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# Covid-19 pandemic in the state of Piauí (Brazil): Reported cases, deaths and bed occupancy

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## Abstract

Introduction: This work describes the evolution over time of the Covid-19 pandemic in terms of reported cases, deaths and bed occupancy in the state of Piauí (Brazil) from 6 April 2020 to 4 January 2021. Objectives: The aim is to provide quantitative information on decision-making related to preventive measures and their effectiveness. Methodology and resources: Data were surveyed from the "Covid-19 in Piauí – Panel" to support a cross-sectional study that includes gender, age group, reported deaths, and bed occupancy as variables for built-in descriptive statistics and mobile mean estimates. Results and discussion: The data pointed to a slightly higher incidence (54.63%) in women, the highest (22.64%) being among patients in the range from 30-39 years. Recovery comprised 140,420 patients (97.48%) while confirmed deaths included 2,862 patients (1.99%), along with 774 (0.53%) sub-notifications. With respect to the latter, lethality was higher (58.56%) in men, reaching 77.67% in the case of those older than 60 years. In 2020, demands for either clinical or intensive care unit beds increased quickly during the first months of the pandemic, whereas demand for stabilization beds fluctuated intensely. Conclusion: Since a high prevalence (71.55%) was observed in economically active age groups and the highest lethality occurred among the elderly, preventive measures are still required and should be continuously adopted to mitigate the spread of Covid-19 in the state of Piauí (Brazil).

**Keywords**: Public health; Epidemiological monitoring; 2019-nCoV pandemic.

## Introduction

Belonging to the *Coronaviridae* family – *Nidovirales* order, coronaviruses are positive non-segmented enveloped RNA viruses that are widespread among humans (as well as other mammals), in whom they usually cause mild infections. Even so, high mortality rates were reported worldwide in the case of previous epidemics caused by two beta-coronaviruses, namely, severe acute respiratory syndrome coronavirus (SARS-CoV).[1,2,3] and Middle-East respiratory syndrome coronavirus (MERS-CoV).[4,5]

Previously identified coronaviruses can be starting points for epidemiological science to broadly assess

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and study potential newer as well as serious zoonotic events due to the increasing consumption of exotic animals as human food.[6] With clinical manifestations similar to viral pneumonia, in December 2019 a series of unknown-cause pneumonia cases emerged in Wuhan (China), which were subsequently identified as Covid-19.[7] SARS-CoV-2 transmission occurs from person to person in close contact, mainly via respiratory droplets produced when an infected person either coughs or sneezes. Fomites can be a major source of transmission, since SARS-CoV-2 has been found to persist on surfaces for up to 96 hours while other coronaviruses can persist for up to 9 days.[8,9]

Covid-19 ranges from a simple cold to severe pneumonia, clinically presenting a flu-like syndrome at the onset of disease but is capable of leading to death in more severe stages. Its physical symptoms customarily involve coughing, fever, anosmia, ageusia, fatigue and

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breathing difficulties.[10] People with Covid-19 present signs and symptoms on average 5-6 days after contact with the virus and infectious condition development.[11]

Insofar as Covid-19 is a highly contagious disease, its early detection, isolation, hospitalization and diagnosis are vital for control purposes and can effectively mitigate disease transmission risks.[12-14] With respect to infectious disease (Covid-19) control, delays in hospitalization or isolation may lead to prolonged infection periods while increasing the rate of recovery of patients.

Previous studies have described characteristics of Covid-19 patients, including the time interval between major events.[15-17] Also, a reduction in the time interval from symptom onset to hospitalization-isolation is an evident result of the adoption of public health measures.[18,19] At the individual level though, little is known about the influencing factors associated with delayed hospital admission and length of stay. Identifying those factors may be helpful in making inferences about the workload of the medical and multidisciplinary team, while allocating medical resources rationally and assisting response efforts, as well as about their effectiveness at a global level.[20]

