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Brazilian battle against COVID-19

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When and how did the severe acute respiratory syndrome coronavirus 2 pandemic begin in Brazil?

After the devastating effects of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in China, European countries, and the United States, the first case of coronavirus disease 2019 (COVID-19) in Brazil was registered on February 26, 2020, in São Paulo city. The patient was a male subject who returned from a trip to Italy and tested positive to SARS-CoV-2. In February 27, 2020, the Brazilian government informed that 20 suspect cases were monitored, from whom 12 have returned from Italy. In the same day, there were 132 suspected cases in 15 states, 85 of them were in the state of São Paulo.\textsuperscript{1} On February 3, 2020, the Brazilian Ministry of Health declared a state of emergency due to the COVID-19 pandemic based on information on SARS cases notified to the Brazilian Information System for Notification of Grievances (a legal requirement since 2009, after the influenza A [H1N1] pandemic).\textsuperscript{2} After then, the disease spread alongside the country, reaching 1,228,114 infected patients and 54,971 deaths by June 26, 2020.\textsuperscript{1}

Health policies to combat the COVID-19

The public health-care system in Brazil is universal, meaning that all inhabitants are covered by the Unified Health Care System (SUS). Nevertheless, around 20% of Brazilian citizens are also covered by private health insurances, mainly in major cities and among high-income people.

Some government actions to combat the COVID-19 pandemic were as follows\textsuperscript{3}:

1. Establishment of guidelines for COVID-19 prevention and management (https://aps.saude.gov.br/ape/corona);
2. Allocation of 200 million reals (approximately US$ 36,496,350) to support the primary health care;
3. Extension of service hours in primary health care units;
4. Increase in the number of health-care professionals available;
5. Distribution of approximately 22 million of COVID-19 tests;
6. Implementation of a tele-system (Tele-SUS) to track back, diagnosis, and monitor patients with flu-like symptoms and COVID-19;
7. Implementation of telehealth guidance (Tele-UTI) for severe and critical cases of COVID-19;
8. Provision of a telemedicine platform for multiprofessional care; and
9. Teleconsulting with psychiatrist and psychologists.

Despite all these important measures, Brazil is facing many difficulties during the COVID-19 pandemic, mainly related to the pressure for flexibilization of social isolation, lack of medical equipment and supplies such as personal protective equipment (PPE) and mechanical ventilators, and a low availability of hospital bed and trained professionals to manage severe ill COVID-19 patients, especially in the intensive care unit (ICU).

A big concern from the Brazilian government was related to the economic impact of social isolation. In this sense, many government actions were taken in order to reopen the economy even before the peak of COVID-19 infections has been reached, sometimes ignoring the recommendations of health authorities such as the World Health Organization. Additionally, some government recommendations (e.g., hydroxychloroquine/chloroquine use) were not supported by the best available evidence, leading to doubts among health-care professionals at the front line and provoking treatment variability.

Nongovernmental initiatives were also important to combat the COVID-19 pandemic. Notably, the Epimed Solutions, a health company that collects data on health quality indicators from public and private hospitals, created a robust database including patients with SARS-CoV-2. This information has been useful to identify risk areas, profile of susceptible people, resource use, outcomes, and benchmarking. Also, a partnership with the Brazilian Society of Intensive Care, the Brazilian Society of Infectious Diseases, and the Brazilian Society of Pneumology and Tisiology published rapid guidelines based on best available evidence using the GRADE system for the pharmacological treatment of COVID-19. These recommendations have been endorsed by multiple health-care professional societies and adopted in many public and private health-care contexts.

**SARS-CoV-2 epidemiology in Brazil**

Seventeen days went through from the first confirmed case of COVID-19, on February 26, 2020 to the 100th case. The time frames between the 100th and the 1000th, and between the 1000th and the 10,000th confirmed cases were 7 and
14 days, respectively. All the Brazilian states have reported deaths related to the COVID-19. Currently, the epicenter of SARS-CoV-2 pandemic is located in São Paulo city and Rio de Janeiro. Also, cities in the North and Northeast, such as Manaus and Fortaleza, have been highly affected by the COVID-19 pandemic. In São Paulo and Rio de Janeiro, health authorities created new hospitals to attend COVID-19 patients. However, even with these measures, both public and private health-care systems are still fighting to keep ICU occupancy below 90%. Unfortunately, there was a delay to conclude COVID-19 hospitals in Rio de Janeiro, leading the public health-care system to a state of emergency. This scenario is also worrisome in North and Northeast states. Along with ICU bed scarcity, the lack of qualified health-care professionals, PPE, mechanical ventilators, and medications are challenging the quality of care provided to COVID-19 patients. In the South, the scenario seems to be less dramatic, without significant problems in bed shortage, professionals, and ICU resources. However, this context might reflect the smaller number of cases in comparison to the other geopolitical regions.

