

IMPACT OF THE BED OCCUPATION RATE OF THE HOSPITAL STRUCTURE OF THE PUBLIC NETWORK OF THE ILHA DE SÃO LUIS IN THE FIGHT AGAINST THE COVID-19 PANDEMIC

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Abstract: The coronavirus mainly affects the human respiratory system. In this context, depending on the speed of propagation of the virus in the population, health systems were under strong pressure because of the extra demand generated by the disease, especially between Mar/2020 Jun/2021. In this sense, this study aimed to analyze the hospital structure occupancy rate of the public network of the greater São Luís island in the fight against the COVID-19 pandemic and to correlate the number of deaths from the disease. This is a retrospective, documentary, descriptive study with a quantitative approach in which information was collected on the number of beds (available, occupied and occupancy rate) and number of deaths between 09/01/2020 and 08/25 /2021. Regarding death between the analyzed period, there was a prevalence in São Luís (76%), followed by São José de Ribamar (15%) and Paço do Lumiar (9%). The result suggests that there is a strong correlation between the bed occupancy rate and the number of deaths (Pearson correlation 0.705; p-value<0.05). It is concluded that the high bed occupancy rate may have had an even greater impact on the number of deaths caused by COVID-19.

Keywords: Pandemic, Hospital Assistance, Access to Health Services, Covid-19.

INTRODUCTION

The coronavirus (CoVs) is one of the main viruses that mainly affect the human respiratory system (MARENELLI et al., 2020). In late December 2019, a group of patients were admitted to hospitals with an initial diagnosis of pneumonia of unknown etiology in Wuhan, Hubei Province, China, the outbreak of the Coronavirus Disease (COVID-19) caused by (SARS)-CoV-2 (BOGOCH et al., 2020). It is noteworthy that in addition to (SARS)-CoV-2, other types of CoVs have caused outbreaks during

this century (ROTHAN; BYRAREDDY, 2020). They include severe acute respiratory syndrome (SARS)-CoV and Middle East respiratory syndrome (MERS)-CoV, which were previously characterized as agents of major public health threat (NORONHA et al., 2020).

In Brazil, according to the Ministry of Health (MS), the first confirmed case of COVID-19 was on February 26, 2020 (BRASIL, 2020). According to the latest epidemiological bulletin from the Ministry of Health, there were 21,897,025 confirmed cases, of which 10,948 are new cases, with an average incidence of 10,419.9/100,000 inhab. As for death, to date, 609,756 have been reported, with a lethality of 2.8% and mortality of 290.2/100,000 inhab. (BRAZIL, 2021).

Regarding Maranhão, according to the epidemiological bulletin of the MS, there were 362,105 cases, with 10,248 deaths. In São Luís, there were 47,299 cases, in which 2,574 died, with a lethality of 5.44% (MARANHÃO, 2021).

In this context, the expansion of hospital facilities to treat COVID-19 and government appropriations to facilitate the voluntary isolation of cases were necessary actions. Noronha et al. (2020) emphasize that there could be an increase in the probability of saturation of health systems in a short time, since hospitalization is related by multiple factors, such as age and preexisting conditions.

In this context, the characteristics of hospital services have changed, as there is an increase in pressure caused by a new, sudden, extensive and serious event (ROTHAN; BYRAREDDY, 2020). If, on the one hand, there was a growing and often excessive demand, on the other hand, the supply suffers from structural problems that prevent the best response to this type of demand (COSTA et al., 2020). This is due to the most diverse reasons, including: the

scarcity of human resources, lack of specialist, old and functionally inadequate facilities, disarticulation of the service, lack of internal and external continuity of care at clinical discharge and low quality records, which promote the long waiting times, the lack of effectiveness and the general dissatisfaction with the provision of hospital care (COSTA et al., 2020).

Although major changes in the flows and organization of hospital services can be difficult, the ability of the health system to save lives in this pandemic has depended not only on the number of ICU beds, but also on the organization of the care network to ensure timely access. to these beds, the maintenance of lines of care for other diseases and the care of urgencies and emergencies of the most diverse natures (COTRIM; CABRAL, 2020).