Located in Northeast region of Brazil, the state of Piauí confirmed its first Covid-19 case on March 19, 2020. In this Brazilian state, more than 146,000 cases and 2,895 related deaths due to Covid-19 were confirmed up to 9 January 2021 (those numbers may be even higher due to untested positive cases and delays in notification). In order to prevent the spread of Covid-19, the government of Piauí applied contingency measures and created crisis management committees, while social isolation measures were intensified and a health emergency declared.[11]

In Piauí, the monitoring of the dynamic evolution of Covid-19 cases, deaths and demand for hospital beds became necessary, since this evolution directly influences social and governmental decision-making. Accordingly, the present work describes the dynamic evolution of Covid-19 pandemic and the occupation of hospital beds in Piauí from 6 April 2020 to 4 January 2021. The survey data can provide quantitative information to support the planning of preventive measures while providing measures of their corresponding effectiveness.

### Methodology and resources

The present work focused on the state of Piauí, which is located in the Northeast region of Brazil. Its population comprises almost 3.3 million people (~5.75% of the population of the Northeast), distributed among 224 municipalities. The capital city of Piauí is Teresina, whose population is about 870,000 inhabitants.[21] Being of a descriptive cross-sectional quantitative nature, the present work was carried out by evaluating secondary data available online from the "Covid-19 in Piauí – Panel".[22]

The evaluated sample consisted of all confirmed Covid-19 cases in Piauí from 6 April 2020 to 4 January 2021. The variables investigated included gender, age group, confirmed deaths caused by Covid-19, and the evolution of beds occupied by Covid-19 patients (i.e. general, ICU and stabilization beds). The criteria for inclusion were all the reported Covid-19 cases in Piauí available in the State Department of Health database. Exclusion criteria were incomplete reports, registration outside the survey sample and variables not analyzed in this study. Data were organized, tabulated and processed via Microsoft Excel® software, with the help of built-in descriptive statistical analysis and moving average estimate numerical tools.

Since the present work used secondary data of public free access available from "Covid-19 in Piauí – Panel", no procedure in the Research Ethics Committee was required (in accordance with Brazilian National Health Council Resolution No. 466/2012 and current ethical norms). At this point, the commitment of the authors to data veracity and result content suitability is acknowledged.

### Results and discussion

Until 4 January 2021, the "Covid-19 in Piauí – Panel" reported 144,056 cases in all 224 municipalities in the state,[22] with 140,420 cases of recovery (97.48%) and 2,862 confirmed deaths (1.99%), as well as 774 subnotifications (0,53%). The percentage of confirmed deaths shows that the Covid-19 lethality rate in Piauí is slightly lower than either worldwide or Brazilian figures, which are respectively 2.14%[23] and 2.4%.[24]

As far as gender distribution is concerned, 65,360 reports (45.37%) referred to men whereas 78,696 notifications (54.63%) referred to women.[22] The above-mentioned incidence contrasts with existing data,[25] which point to SARS-CoV-2 infection as being more frequent in adult men.

In terms of lethality, 1,676 deaths (58.56%) referred to men while 1,186 deaths (41.44%) referred to women.[22] These differences in reporting deaths may refer to the cultural fact in Brazil that women are

more concerned with health issues while men only seek medical care in more extreme circumstances.[26] Moreover, these values may refer to lifestyle and/or epigenetic and hormonal differences that possibly affect innate immunity in males.[27]

With regard to distribution among age groups, Table 1 shows confirmed Covid-19 cases and subsequent deaths in Piauí. Economically active people (i.e. those 20-59 years old) comprise 103,076 reported cases (71.55%), mostly within the 30-39 years age group with 32,614 cases (22.64%). These findings are consistent with data from the State of Tocantins (also in Brazil) and the average age of 34 years found in surveys of Chinese hospitals.[28] As claimed in the latter work, this population

segment forms the basis of economic activities and is more exposed to several risk factors that underlie the transmission chain.

The above-mentioned findings are reasonably close to data[29] for the State of Espírito Santo (also in Brazil). This latter cross-sectional study showed factors linked to higher mortality risks due to Covid-19, including age above 60 years, low education, either yellow or black skin color, and the presence of morbidity and multimorbidity.