**Resources and outcomes: How to solve this equation**

The resource scarcity is a great challenge in Brazil. Due to lack of tests to confirm suspected cases, all patients are not being tested, prioritizing the most severe cases and high-risk groups. Unfortunately, this strategy leads to underreporting of affected patients and deaths caused by SARS-CoV-2 and biased conclusions regarding possible risks and prognostic factors.5

The peak of the incidence of COVID-19 seems to have already been overcome in several capitals of Brazil, which allows to partially analyze the Brazilian experience from what happened in these cities and regions. Cities as Manaus, as well as Fortaleza and Belém, just to name a few, experienced the collapse of their health systems, characterized mainly, but not exclusively, by the deficit of ICU beds. Some states, such as Paraíba, adopted social distancing early during the pandemic, which gave them time to provide infrastructure resources, but not specialized staff, which became a major limitation in providing appropriate care to critically ill patients.

Besides, even with a centralized state regulation of beds to patients with COVID-19, health-care managers were unable to promote an adequate integration, notably between the state and municipal health sectors, and this lack of integration may have contributed to a lower efficiency of COVID-19 management.

This scenario seems to have been the rule in most Brazilian states. Even where minimally adequate contingency plans were established, the lack of specialized human resources was added to problems in supply of medical materials, such as essential drugs for the management of critically ill patients, such as sedatives, neuromuscular blockers, and PPE for health professionals, which were forced, for example, to reuse N95 masks for several shifts on duty in some hospitals. The excessive demand resulting from the increasing number of severe and critical cases of COVID-19, in addition to the illness or contagion of the health professionals themselves, led
the health-care institutions to hire human resources with little or no qualification. Until June 10, 2020, there was 18,354 nurses infected with SARS-CoV-2, and 182 had died, showing that in Brazil there is a critical loss of professionals caring patients with COVID-19. The result could not be other than a greater proportion of unfavorable clinical outcomes, especially for cases in which recovery would depend fundamentally on specialized care.

The quality of care, despite having suffered a negative impact, proved to be acceptable so far in the face of such an adverse scenario. In a cohort of 219 patients who were admitted consecutively to an ICU intended for exclusive care of victims of COVID-19 between March and May 2020, the outcomes were reasonable despite worsening of efficiency indicators. The average age of patients was 72 years, the average length of stay in the ICU was 6.48 days, and the mortality rate was 19.72% for an average simplified acute physiology score 3 (SAPS 3) of 53.4. The standardized mortality rate was 0.8. In the year prior to the pandemic (2019), the same unit admitted 1100 patients with a mean age of 71 years, an average length of stay of 5.1 days, a mortality rate of 14.03% for an average SAPS 3 of 61.27, and standardized mortality rate of 0.49. The reasons for this performance drop, in this specific center, fall on the exacerbated demand at the peak of the pandemic coupled with the need to hire nonspecialist professionals or with little experience to compose the ICU staff.

In some regions, regulatory authorities adopted criteria for admission in the ICU, in case of lack of ICU beds. These recommendations intended to assist physicians in the decision-making process for ICU admission, taking into account the ethical principles of distributive justice, nonmaleficence, and respect for the autonomy and dignity of patients (Table 1).

