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COVID-19 morbidity and mortality in 2020: the case of the city of Rio de Janeiro

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DEAR EDITOR:

In March of 2020, community transmission of severe acute respiratory syndrome coronavirus 2 was confirmed in Brazil. In the present study, we investigated possible changes in trends, as well as the levels of morbidity and mortality, associated with coronavirus disease 2019 (COVID-19) during the pandemic in the city of Rio de Janeiro, Brazil, using time series analyses. Further details about the data used in this study—cases and deaths occurring between March 6 and July 22, 2020 (a period of 139 days) in the city—are available at . We collected data on the daily numbers of new cases of and deaths from COVID-19 during that period.

For the numbers of COVID-19 cases and deaths in 2020, we compared periods. For cases, we compared the 74-day period from March 6 to May 18 with the 65-day period from May 19 to July 22. For deaths, we compared the 62-day period from March 6 to May 6 with the 77-day period from May 7 to July 22.

Because this was a relatively short time series, we chose to use the Prais-Winsten and Cochrane-Orcutt regression to adjust the models for both outcomes (COVID-19 cases and deaths). The models included a constant, a term indicating a change in level from the first to the second period, and another term indicating a change in trend (slope) from the first to the second period.

The model is expressed as follows:

$$Y_t = (\hat{\beta}_0 + \hat{\beta}_1 \times \textit{total days} + \hat{\beta}_2 \times 1 + \hat{\beta}_3 \times \textit{days after the pre-prediction period}) + e_t$$

where Y_t is the absolute effect for a given period of time, $\hat{\beta}_0$ is the constant, $\hat{\beta}_1$ is the parameter related to the total investigation time, $\hat{\beta}_2$ is the parameter related to the prediction period, $\hat{\beta}_3$ is the parameter related to the duration of the effect to be estimated, and e_t is the random error.

Between March 6 and July 22, there were 68,334 new COVID-19 cases and 7,887 COVID-19-related deaths. The mean number of cases in the first and second periods were 181.66 ± 208.86 and 844.48 ± 553.34, respectively, whereas the mean number of deaths per day in the first and second periods were 12.32 ± 14.51 and 92.51 ± 46.92, respectively.

The serial correlation coefficient for cases was 7.17 (95% CI: 3.18-11.16; $p < 0.001$), indicating an increase in the number of cases. Starting on the 75th day, the trend was reversed, indicating a decrease in the number of cases (coefficient = −21.87; 95% CI: −28.07 to −15.67; $p < 0.0001$). We detected a change in the level of cases in the second period (coefficient = 887.56; 95% CI: 642.88-1.132.25; $p < 0.0001$), as shown in Figure 1A.

The serial correlation coefficient for deaths was 0.73 (95% CI: 0.14-1.31; $p < 0.02$), which indicates growth. Starting on May 7, the trend reversed, indicating a decrease in the number of deaths (coefficient = −1.53; 95% CI: −2.24 to −0.83; $p < 0.0001$). The regression model estimates for the change in level were significant, indicating a mean increase of 90.11 COVID-19 deaths (95% CI: 63.64-116.58; $p < 0.0001$) in the second period, as shown in Figure 1B.

Since the beginning of the epidemic in the city of Rio de Janeiro, the municipal testing policy has made RT-PCR tests available for inpatients and for patients with suspected COVID-19 seen in emergency departments, although no tests have been made available at primary health care clinics. Our findings indicate that, in the first two months after the onset of the epidemic, the number of deaths was low, although there was thereafter a significant increase in morbidity and mortality, associated with the high transmissibility of the disease, the lack of knowledge about the biological behavior of the virus, and the lack of a specific treatment or vaccine.

According to the Brazilian National Ministry of Health, by the second half of May, there were more than 240,000 confirmed COVID-19 cases and just over 16,000 thousand deaths attributed to the disease in the country. At that time, nearly 140,000 patients had been hospitalized with suspected COVID-19 in Brazil.

Measures have been put in place to control the pandemic. Although social distancing was adopted as the main policy to confront COVID-19 in Brazil, the country lacked important coordinated actions, such as investments in a unified information system; greater availability of diagnostic tests for suspected cases; rerouting of the operational flow at health care facilities; and streamlining of patient care with the construction of field hospitals and purchasing of equipment.[1,2]

In terms of COVID-19 mitigation measures, two different scenarios were observed in Brazil. The first is related to a short period of time in which there was no mitigation, whereas the second is related to a period with medium-level mitigation measures in place. This second scenario differs from that seen in other countries, such as France, Spain, and Switzerland, which adopted stricter measures with the imposition of a total lockdown after the cumulative number of cases reached 50 (intense