The specific solutions for this organization must be adapted to each context, respecting general premises and the local response capacity, understanding that Brazil is a continental and heterogeneous country (NORONHA et al., 2020). For large cities, where the disease has advanced faster, much can be done with existing structures, complemented by new contributions and initiatives (DAUMAS et al., 2020).

The distribution of deaths from COVID-19 reflects the geographic and social heterogeneity of the country, in this sense, despite the uncertainties about the specific mortality caused by the virus, indicators of excess deaths are more objective and comparable parameters to assess the impact of the pandemic on mortality. (SANTOS et al., 2020). In this context, depending on the speed of propagation of the virus in the population, health systems are under strong pressure because of the extra demand generated by the disease.

In this aspect, the importance of knowledge in the technical-scientific domain

is fundamental for the contribution of better hospital care, however, the scientific literature reports that there are still few studies on the subject, especially in the Northeast Region and in the state of Maranhão. It is very important to develop studies on the subject nowadays. Acquisition of more knowledge on the subject, aiming at the development of actions that can help to reduce mortality not only from COVID-19, but also for future pandemics.

Therefore, understanding the correlation between the increase in mortality and the use of hospital structure, especially in Maranhão, can help to dimension the appropriate adjustments, investments and improvements in the public network (COSTA et al., 2020).

In view of the above, this study aimed to analyze the hospital structure of the number and occupancy rate of beds in the public network in the city of São Luís, in the fight against the COVID-19 pandemic and to correlate the number of deaths from the disease.

METHODOLOGY

This is a descriptive, cross-sectional, retrospective study in which the number of deaths and the total number of existing, occupied and available beds in the greater São Luís Island were identified.

The data were extracted from the page of the Health Portal of the State of Maranhão, intended for information about coronavirus, located at the electronic address (available at <https://painel-covid19.saude.ma.gov.br/>). The information was gathered in a Microsoft Excel and Microsoft Powerpoint document. The study was composed of service provider hospitals affiliated to the Unified Health System (SUS), which made their data available in the SUS Hospital Information System (SIH-SUS) and SUS Analytical. In this context, the following information was acquired: number

of free and occupied beds and number of deaths on the Big Island. All data used in the work were taken from secondary sources, made available without identification of individuals, in the public domain on the website of the State Government of Maranhão on coronavirus, available at <https://painel-covid19.saude.ma.gov.br/>. Therefore, there was no need for approval of the work by the Research Ethics Committee.

Data were processed using the SPSS statistical package (version 18.0, Chicago, IL, USA). Descriptive analysis was presented as mean \pm standard deviation, relative and absolute frequency. For quantitative variables, Student's t test was performed to compare the means. To correlate variables, Pearson's test was used. $P \leq 0.05$ was considered significant, in which the null hypothesis was rejected and the alternative was accepted and, if greater, the null hypothesis was accepted and the alternative was rejected, with 95% confidence.

