




# Impact of the Strategies Adopted to Face the COVID-19 Pandemic in a Brazilian Reference Institute for High Complexity Surgery in Orthopedics and Traumatology\*

## *Impacto das estratégias adotadas para enfrentar a pandemia de COVID-19 em um Instituto Brasileiro de referência em cirurgia de alta complexidade em Ortopedia e Traumatologia*

Geraldo da Rocha Motta Filho<sup>1</sup>  Ana Carolina Leal<sup>2</sup> Marcus Vinicius Galvão do Amaral<sup>3</sup>  
Phelippe Augusto Valente Maia<sup>4</sup> Maria Eugênia Leite Duarte<sup>2</sup> Germana Lyra Bähr<sup>5</sup>

<sup>1</sup> Division of Teaching and Research, Instituto Nacional de Traumatologia e Ortopedia, Rio de Janeiro, RJ, Brazil

<sup>2</sup> Teaching and Research Division, Instituto Nacional de Traumatologia e Ortopedia, Rio de Janeiro, RJ, Brazil

<sup>3</sup> Division of Orthopedics and Traumatology, Instituto Nacional de Traumatologia e Ortopedia, Rio de Janeiro, RJ, Brazil

<sup>4</sup> Hospital Unit, Instituto Nacional de Traumatologia e Ortopedia, Rio de Janeiro, RJ, Brazil

<sup>5</sup> Special Programs, Instituto Nacional de Traumatologia e Ortopedia, Rio de Janeiro, RJ, Brazil

Address for correspondence Geraldo da Rocha Motta Filho, MD, MSc, Rua Raimundo de Magalhães, 92, Rio de Janeiro, RJ, 22451-150, Brazil (e-mail: geraldomotta@terra.com.br).

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### Abstract

COVID-19 pandemics required substantial reorganization and adaptation of healthcare services all over the world. This study aims to analyze the effect of operational strategies implemented in Brazil to manage the extra strain placed on healthcare services by the COVID-19 pandemic of 2020. In particular, this investigation examines the strategy to convert an institute specialized in elective orthopedic procedures of high complexity into a trauma unit for all musculoskeletal trauma patients of an entire federative unit. A retrospective study was conducted comparing hospital variables at the peak period of the pandemic (from March 16, 2020 to June 30, 2020) with the same period in 2019 as a comparative baseline. The variables analyzed included number of professionals away from work, surgeries performed, outpatient care, transfers, length

### Keywords

- ▶ COVID-19
- ▶ coronavirus
- ▶ SARS-CoV-2
- ▶ trauma
- ▶ orthopedics
- ▶ surgery

\* Work developed at the Teaching and Research Division, National Institute of Traumatology and Orthopedics, Rio de Janeiro, RJ, Brazil.

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of stay, number of patients diagnosed with COVID-19 and patient mortality. During the COVID-19 peak period, there was a 48.5% reduction in surgical productivity and 72.4% reduction in outpatient care compared with the same period in 2019. The number of transfers increased substantially (124.5%), while 94 confirmed cases and 77 suspected cases of COVID-19 were reported. The mortality rate increased by 245%. The present study highlighted the effect of COVID-19 on a tertiary orthopedic hospital. Despite the dramatic changes in hospital operations, due to the implementation of protocols to manage the pandemic, the results demonstrated the feasibility and efficiency of such protocols in prioritizing quality and safety for patients and the healthcare workforce.

## Resumo

A pandemia de COVID-19 exigiu reorganização e adaptação substanciais dos serviços de saúde em todo o mundo. Este estudo tem como objetivo analisar o efeito das estratégias operacionais implementadas no Brasil em resposta à pressão extra imposta aos serviços de saúde pela pandemia de COVID-19 de 2020. Esta pesquisa examina principalmente a estratégia de conversão de um instituto especializado em procedimentos ortopédicos eletivos de alta complexidade em uma unidade de trauma para todos os pacientes com traumatismo musculoesquelético de toda uma unidade federativa. Um estudo retrospectivo comparou as variáveis hospitalares no período de pico da pandemia (de 16 de março de 2020 a 30 de junho de 2020) com o mesmo período de 2019, que representou os valores basais. As variáveis analisadas foram número de profissionais afastados do trabalho, cirurgias realizadas, atendimento ambulatorial, transferências, tempo de internação, número de pacientes com diagnóstico de COVID-19 e mortalidade dos pacientes. Durante o período de pico de COVID-19, houve uma redução de 48,5% na produtividade cirúrgica e de 72,4% no atendimento ambulatorial em comparação ao mesmo período de 2019. O número de transferências aumentou de maneira substancial (124,5%), com relato de 94 casos confirmados e 77 casos suspeitos de COVID-19. A taxa de mortalidade aumentou 245%. Este estudo destacou o efeito da COVID-19 em um hospital ortopédico terciário. Apesar das mudanças dramáticas no funcionamento do hospital devido à instituição de protocolos em resposta à pandemia, os resultados demonstraram a viabilidade e a eficiência de tais protocolos em priorizar a qualidade e a segurança dos pacientes e dos profissionais de saúde.

