table 4**).

Sensitivity analyses (**Table 5**) excluding the two last months of notification, to account for the slowness of data management in Rio de Janeiro, and another one considering all missing cases for the variable evolution as non-cases, what is expected to be a more conservative analysis, shown in both scenarios, the same pattern of great disparities in mortality in Rio.

One possible explanation for the Rio/São Paulo disparity in mortality would be differences in available beds for Covid. Concerning hospital beds (per 100 000 population), São Paulo shows a better scenario compared to Rio de Janeiro (27.8 and 23.3, respectively)[3]. However, in the period evaluated, the lag in time between diagnostic and hospitalization was similar for Rio and São Paulo, around 5 days (5.8 and 5.9, respectively).

Discussion

Our findings of greater lethality for Covid-19 among hospitalized patients in Rio de Janeiro compared to São Paulo, both at the capital and interior of the states, is in line with findings of mortality for 100,000 inhabitants of the Epidemiological Monitor of the Ministry of Health[1]. Also, a recent study using data from the SIVEP-Gripe from March 2020 to January 2021 drew attention to the fact of the age-standardized mortality by Covid-19 in Rio de Janeiro was 56% higher if compared to São Paulo[2]. In this study, the authors showed that the SIVEP-Gripe is a reliable source of mortality by Covid-19 and that the specific mortality coefficients by all age groups are higher in Rio de Janeiro in contrast to those from São Paulo.

In our analysis, removing the last two months of 2020 and including in the denominator all missing information for case definition, allowed us to explore whether the quality of data could explain the discrepancy in mortality between the two cities, but the discrepancy remained high, despite these procedures.

Having twice the chance of die of COVID-19 by being hospitalized in Rio de Janeiro compared to São Paulo is unacceptable since Rio is the second economy in the country[4] and has almost many UTI beds in public hospitals.

São Paulo has more hospital beds per inhabitant compared to Rio and greater primary health care coverage in 2020 (62.9% and 58.9%, respectively)[5], but these differences are not that great to explain the discrepancy in hospitalized patients with Covid. Greater disorganization of the health system in Rio de Janeiro compared to São Paulo is an ongoing process. In July 2019, the Regional Labor Court of the 1st Region in Rio de Janeiro determined the seizure of R$ 38 million of accounts to the municipality of Rio de Janeiro to pay compensation to 1,500 health agents dismissed by the Institute of Basic and Advanced Health Care (Iabas, acronym in Portuguese,

Instituto de Atenção Básica e Avançada à Saúde)[6]. This same institution was involved in the disastrous administration of the field hospitals during the pandemic and, as is well known, corruption in the health department of Rio de Janeiro culminated in the arrest of the state health secretary.

São Paulo occupies the second position in monthly household income per capita and Rio de Janeiro the fourth position, with a monthly income of R$ 1,814 and R$ 1,723, respectively. The proportion of the population over 16 years of age employed in the first quarter of 2021 was 67.1% in the state of São Paulo and 63.6% in Rio de Janeiro[7]. Thus, economic differences exist but they are small to explain the large differences in mortality. Also, the proportion of the population registered in the Cadastro Único, available to families with monthly income lower or equal to ½ minimum wage was 12.2% in the city of São Paulo compared to 8,9% in the city of Rio de Janeiro[8]. With the exception that the records do not portray the total vulnerability of families, it appears that São Paulo is not less vulnerable than Rio de Janeiro. The vulnerability has been shown to affect COVID-19 mortality. In Belo Horizonte, a metropolitan city also in the Southeast of Brazil, the overall mortality per 100,000 older adults (60+ years) was 292, increasing from 179 to 354 and 476, in low, intermediate, and high vulnerability areas, respectively [9].

These various aspects show that there is not much plausible explanation for the differences in mortality from Covid-19 comparing Rio de Janeiro and São Paulo, and the COVID-19 crisis revigorated an old principle of Public Health, which says that political power to implement measures is one of the cornerstones of success. São Paulo – Rio de Janeiro discrepancy can in part be explained by the Brazilian intense political conflicts. The national government is negationist, never planned a pandemic response, never articulated municipalities, states, and federal government to face and to prepare in

advance for the pandemic. Both municipality and state-level government in Rio de Janeiro, until the beginning of 2021, were in line with the federal government and followed, in many ways, the lack of preparedness to deal with the pandemic. The governor's impeachment aggravated the situation and may be responsible for the observed excess mortality. In contrast, the São Paulo municipality together with the state-level government planned the actions to expedite the opening of hospital beds and hospital care, although preventive measures have fallen short of what is necessary for both Rio de Janeiro and São Paulo.