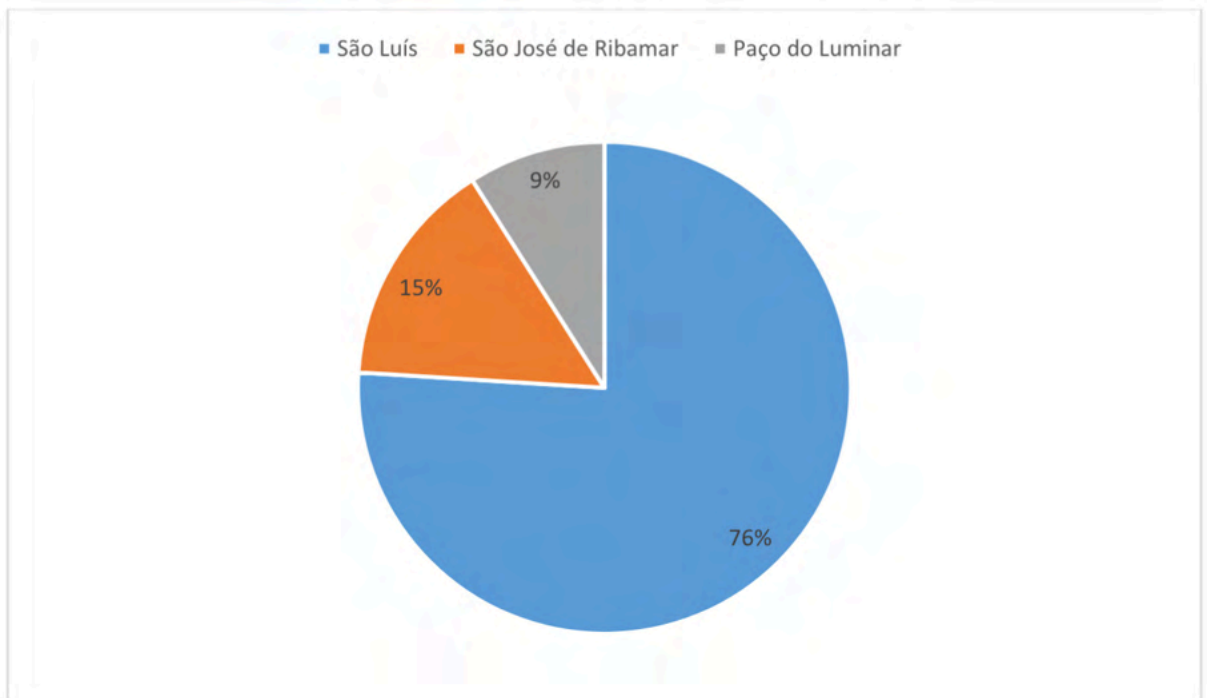
RESULTS

Between the days analyzed (09/01/2020 to 08/25/2021), 1,971 deaths were reported. Of these, the peak in the municipality of São Luís occurred between the months of April and June 2021, while in the other municipalities, the peaks were from June to July 2021 (Table 1). It is noteworthy that no information was found on the municipality of Raposa-MA on the State Government website or on the website of the respective city hall. This way, it is possible that their numbers are incorporated into that of any of the three analyzed municipalities. All raw data from this work are described at the end of this document.

Approximately 76% of the deaths reported on Grande Ilha occurred in the municipality of São Luís, followed by 15% in São José de Ribamar and 9% in Paço do Luminar (Graph 1).

Month	Deaths in São Luís	Deaths in SJ Ribamar	Deaths in Paço do Lumiar	Total
sept/20	34	0	2	36
oct/20	14	1	5	20
nov/20	27	0	2	29
dec/20	24	0	2	26
jan/21	42	5	5	52
feb/21	89	6	30	125
mar/21	219	13	29	261
apr/21	263	8	50	321
may/21	201	19	49	269
jun/21	264	48	50	362
jul/21	177	46	68	291
aug/21	144	22	13	179
TOTAL	1498	168	305	1971

Table 1– Number of deaths in Grande Ilha de São Luís.