## Palavras-chave

- ▶ COVID-19
- ▶ coronavírus
- ▶ SARS-CoV-2
- ▶ trauma
- ▶ ortopedia
- ▶ cirurgia

## Introduction

On March 12, 2020, the World Health Organization (WHO) declared COVID-19—the disease caused by the SARS-CoV-2 virus—a global pandemic, resulting in many changes to diverse aspects of life worldwide.<sup>1</sup>

In Brazil, the first case of COVID-19 was confirmed in São Paulo on February 26, 2020. Soon after, Rio de Janeiro reported its first case on March 5, 2020 and by March 17, 2020, the state was already showing community transmission of the disease, prompting the declaration of a state of emergency and the introduction of measures to contain the progress of the disease. Despite these measures, the disease spread quickly, reaching its peak in May 2020, and sustaining a high national level of new cases and deaths. At the end of June, 1 408 485 cases and 59 656 deaths had been recorded, of which 10 080 confirmed cases were from the state of Rio de Janeiro.<sup>2</sup> All Brazilian states experienced a period of high

demand for diagnostic tests, personal protective equipment (PPE) and hospital beds in the months of April and May 2020 but this demand was met with lack, despite the construction of field hospitals for the exclusive care of patients with COVID-19.

Although orthopedics and traumatology, as a medical specialty, does not directly deal with the effects caused by SARS-CoV-2, its performance has been profoundly affected due to the suspension of elective procedures by health authorities. This measure, adopted worldwide, was motivated by the high risk of exposing patients and health professionals to the virus and by the need to allocate resources and hospital infrastructure to the treatment of pandemic victims.<sup>3-5</sup>

Most Brazilian states have reorganized their health services to free up beds from general and emergency hospitals to prioritize patients with COVID-19. In a particular state, this resulted in the transfer of all cases of orthopedic trauma to a

single hospital specialized in elective orthopedic procedures of high complexity.

The aim of this study is to assess the effect of the operational strategies within the context of the pandemic, specifically, in converting an institute specialized in elective orthopedic procedures of high complexity into a unit to assist patients of musculoskeletal trauma. The protocols and strategies described in the article can be readily applied to other health units, being of great use in coping with the ongoing second wave of the disease.

## Methods

This retrospective study assesses the effect that the measures taken to manage the COVID-19 pandemic had on the activities of a highly-complexity orthopedic hospital in Brazil. The data were collected from information contained in the institutional data management system (MV and MV Portal) and from the minutes of meetings of the institutional Crisis Office. This study was approved by the institutional Ethics on Research Committee.

According to the guidelines of health authorities and control bodies, elective procedures were suspended, and only oncological, orthopedic trauma and treatment for infections and postoperative complications were performed. In addition, the hospital was responsible for treating all orthopedic trauma patients in the state where it is located. To adapt to the new routine, elaborate protocols and strategies were put in place and their implementation was coordinated by the Crisis Office through virtual meetings. Decisions were communicated to the workforce through reports conveyed through WhatsApp, on institutional television sets located in areas with high staff concentration and on the intranet, which all employees had access to. The new protocols which were implemented as of March 16, 2020 involved the reorganization of institutional activities; reception and referral of transferred patients; and reorganization of surgical procedures. These areas constitute the scope of this study.

## Reorganization of Institutional Activities

The actions related to the reorganization of institutional activities covered both assistance and academic activities and are summarized in **Table 1**.

## Reception and Referral of Transferred Patients

Due to the impossibility of performing polymerase chain reaction (PCR) in naso and/or oropharynx swabs for all patients, flows and entry protocols for transferred patients had to be defined. The first group, asymptomatic patients, were accommodated in a specific area. The second group consisting of suspected COVID-19 cases (i.e., those with a history of possible contagion or influenza like symptoms) were placed in a second area with 40 beds and the third group, transferees who were admitted with a confirmed COVID-19 diagnosis, were placed in a third area (**Fig. 1**). All symptomatic patients or those with a history of contagion underwent screening for COVID-19 through PCR. The test result was made available within 72 hours.