The conflicts in the management of the pandemic between the national government and state and local level governments were dependent on their political affiliations, which partially may explain the death discrepancies by Covid-19 in the two most developed states.

On the other hand, the greater risk of dying of COVID-19 in public hospitals compared to private ones indicates the need for better-equipped public services. According to Paim [10], chronic underfunding of Brazil's Unified Health System (SUS) is one of the major problems. The Federal Government reduced its share of 63.8% of public spending on health in 1995 to about 42% in 2017. In 1994, the Federal Government created the Emergency Social Fund, which promoted, in 2016, the removal of 30% of the Social Security Budget for other expenses. Also, the Constitutional Amendment Nº 95 implemented in 2016, established a spending ceiling for the Federal Government and froze public resources for health for 20 years [11 12].

Although initiatives were taken to improve financing (Provisional Contribution on Financial Transactions, EC29/2000 and the Health +10 Movement), the percentage of gross domestic product (GDP) allocated for SUS, remained below that of private

spending. In 2017, Brazil spent 9.2% of GDP on health, with 3.9% (42%) public spending and 5.4% (58%) private spending [11].

Thus, SUS has difficulties in maintaining its service network and remunerating its workers, limiting the needed expansion of the public infrastructure. Paim concludes "a passive boycott prevails due to public underfunding, and an active boycott gains momentum when the state rewards, recognizes and privileges the private sector through subsidies, deregulation, and sub-regulation" [10].

In addition to the SUS underfunding, the Covid-19 epidemic increased the costs of health services. The expenditure associated with the average length of stay in hospital for COVID-19 treatment had the highest mean total amount spent in the South region of Brazil compared to the other ones, but in Rio de Janeiro the cost was almost half of the South region mean and Rio de Janeiro had also higher lethality rate [13].

The Covid-19 epidemic found Brazilian public institutions in difficulty due to the fiscal austerity measures and the strong restriction. SUS lost almost 22.5 billion reais between 2018 and 2020 [14], and the transfer of specific federal financial resources to states and municipalities was not well managed in Rio de Janeiro, as already pointed out.

Therefore, reduction of discrepancies in the public/private findings requires resources for improvements in governance, hiring and better training of health teams, as well as purchasing equipment and adapting services. Public/private discrepancies may also be due to greater morbidity in the public services clientele, a factor that was not fully accounted for in the analysis by the morbidities included. It is well known the greater prevalence of less healthy lifestyle habits in these patients of lower socioeconomic level. As an example, food consumption data in Brazil are worse in the lowest incomes [15].

In conclusion, it appears that the worst governance in the health sector in Rio the Janeiro, more than lack of resources, explains the excess mortality of hospitalized Covid-19 patients in Rio de Janeiro.

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Table 1. Characteristics of individuals notified with COVID-19 or unspecified SARS in Rio de Janeiro and São Paulo states from 01 January 2020 to 31 December 2020.

	Rio de janeiro (n = 91532)				**São Paulo (n = 297125)**			
	Capital[a] (n = 49798)		Other cities[b] (n = 41734)		Capital[c] (n = 120159)		Other cities[d] (n = 176966)	
	Private (n= 19481)	Public (n= 19187)	Private (n= 11084)	Public (n= 21423)	Private (n= 38860)	Public (n= 63685)	Private (n= 37182)	Public (n= 114378)
Age(y)								
18-40	1776(9.12)	1877(9.78)	1603(14.46)	2221(10.37)	7863(20.23)	8184(12.85)	5942(15.98)	13568(11.86)
41-60	5356(27.49)	5318(27.72)	3825(34.51)	6468(30.19)	13340(34.33)	20349(31.95)	13165(35.41)	35068(30.66)
+60	12349(63.39)	11992(62.50)	5656(51.03)	12734(59.44)	17657(45.44)	35152(55.19)	18075(48.62)	65742(57.48)
Sex								
Male	10788(55.38)	10281(53.58)	5916(53.37)	11719(54.70)	20888(53.75)	35266(55.38)	20749(55.80)	63245(55.29)
Female	8693 (44.62)	8906(46.42)	5167(46.62)	9699(45.27)	17972 (46.25)	28.419(44.62)	16425(44.17)	51123(44.70)
Missing	0.00	0.00	1(0.01)	5(0.02)	0.00	0.00	8(0.02)	10(0.01)
Race								
White	5407(27.76)	4383(22.84)	4097(36.96)	7533(35.16)	15350(39.50)	27677(43.46)	23328(62.74)	69879(61.09)
Black	772(3.96)	1499(7.81)	507(4.57)	2039(9.52)	910(2.34)	4433(6.96)	1320(3.55)	6208(5.43)
LSB*	2609(13.39)	8270(43.10)	2126(19.18)	5928(27.67)	4069(10.47)	16921(26.57)	4455(11.98)	21978(19.22)
Others	121(0.62)	89(0.47)	65(0.59)	144(0.67)	775(2.00)	958(1.51)	471(1.27)	1039(0.90)
Missing	10572(54.27)	4946(25.78)	4289(38.70)	5779(26.98)	17756(45.69)	13696(21.51)	7608(20.46)	15274(13.35)