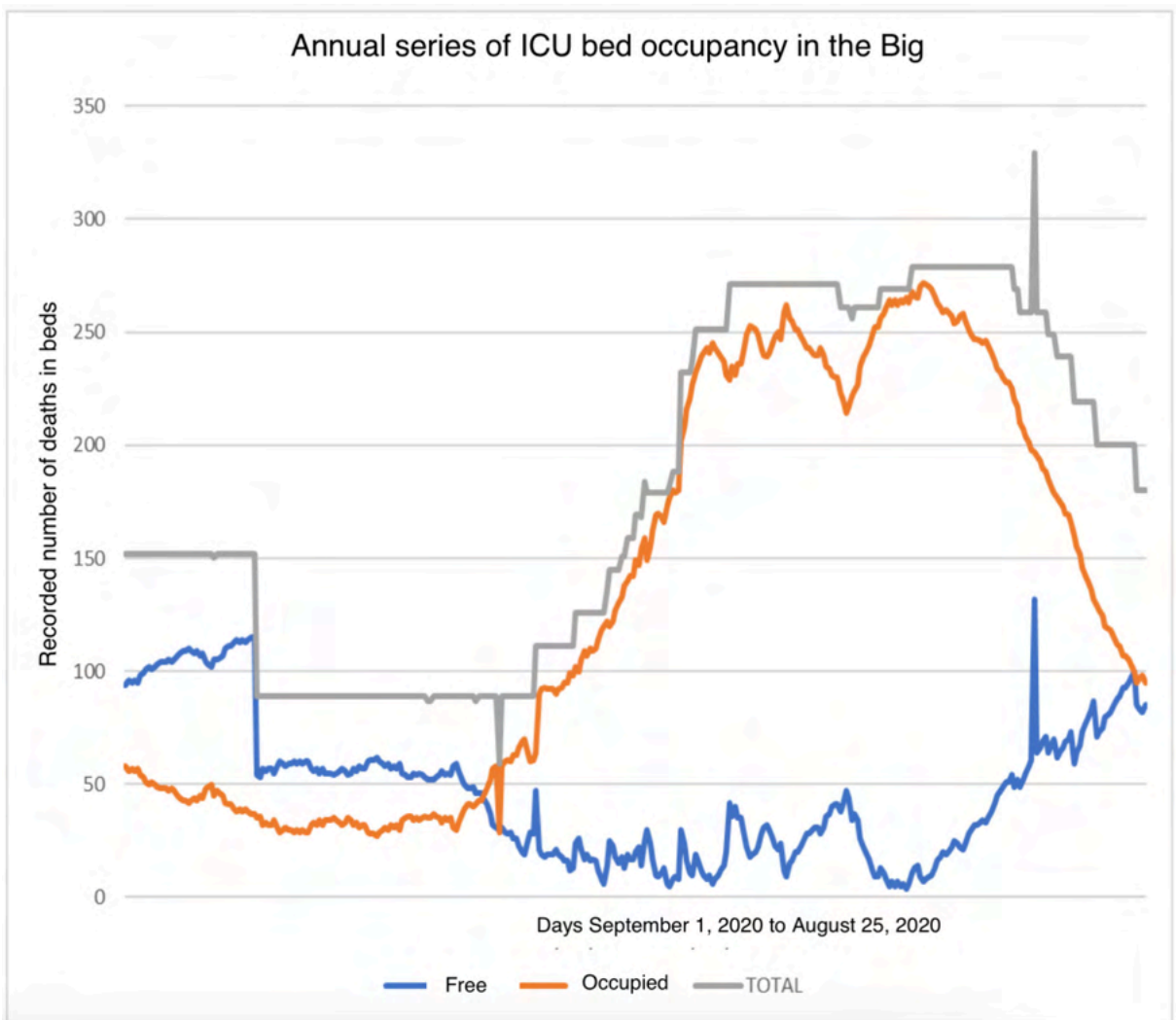


Graph 1 – Distribution of deaths by COVID in the municipalities of São Luís, Paço do Lumiar and São José de Ribamar, from September 2020 to August 2021.

In order to assess the saturation of the system, via the occupation of beds, a series was drawn for the entire period analyzed (Graph 2). It is noticed that between March/2021 and July/2021, there was a substantial increase in the opening of new beds, accompanied by their occupation. Corroborating the data found, it is noteworthy that this period of growth in beds and occupancy coincides with the second wave of the pandemic on the Big

Island. This shows that even before opening them, there was a great pent-up demand. Furthermore, in the same period, the average that these beds opened quickly reached almost 100% occupancy (Graph 2).