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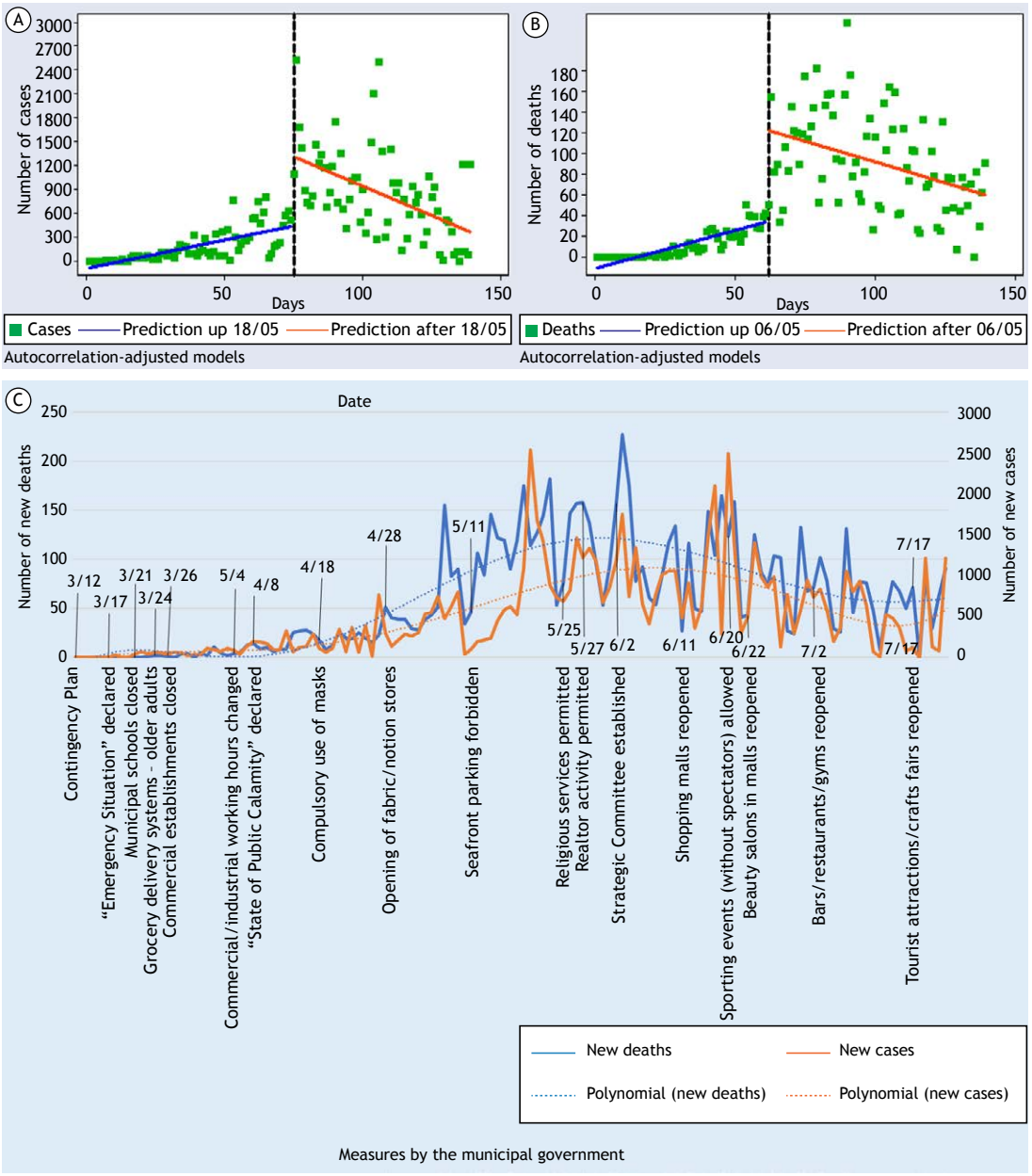

Figure 1. Time series of COVID-19 morbidity and mortality in the city of Rio de Janeiro (RJ)—March 6 to July 22, 2020. A: Number of cases. B: Number of deaths. C: Effects of the passing of municipal decrees on the number of COVID-19 cases and deaths.

mitigation scenario). Germany, Italy, and the United Kingdom took longer to implement such actions.[3]

Despite the containment measures implemented, the estimated capacity of an infected individual to infect others (R_0) in the state of Rio de Janeiro and in the greater metropolitan region of the city of Rio de Janeiro was 2.4 in early May,[4] which suggests that the number of cases was growing and that other measures would be needed to contain the spread of the disease.

The successful use of nonpharmacological disease mitigation measures in China has given rise to effectiveness studies.[5-7] Many researchers argue that nonpharmacological intervention measures can, by lowering the occupancy rate of ICU beds and the number of deaths, avoid the collapse of the health care system, which could be overwhelmed by severe cases that require hospitalization.[8-10]

Predominant among the obstacles that hindered the control of COVID-19 in Brazil are the high turnover of health ministers during the pandemic, the belief that there was no need for stricter mitigation measures, the constant pressure to resume economic activities, and the delay in providing government aid to the

vulnerable population, which led to long lines at banks and consequent agglomerations of individuals.

Although we saw a significant increase in the number of deaths and new cases in May, the measures adopted to face the pandemic were eased, mainly in late May/early June (Figure 1C). Additional surveillance activities could contribute to increasing compliance with the mitigation measures in place.

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