In addition to the three different cohorts in the hospitalization area, in the ICU, 10 exclusive isolation beds were reserved for confirmed COVID-19 patients. Between these areas, safety barriers were set up, with transition limits. Access to the floor, where the isolated area for COVID-19 patients was located, was blocked for employees who were not part of the staff selected to work in the space.

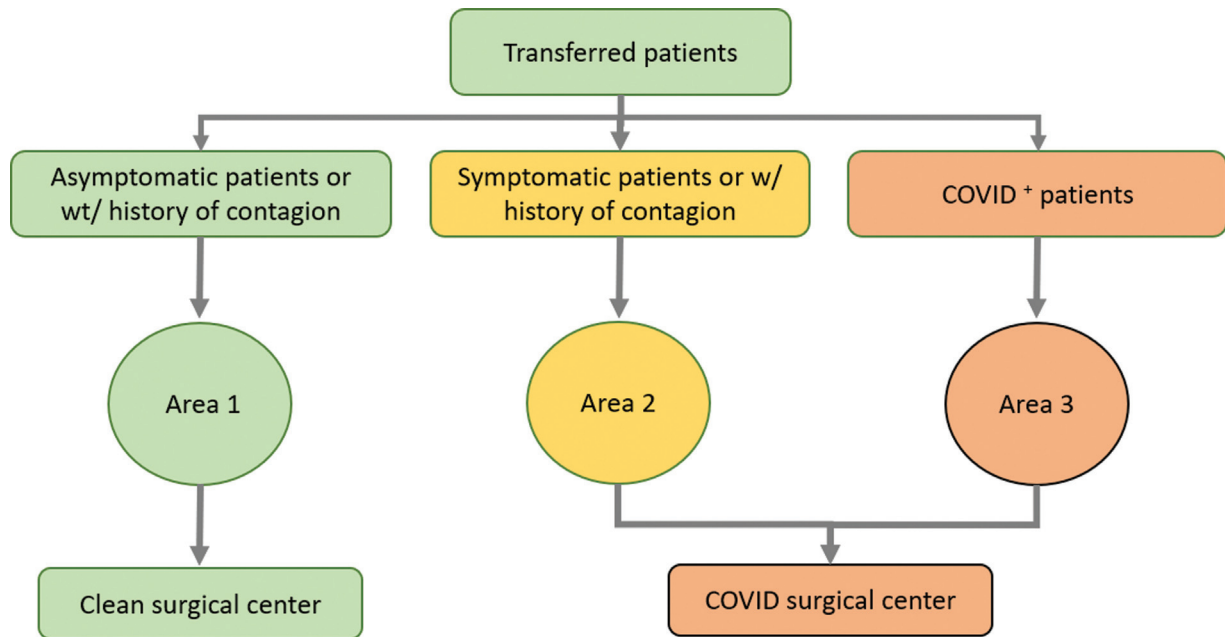
## Reorganization of Surgical Procedures

Surgical procedures were performed in two different surgical centers. Asymptomatic patients were referred to the main surgical center with 18 rooms. Positive or suspected COVID-19 patients were referred to another surgical center with three operating rooms on another floor, which was completely independent of the first.

The flow of care in these units was altered with restrictions placed on the number of professionals allowed during surgery. The surgical team involved in performing the procedure was only granted access to the operating room after the end of anesthesia.

**Table 1** Reorganization of institutional activities

Welfare activities	Academic activities
<ul style="list-style-type: none"> <li>• Release of professionals with a high COVID-19 risk for remote work.</li> <li>• Reduction of outpatient care, with suspension of care for new patients.</li> <li>• Separation of waiting areas in outpatient units and creation of a staggered system of attendance.</li> <li>• Definition of an exclusive area for the care of symptomatic patients and employees.</li> <li>• Relocation and training of professionals to work in the most critical areas—the Intensive Care Unit (ICU), Referenced Trauma Unit, and COVID-19 areas in the wards.</li> <li>• Making iPads available in the ICU and wards for patients to hold virtual meetings with their families.</li> <li>• Elaboration of the efficient use of PPE through a manual placed at the Hospital Infection Area.</li> </ul>	<ul style="list-style-type: none"> <li>• Suspension of face-to-face activities and adoption of a remote format for activities in various areas of specialization, such as master's classes and clinical sessions.</li> <li>• Use of mannequins and realistic simulation to train professionals, including professionals from other health units, on intubation, ventilator management and respiratory physiotherapy for COVID-19.</li> <li>• Organization of scales to maintain activities in research laboratories and vivarium.</li> </ul>