Missing data for the variable type of service (private/public): [a] 11130 (22.4%); [b] 9227 (22.1%); [c] 17614 (14.7%); [d] 25406 (14.4%).LSB = Light-skinned black

Table 2. Crude hospital COVID-19 mortality in Rio de Janeiro and São Paulo states by private and public services, according to age groups.

Age groups (years)	Rio de Janeiro				São Paulo			
	Private		Public		Private		Public	
	n	%	n	%	n	%	n	%
18 – 40	228	9.35	764	22.72	423	3.23	2187	10.69
41 – 60	1171	17.70	3439	34.92	1969	7.81	9972	19.06
61 – 80	3597	42.93	8569	54.58	5229	23.80	25382	36.55
80 – 90	2266	59.51	2989	68.10	3403	39.18	9940	47.94
+ 90	993	70.88	870	74.23	1504	44.96	3123	54.09

Table 3. Adjusted odds ratio for COVID-19 mortality, comparing the states and capitals of Rio de Janeiro and São Paulo, by type of service.

State			**Private**		**Public**	
	OR	CI 95%	OR	CI 95%	OR	CI 95%
Model 1						
São Paulo	1.00	--	1.00	--	1.00	--
Rio de Janeiro	2.28	2.24 – 2.32	2.47	2.39 – 2.56	2.21	2.16 – 2.26
Model 2						
São Paulo	1.00	--	1.00	--	1.00	--
Rio de Janeiro	2.35	2.31 – 2.39	2.51	2.42 – 2.61	2.29	2.23 – 2.35
Capital			**Private**		**Public**	
	OR	CI 95%	OR	CI 95%	OR	CI 95%
Model 1						
São Paulo	1.00	--	1.00	--	1.00	--
Rio de Janeiro	2.93	2.86 – 3.01	3.39	3.23 – 3.56	2.66	2.57 – 2.76
Model 2						
São Paulo	1.00	--	1.00	--	1.00	--
Rio de Janeiro	3.01	2.94 – 3.09	3.46	3.29 – 3.63	2.74	2.64 – 2.84

Model 1 adjusted for age and sex

Model 2 adjusted for age, sex, obesity, diabetes, cardiovascular disease, neurologic disease, kidney disease

Table 4. Adjusted odds ratio for COVID-19 mortality in Rio de Janeiro and São Paulo, comparing public and private services.

Type of service	**State**				**Capital**			
	Rio de Janeiro		**São Paulo**		**Rio de Janeiro**		**São Paulo**	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Private	1.00		1.00		1.00		1.00	
Public	1.84	1.77 – 1.91	1.95	1.91 – 2.00	1.90	2.20 – 2.40	2.37	2.28 – 2.45

Model adjusted for age, sex, obesity, diabetes, cardiovascular disease, neurologic disease, kidney disease

Table 5. Adjusted odds ratio for COVID-19 mortality, comparing the capitals of Rio de Janeiro and São Paulo capital, according to the type of service.

Model 1			**Private**		**Public**	
	OR	CI 95%	OR	CI 95%	OR	CI 95%
São Paulo	1.00		1.00		1.00	
Rio de Janeiro	2.96	2.87 – 3.04	3.21	3.04 – 3.39	2.80	2.68 – 2.92
Model 2			**Private**		**Public**	
	OR	CI 95%	OR	CI 95%	OR	CI 95%
São Paulo	1.00		1.00		1.00	
Rio de Janeiro	2.12	2.07 – 2.17	2.19	2.09 – 2.29	2.17	2.10 – 2.25

Model 1 adjusted for age, sex, obesity, diabetes, cardiovascular disease, neurologic disease, kidney disease and excluding the notification of the last 2 months (November and December) of 2020.

Model 2 adjusted for age, sex, obesity, diabetes, cardiovascular disease, neurologic disease, kidney disease and considering the missing data for the outcome (evolution) as a cure.

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