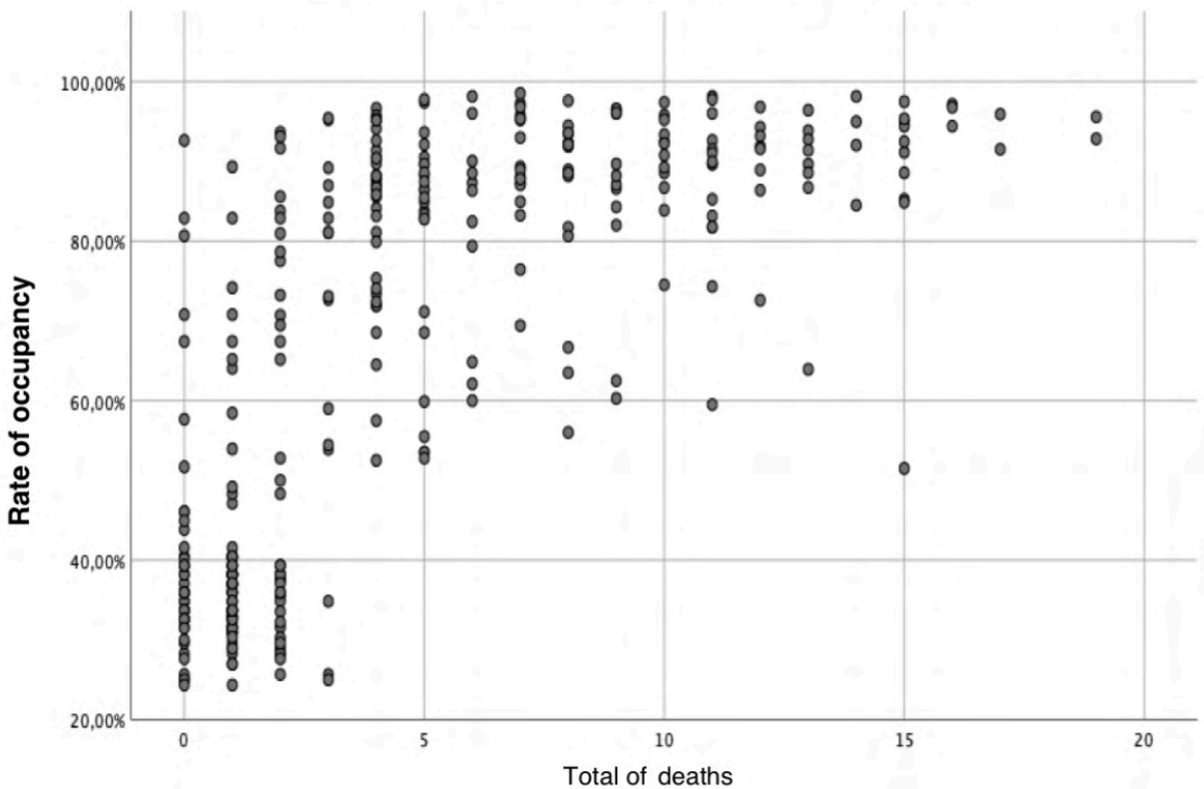
To assess the correlation between the number of daily deaths and the occupancy rate of beds for the treatment of COVID-19, a scatter plot between the two variables was performed (Graph 3).



Graph 2 – Number of occupied, free and total beds during the period from 09/01/2020 to 08/25/2021.

Legend: The graph above illustrates the number of occupied (orange), free (blue) and total (grey) beds during the period from 01/09/2020 to 25/08/2021.

Simple scatter plot of occupancy rate by total deaths



Graph 3: Dispersion between total deaths and occupancy rate.

It is observed that the points of the graph approach a growing line, which suggests the existence of a possible correlation between the two variables. To measure the correlation, Pearson's correlation coefficient and Student's t test were used. Both the Pearson correlation result (0.705) and the Student t test result ($p\text{-value} < 0.05$) suggest that there is a strong correlation between the two variables, which makes us conclude that this correlation is not statistically null, with 95% confidence.

DISCUSSION

According to the results presented, it was observed that in the Grande Ilha, the city of São Luís has the highest number of deaths.

This data can be explained by the population density of the city. According

to Fan et al. (2020) and Lai et al. (2020) the points of concentration of cases, at the beginning of the pandemic, were restricted to areas of greater economic development and population density. The significant association between the spread of COVID-19 with population density was also cited in other countries such as Italy, being the main and potential transmission mechanism (COCCIA et al., 2020). However, in China, this factor was not important for the spread of the virus, probably because of the multiple lockdown policies in the regions, with the Chinese establishing one of the strictest controls in the world (SUN et al., 2020).

In this context, Oliveira et al. (2021) point out that the city of São Luís has a dense concentration in the supply of medical and

hospital services, which causes a great mobility of people in search of diagnosis and treatment, moving from small centers to larger ones. Therefore, the spatial displacement of the population, especially between urban centers, in search of goods and services, and the complex circulation that makes it possible to provide these services, impatient geographic exchanges accentuated in the transmission of the Covid-19 pandemic.