**Fig. 1** Algorithm for reception and referral of transferred patients.

**Data Analysis**

The evaluation of the effect of the implementation of the described protocols was done by comparing hospital data from March 16, 2020 to June 30, 2020 with information from the same period in 2019. The variables analyzed were: (i) the number of professionals who were placed on leave, (ii) the number of surgeries performed, (iii) outpatient care, (iv) the number of transfers, (v) length of hospital stay, (vi) the number of patients diagnosed with COVID-19 and the origin of the infection, and (vii) the number of deaths. The criterion used to characterize the infection—as community infection or coming from another health unit—was the appearance of symptoms until the seventh day of hospitalization. After this period, the infection was classified as having been acquired at the institute.

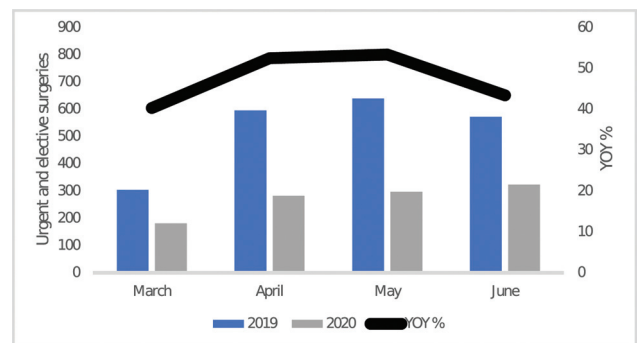
**Results**

During the period studied, 231 employees—including 160 healthcare professionals—were placed on leave according to Ordinance No. 428 of the Ministry of Health, which allowed remote work for professionals over 60 years old, with chronic diseases and high-risk pregnant women.

The academic activities of stricto and lato sensu postgraduate courses were maintained, with classes, scientific meetings and dissertation defenses done through video conferences.

Comparing all data year over year (YOY), the restriction to performing elective procedures, both surgical and outpatient, resulted in a 48.5% reduction in surgical productivity (→Fig. 2) and in a 72.4% reduction in outpatient care compared with the same period in 2019 (→Fig. 3).

The new role assumed by the institute—to attend to all orthopedic trauma patients in the state in which it is located—resulted in an increase of 124.5% in the number of transfers (→Fig. 4). The increase in transfers was accompanied by an



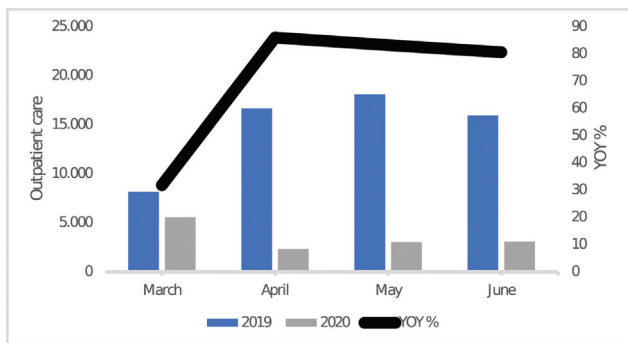
**Fig. 2** Number of urgent and elective surgeries performed during the two periods evaluated. Blue: 2019. Gray: 2020. Black line: YOY%.

increase of 63% in the length of stay in April and an increase of more than 100% in May and June 2020 compared with 2019 (→Table 2).

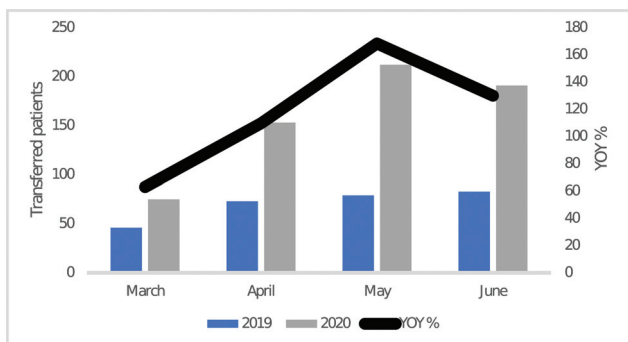
The increase in the number of transfers also resulted in an increase in the number of inpatients diagnosed with COVID-19 and in cases of in-hospital contamination (→Fig. 5). In addition, due to the transmission of the virus among hospital professionals, there was an increase in the number of professionals on sick leave (→Fig. 5), which mainly affected nurses and nursing assistants in April (→Table 3).