SARS-CoV-2 is prone to infect people with chronic comorbidities, such as diabetes, cardiovascular and cerebrovascular diseases.[25] Serious cases are concentrated among adults older than 60 years and in those with the

**Table 1. Covid-19 in Piauí (Brazil)[22]: Age group distribution of confirmed cases and deaths until 4 January 2021**

| Age group (years) | Confirmed cases | Confirmed deaths |
|---|---|---|
| 0 – 9 | 7163 | 6 |
| 10 – 19 | 11752 | 10 |
| 20 – 29 | 27919 | 35 |
| 30 – 39 | 32614 | 83 |
| 40 – 49 | 24449 | 184 |
| 50 – 59 | 18094 | 321 |
| 60 – 69 | 11400 | 539 |
| 70 – 79 | 6597 | 752 |
| Above 80 | 4068 | 932 |

**Source:** The authors (2022).

above-mentioned conditions.[30,31] Serious manifestations can equally be associated with co-infections of bacteria and fungi.[25]

Higher death risks after Covid-19 infection have indeed been noted in patients with comorbidities.[32] The presence of either chronic obstructive pulmonary disease (COPD) or chronic kidney diseases (CKD) may increase the risk of serious events by up to 6.6 or 5.3 times, respectively. The risks of serious events associated with cardiovascular diseases are about 4.5 times greater, while diabetes mellitus leads to a statistically significant 3.07-fold increase in the probability of severe Covid-19.

Figure 1 shows the evolution of the occupancy of clinical beds and the associated weekly moving average in Piauí until 4 January 2021. Bed demand increased

rapidly during the initial months in 2020, with peaks in June and July, e.g. the highest peak reached 580 Covid-19 patients on 7 July 2020, followed by a fluctuating drop in occupation in subsequent months. Based on the moving average, Figure 1 suggests a downward trend of 14.03% in the final 14 days in the observed period.

With respect to the occupancy of beds due to Covid-19 in Piauí, recent official data[33] point to 738 beds in nursing wards, 180 beds in Intensive Care Units (ICUs), and 34 stabilization beds. While data show that the number of beds occupied was basically the same throughout 2020, mortality rates were indeed reduced due to vaccine campaigns, so that the occupation of beds in wards overlapped their counterparts in ICUs. However, the elderly remain a critical challenge in terms of immunization against Covid-19, since they still rep-
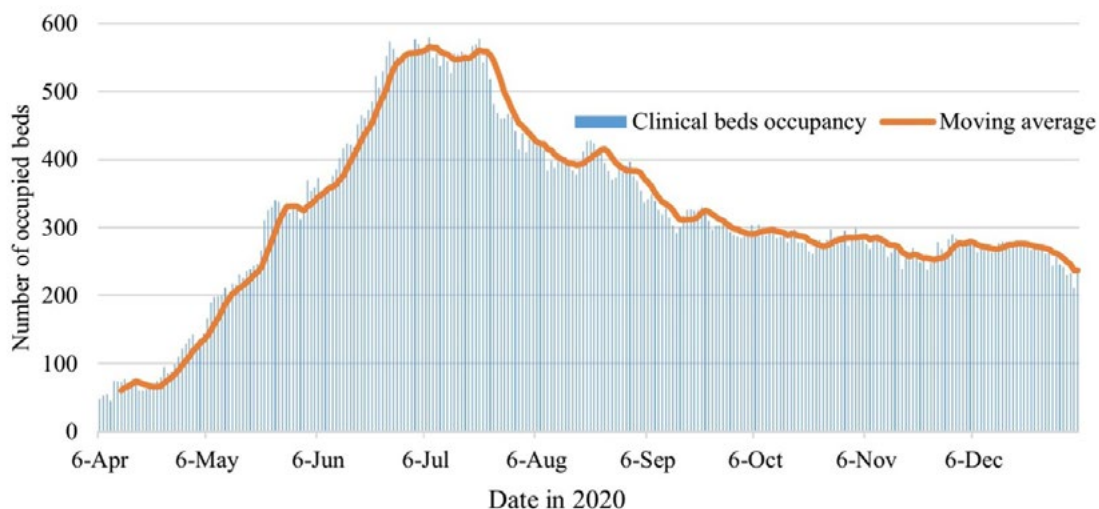
**Figure 1. Covid-19 in Piauí (Brazil)[22]: Evolution of the occupancy of clinical beds and associated moving average until 1 January 2021**
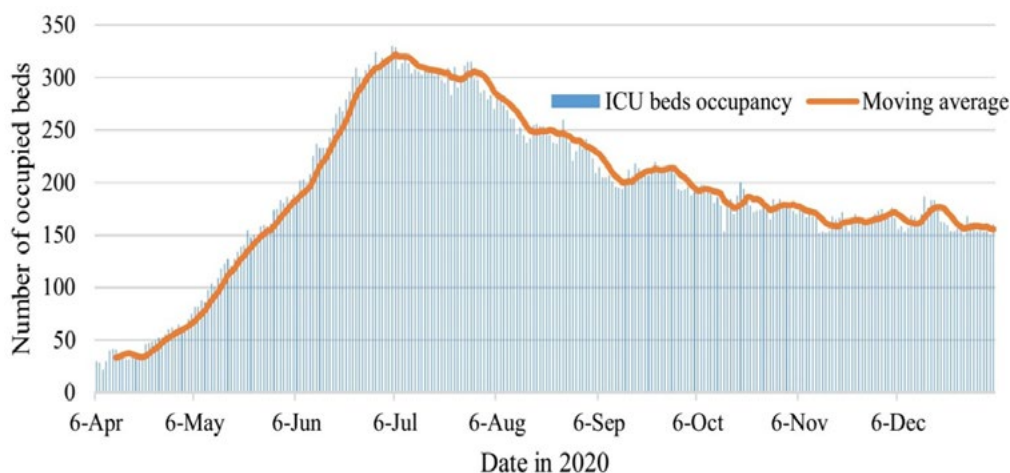
**Source:** The authors (2022).