It is worth remembering that before the pandemic, the displacement of people from smaller centers was already intense in search of health services, making the smaller municipalities conditioned to the larger ones, especially in cases of hospitalization in the ICU, since according to IBGE in 2018 there were 293 units of care. intensive care in Maranhão, in which they were concentrated in only nine municipalities: São Luís (161 ICUs), Imperatriz (52 ICUs), Caxias (20 ICUs), and Bacabal, Pinheiro, Santa Inês, Balsas, Chapadinha and Presidente Dutra (10 ICUs respectively) (IBGE, 2018).

In addition, these factors are associated with a greater number of cases as they provide greater commuting, greater number of trips and a greater number of health facilities qualified to perform care and diagnosis. Corroborating this, it was shown that in the first month of the outbreak, all Brazilian capitals had the 292 accumulated daily records of COVID-19 due to flights and population density (PEQUENO et al., 2020)

However, Moreira (2020) also emphasizes that the health regions with the highest averages in mortality are located in places where there is a lack of beds and ventilators, mainly in parts of the Northeast, Southeast and South regions. Another important fact would be the distribution of beds by hospitals, since each institution establishes its own criteria for the distribution of vacancies, it must be analyzed that in times of the pandemic, when resources

are lacking, the centralization of the decision on the use of beds can be a logistically valid option. Since the epidemic in the country after the unacceptable establishment of the health expenditure ceiling, resulted in the reduction of resources for this sector (DAUMAS et al., 2020).

Regarding the correlation of the rate of beds, in the study, it was found that the period of growth of beds and occupation coincide with the second wave of the pandemic on the Big Island. This shows that even before opening them, there was a great pent-up demand. Therefore, even though in practice the beds did not have an occupancy rate of 100%, it can be said that virtually this rate had already been reached, and that the demand had already exceeded the supply of beds.

Similar data with the research by Pereira (2021) that in the first wave, on April 11, Porto Alegre had 523 operational beds available for adult patients, distributed in 16 hospitals, which resulted, at the time, in an occupancy rate of 72.76% and already in the second wave, between July and August 2021, this rate has fluctuated between 88% and 92%, not because the number of patients has remained stable, but because the increase in operational beds has grown in the same proportion of hospitalizations. In this sense, the increase in the number of hospitalizations is especially worrying because almost half of these hospitalizations result in death (PEREIRA, 2021).

In view of the above, it is observed that the number of hospitalizations was correlated with an increase in deaths. That is, as the bed occupancy rate increases, there is also a concomitant increase in the number of deaths. This can perhaps be explained by the increase in physicians' selectivity when referring only the most severe patients to ICU beds, for fear of filling all available beds, for example. In addition, the increase in beds

does not mean an increase in the number of health professionals available, so there may be a mismatch between the number of patients who need care and the number of professionals.

CONCLUSION

According to the results found, it is concluded that: between the days analyzed (09/01/2020 to 08/25/2021), 1,971 deaths were reported. Approximately 76% of the deaths reported on the Grande Ilha occurred in the municipality of São Luís. It is noticed that between March/2021 and July/2021, there was a substantial increase in the opening of new beds, accompanied by their occupation. In addition, in the same period, the average that these beds opened quickly reached almost 100% occupancy and most of them almost reached 100% of deaths.

In addition, the data found in this research strongly suggest that the increase in the

number of deaths may be influenced by the increase in the bed occupancy rate. Therefore, the opening of new beds must not be motivated only when their occupancy is close to 100%.

These data may be important to show that the number of beds has a relationship between before and after the lethality of the disease. However, it is noteworthy that this study has several limitations. First, it is a retrospective study based on data collected by database, mainly for clinical purposes. However, most of the data found are not complete, that is, data with unique and not detailed values, in addition to the difficulty of accessing the databases, especially those linked to DATAUS. Therefore, it suggests the performance of other studies that address this issue, and above all, studies to show the results of vaccination in the number of cases and spread of the virus, being able to establish a relationship between before and after the vaccine.

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