In the period studied, 631 patients from other units were transferred to the institute, and 1087 surgical procedures were performed. Among the transferred patients, COVID-19 was confirmed in 94 of them, of which 46 patients had their diagnosis confirmed before transfer, 28 acquired COVID-19 at the institute, and the origin of infection could not be traced in the remaining 20 patients. In another 77 transferred patients, despite being suspected cases, a COVID-19 diagnosis was not confirmed by PCR.

In the period of this study, 38 deaths were recorded (11 in the same period of 2019), representing an increase of 245%.



**Fig. 3** Number of outpatient care performed during the two periods evaluated. Blue: 2019. Gray: 2020. Black line: YOY% .



**Fig. 4** Number of transferred patients in the two periods evaluated. Blue: 2019. Gray: 2020. Black line: YOY%.

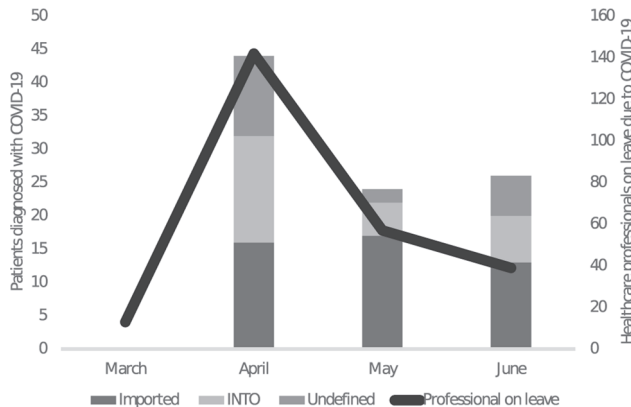
**Table 2** Length of hospital stay

	2019 Average number of days	2020 Average number of days	YOY % Increase / (Decrease)
March (March 16 to March 31)	8.2	8.5	3.6%
April	9.1	14.9	63.7%
May	7.8	16.3	108.9%
June	7.7	16.6	114.1%

Among the patients who died, 31 (or 81.5%) had a confirmed COVID-19 diagnosis.

### Discussion

The spread of the SARS-CoV-2 virus was rapid and extensive in Brazil, especially in highly populated states such as Rio de Janeiro and São Paulo. This resulted in a need to reorganize healthcare systems to redirect resources and free up hospital beds for patients with COVID-19. With this new directive, it was necessary to implement new measures and strategies for patient reception routines, identification of COVID-19 carriers, making PPE available, controlling the movement of healthcare professionals and patients, and allocation of separated surgical rooms for COVID-19 and non-COVID-19 patients.<sup>4-6</sup> In addition to these strategies, it was necessary



**Fig. 5** Number of patients and professionals diagnosed with COVID-19 and number of healthcare professionals on leave. Bars represent the number of patients with COVID-19 classified according to the source of the infection. Line represents the number of professionals on leave due to the disease.

**Table 3** Number of healthcare professionals diagnosed with COVID-19

	Physician	Nurse	Nursing assistant	Others
March (March 16 to March 31)	10	0	3	0
April	30	46	59	7
May	11	14	19	13
June	4	13	18	4
Total	55	73	99	24

to adopt measures to allow teaching and research activities to continue in the least disruptive way possible.<sup>7-9</sup>

Over the study period, 502 professionals were removed from their daily professional activities either because they belonged to a high-risk group or were diagnosed with COVID-19. This caused a 21.6% reduction in the workforce. Such a reduction led to a representative deficit of human resources in critical areas, mainly those who care for COVID-19. This resulted in a temporary reduction in the global availability of beds due to a shortage of these professionals. Approximately 11% of healthcare professionals were placed on leave due to a COVID-19 infection. This figure is comparatively lower than those reported in hospitals in Hong Kong and Italy, which stood at 22% and 20% respectively.<sup>10</sup> However, the number of healthcare professionals who were infected with COVID-19 may have been underestimated, as there were many cases which could not be diagnostically confirmed due to limitations in COVID-19 testing, particularly at the start of the pandemic.

The reduction in the number of outpatient visits and surgical operations were a direct reflection of the measures and protocols implemented by the Crisis Office. The reduction of these activities has also been adopted in other Brazilian and international services, highlighting their role in helping to mitigate the spread of the virus.<sup>6,11</sup>

The Institute's central role in taking over the care of all orthopedic trauma cases in the state has led to a substantial increase in the number of transfers and, consequently, in the admission of patients who already had the virus into its facility. In April 2020, 16 patients acquired COVID-19 during the hospitalization period. In the following months, with the reinforcement of safety and hygiene measures, it was observed that, although the number of infected patients transferred remained constant, there was a drastic drop in the number of patients who contracted the disease at the institute, showing the effectiveness of the protocols adopted.