**Figure 2. Covid-19 in Piauí (Brazil)[22]: Evolution of the occupancy of ICU beds and associated moving average until 1 January 2021**

**Source:** The authors (2022).

resent about 50% of both bed occupancy and mortality rates. Even in scenarios with 3 or more vaccine doses, the elderly no longer have efficient immunity and, hence, vaccine effects tend to be weaker in this age group.[34]

Figure 2 shows the evolution in the occupancy of ICU beds and associated weekly moving average in Piauí up to 1 January 2021. Impressive growth occurred in the initial months, with a peak on 5 July referring to occupation by 330 patients requiring intensive care. Analysis of the variation of the moving average pointed to a downward trend of 9.33% in the last 14 days of the period under observation.

In addition to asymptomatic cases, Covid-19 symptoms can be either mild or severe. In the latter case, patients may also suffer from severe dyspnea and tachypnea (>30 rpm), thus requiring hospitalization, which explains the increase of ICU bed occupancy in July when compared to previous months.[35]

Data from Figures 1 and 2 may be the result of the adoption of social distancing measures by the population of Piauí, which practice has been pointed out as the most important prevention measure against the spread of coronavirus.[36] The evolution of bed occupancy in June-July may suggest a weakening of steps
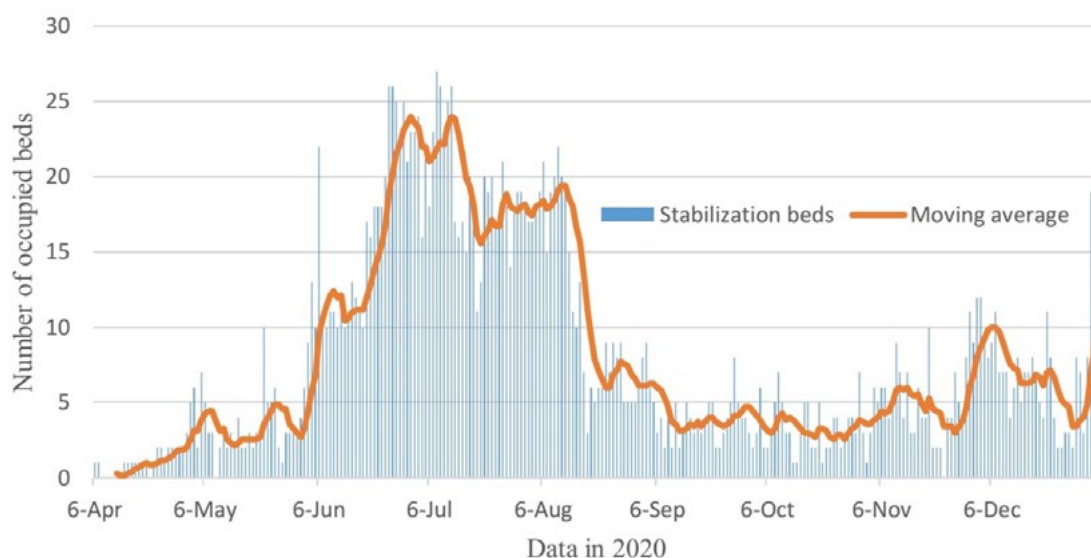
**Figure 3. Covid-19 in Piauí (Brazil)[22]: Evolution of the occupancy of stabilization beds and associated moving average until 1 January 2021**
**Source:** The authors (2022).

to prevent the spread of Covid-19, leading government authorities to adopt measures such as the opening of new field hospitals and the implementation of more stringent lockdowns.[37]

The available evidence[38-40] asserts that non-pharmacological interventions (e.g. hand hygiene, social distancing, mask use, and room ventilation) mitigate the spread of the virus, thus reducing bed occupancy and the saturation of the health care system. While social distancing remains a somewhat controversial non-pharmacological measure, the data in Figures 1 and 2 are prone to support its impact on Covid-19 cases and subsequent deaths in Brazil.[41]