Table 1 Guidelines for ICU admission criteria in Rio Grande do Sul, Brazil.

| Priority | Criteria | Clinical aspects |
|----------|----------|-----------------|
| Red      | 1        | COVID-19 diagnostic criteria or high suspicion, attended in service without ICU facility, without other disease that limited prognosis before the pandemic |
| Orange   | 2        | COVID-19 diagnostic criteria or high suspicion, attended in service with ICU facility crowded without other disease that limited prognosis before the pandemic |
| Yellow   | 3        | COVID-19 diagnostic criteria or high suspicion, attended in service with ICU facility but indication to transfer to another more complex unit, without other disease that limited prognosis before the pandemic |
| Green    | 4        | COVID-19 diagnostic criteria or high suspicion, attended in service without ICU facility, with other disease that limited prognosis before the pandemic |
| Blue     | 5        | COVID-19 diagnostic criteria or high suspicion, attended in service with ICU facility, with other disease that limited prognosis before the pandemic |
Lastly, in Brazil, both government and medical regulatory agencies are working together to allow the safe use of telemedicine and telehealth. Since these strategies of care can reduce, at the same time, inequities related to health access in remote and low resource areas and the risk of infection of both patients and health-care professionals, their implementation became a health priority with the COVID-19 pandemic.\(^5\)

**Opportunities for research**

The SARS-CoV-2 affected all health systems in the world. The high mortality rates as well as the social and economic impact of COVID-19 pandemic impulsed research for specific SARS-CoV-2 treatments. In Brazil, some investigational initiatives are trying to contribute to the current evidence. Recently, chloroquine was tested in a randomized trial in a small group of patients from Manaus. There was a comparison between low- and high-dose regimen, and the results suggested that higher chloroquine doses are detrimental.\(^8\) Additionally, the coalition COVID-19 Brazil initiative is currently conducting six randomized clinical trials to assess the impact of treatment candidates (e.g., hydroxychloroquine alone or in combination with azithromycin [NCT04322123, NCT04321278, RBR-3cbs3w], dexamethasone [NCT04327401], tocilizumab [NCT04403685], and anticoagulant therapy [NCT04394377] on clinical outcomes of COVID-19 patients. Notably, this initiative also includes a large follow-up study which aims to assess predictors of long-term quality of life and patient-centered outcomes among survivors of hospitalization due to COVID-19 [NCT04376658]). Probably, these results will contribute for a better understanding of COVID-19 treatment response and the impact of SARS-CoV-2 infection on patient-centered outcome in low- and middle-income settings. Another area of hope comes from the participation of 2000 Brazilian volunteers in the development of a vaccine trial, conducted by the University of Oxford, United Kingdom. This contribution should help the health organizations to manage the pandemics and stop its progression worldwide.

**Lessons for the future**

It is surprising and worrisome that in the 21st century, each country handled the situation according to their possibilities and resources with few global initiatives focused on quality of care and collaboration. On the other hand, despite all adversities of the situation, a lot of lessons might be learned. In Brazil in particular there are some points for evaluation: First, the governors should be acting collaboratively during a pandemic. The establishment of an effective network of collaboration between federal, state, and municipal instances across all levels of care would reduce inequalities by increasing availability of resources and improve efficiency while promoting an organized care according to the patient needs.
Second, the adoption of evidence-based practices during a pandemic should be part of the health policies of both public and private health-care systems. By supporting interventions of proven benefit or discouraging interventions that are ineffective or potential harmful, incorporating evidence into health-care practice is recognized as an essential requirement for the optimal and cost-effective care of patients.

Third, a national plan for increasing the number of ICU professionals is needed. Career development, better remuneration, and prevention of burnout are important topics to be optimized to allow a sustainable increase in the number of qualified ICU professionals in Brazil. Safer work conditions with appropriate PPE are also needed, given the high number of health-care professionals infected by the SARS-CoV-2.

Fourth, creation of national program for catastrophes management must be prioritized by health authorities. The absence of prespecified contingency plans for serious infectious diseases epidemics is unacceptable given our recent experiences. Since 2000, at least three pandemics of viral respiratory agents occurred (i.e., H5N1 in 2004, H1N1 in 2009, and SARS-CoV-2 in 2020) with many deaths and important social and economic impact. Since most of these events are unpredictable, planning and training qualified personal and provisioning appropriate material resources are essential part of damage control measures.

Fifth, a better organization in the management of health system, both in private and mainly in public organizations, is needed. Many field hospitals and ICU beds were projected but, in some states, only few completed on time. In this sense, areas able to be transformed into hospital with ICU beds should be planned, avoiding waste of time and resources implementing critical care beds during pandemics. It seems proven that from now on, any hospital should be prepared to increase its capacity in critical care beds in a short time in catastrophes.

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