The peak period of COVID 19's first wave in the State, coincided with the greater number of infected patients hospitalized and with the most reduced healthcare workforce, due to the virus. This observation suggests that the spread of the disease occurred not only among patients, but also among healthcare professionals. Several factors may have contributed to the rapid spread of the virus among healthcare professionals. In their study, Nguyen et al.<sup>12</sup> showed that despite using PPE, healthcare professionals' risk of contamination by the SARS-CoV-2 virus was three times greater, compared with the general population. In addition, a Chinese study by Guo et al.<sup>13</sup> on orthopedic surgeons reported physical tiredness as another risk factor for contracting COVID-19. This same study demonstrated that the most likely places of exposure to the virus were the wards, public spaces and surgical centers. Such studies emphasize the importance of adopting other measures for effective infection control and reinforce the importance of adequate management of scales and shifts to maintain healthcare professionals' mental balance.

During the study period, 94 transferred patients were diagnosed with COVID-19. It is important to note that in the initial months of the pandemic, there were not enough diagnostic tests available, and some suspected patients were discharged or died without diagnostic confirmation. This suggests that the number of COVID-19 cases was underreported at the unit. The incidence of COVID-19 in patients treated at the institute was higher in April, with a 50% reduction in subsequent months, mainly due to effective control of the spread of the disease.

In the same study period, 631 transfers and 1087 surgeries were performed with an average hospital stay of 16 days compared with eight days in the same period of 2019. At the institute, elective surgeries are usually performed preceded by rigorous preoperative preparation. During the pandemic, a change was noted in the profile of patients seen, and these were those who had serious clinical conditions. The care of these patients, who often needed urgent medical intervention, led to surgical procedures being performed without due control of the patient's comorbidities and clinical decompensations. Conversely, if these patients were diagnosed with COVID-19, it most likely led to the postponement of their surgery, which resulted in the procedure being performed after a longer wait than currently recommended in the literature. Both factors affect the patients' postoperative recovery and may have contributed to longer hospital stays, as previously demonstrated.<sup>14-16</sup> A COVID-19 diagnosis may

have also contributed to the increase in the length of stay, either by aggravating the patient's clinical condition and prolonging his recovery or by the requirement to comply with quarantine requirements during the hospitalization period.

COVID-19 seems to be the main factor that contributed to the significant increase in the number of deaths (245%) since 31 of the 36 patients who died were confirmed COVID-19 cases. In our data, the mortality rate of patients with COVID-19 was 32.9%. In the literature, the mortality rate of patients undergoing orthopedic procedures with a perioperative diagnosis of COVID-19 is quite variable at 7.6% □ 43.7%.<sup>17</sup> Thus, there is still no consensus regarding the effect of COVID-19 on the mortality of patients undergoing urgent orthopedic procedures. While some studies claim that both the mortality rate and the number of complications are higher in patients with COVID-19 and therefore, surgical procedures should be postponed whenever possible,<sup>18</sup> another set of evidence suggests that in elderly patients with femoral fractures diagnosed with COVID-19, early performance of the surgical procedures would result in better outcomes, despite the high mortality rate.<sup>16-19</sup> Knowing the effect of surgical outcomes for patients with COVID-19 is of fundamental importance to doctors and managers since it will allow adequate management of patients who need urgent procedures and guide the development of protocols for reintroducing elective procedures safely.

## Conclusions

Managing an unprecedented health crisis is a huge challenge for all healthcare service providers, but it also provides an invaluable learning opportunity. The strategy defined by the institute, with the support of control bodies, of transforming a center for highly-complex elective surgeries into a trauma hospital during the COVID-19 pandemic allowed operational and resilient systems to be maintained, ensuring safe and quality care for patients with orthopedic trauma from across the state.

Even though this study is limited by its retrospective design and the actions and protocols described are part of a broad set of measures aimed at reorganizing the healthcare system of a single federative unit during the COVID-19 pandemic, the results presented represent the reality of a single institution. However, further studies should be conducted to assess the effect of the protocols and strategies implemented by the Crisis Office on the activities of other hospitals in the region.

### Conflict of Interests

The authors have no conflict interests to declare.

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