Figure 3 shows the evolution in the occupancy of stabilization beds and the associated moving average in Piauí until 1 January 2021. Demand for stabilization beds experienced more intense fluctuations (when compared to their clinical and ICU counterparts), especially from June to August, with relatively high occupations reaching 27 beds on 8 July and 26 beds on 25-26 June. An upward trend is evidenced in the moving average, with a 46.94% increase over the last 14 days in the period under observation.

As far as the Covid-19 assistance framework is concerned, the occupancy data in Figures 1 to 3 are important factors in decision-making because beds (especially ICU ones) are extremely important in saving lives.[31] Such data might support not only the formation as well as the implementation of public pol-

icies against Covid-19, such as increasing the number of health service units and adopting social distancing (or instead flexibilizing it).[42]

While bed occupancy rates may possibly suggest some inefficiency with respect to Covid-19 mitigation in Piauí, Figure 3 supports the need to maintain measures to slow down SARS-CoV-2 propagation in this state of Brazil. Accordingly, prevention actions should always be adopted to reduce the number of Covid-19 cases and, hence, the occupancy of beds (clinical, ICU, stabilization) as a means to relieve and reorganize the health care system.[43]

## Conclusion

As shown by the increasing number of confirmed cases in Piauí, Covid-19 shows a higher prevalence among economically active age groups (i.e. 20-59 years old) and higher lethality among the elderly (i.e. people older than 60 years). Accordingly, preventive measures are necessary and should be continuously adopted in order to mitigate the spread of the disease. While confirmed cases have increased, demands for general and ICU beds have decreased, declining respectively by 14.03% and 9.33% (on weekly moving average basis) in last 14 days of the period under study.

The limitations of the present work include the use of secondary data (which refer exclusively to registered notifications) and possible existence of un-

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derreporting (which may affect the epidemiological profile, thus possibly introducing bias). Nevertheless, the present work contributes to the monitoring of the evolution of the Covid-19 infection-death binomial and its influence on bed occupancy in the state of Piauí as a means to assist decision-makers in planning as well as managing actions geared towards the prevention and mitigation of Covid-19.

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