





# Intervention Protocol of the Orthopedics and Traumatology Department of a High-Complexity University Hospital to Cope with the COVID-19 Pandemic\*

## *Protocolo de intervenção do Departamento de Ortopedia e Traumatologia de um hospital universitário de alta complexidade para enfrentamento da pandemia de COVID-19*

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### Abstract

**Objective** To describe the protocols implemented to adapt the orthopedic team to the COVID-19 pandemic; a secondary objective is to assess the behavior of hospital and departmental variables when implementing such measures.

**Methods** The present is a retrospective study describing three protocols: 1) reduction in the risk of infection for patients and healthcare workers; 2) adaptation of work, academic and scientific activities; and 3) adaptation of the orthopedic treatment during the pandemic. We analyzed hospital and departmental variables, including the number of patients seen in the emergency room and outpatient clinic, the number of hospitalized patients, suspected and confirmed cases in patients and orthopedic team members, changes in teaching activities from on-site attendance to videoconferencing, and number of surgeries. Period A, from March 3 to 16, was compared with period B, from March 17 to 30, 2020, which corresponded to the implementation of the protocols.

**Results** There was a decrease in the number of outpatients and inpatients. One confirmed and two suspected cases were notified. Among the departmental members, there were 12 suspected and 6 confirmed cases. The weekly frequency of classes was maintained, while the clinical-scientific meetings decreased from ten to three. In addition, the number of surgeries was reduced.

**Conclusions** The present study demonstrated the feasibility and efficiency of the rapid implementation of intervention protocols in the midst of the COVID-19

### Keywords

- ▶ COVID-19
- ▶ hospital administration
- ▶ orthopedics
- ▶ pandemics
- ▶ occupational health
- ▶ severe acute respiratory syndrome

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pandemic. The protocols focused on reducing the risk of infection for patients and healthcare professionals, adapting work, academic and scientific activities, and modifying the orthopedic treatment. With the application of the protocols, the healthcare, academic and scientific activities remained functional, prioritizing measures to confront the COVID-19 pandemic.

## Resumo

**Objetivo** Descrever os protocolos implementados para adequar a equipe ortopédica à pandemia de COVID-19 e, secundariamente, avaliar o comportamento de variáveis hospitalares e departamentais frente à implementação das medidas.

**Métodos** Estudo retrospectivo com descrição de três protocolos: 1) redução do risco de contágio dos pacientes e profissionais de saúde; 2) adaptação das atividades laborais, acadêmicas e científicas; e 3) adaptação do tratamento ortopédico frente à pandemia. Foram analisadas variáveis hospitalares e departamentais, como: número de pacientes atendidos no pronto-socorro e ambulatórios, pacientes internados, casos suspeitos e confirmados nos pacientes e na equipe ortopédica, mudança das atividades de ensino do modo presencial para videoconferência, e número cirurgias. Foi comparado o período A, de 03 a 16 de março, com o período B, de 17 a 30 de março, que corresponde à implementação dos protocolos.

**Resultados** Houve diminuição do número de pacientes atendidos e do número de pacientes internados. Foram notificados dois suspeitos e um confirmado. Dos integrantes do departamento, 12 foram suspeitos, e 6, confirmados. Manteve-se a frequência semanal das aulas, e as reuniões clínico-científicas diminuíram de dez para três. Houve redução no volume de cirurgias.

**Conclusões** O presente estudo demonstrou a viabilidade e a eficiência da rápida implementação de protocolos de intervenção em meio ao cenário de pandemia por COVID-19. Os protocolos focaram na redução do risco de contágio dos pacientes e profissionais de saúde, na adaptação das atividades laborais, acadêmicas e científicas, e na adaptação do tratamento ortopédico. Com sua aplicação, mantiveram-se as atividades assistencial, acadêmica e científica funcionantes, priorizando-se medidas de enfrentamento à COVID-19.

## Palavras-chave

- ▶ COVID-19
- ▶ gestão hospitalar
- ▶ ortopedia
- ▶ pandemias
- ▶ segurança ocupacional
- ▶ síndrome respiratória aguda grave

## Introduction

On December 31, 2019, China reported a group of pneumonia cases with an unidentifiable cause that would later be diagnosed as severe acute respiratory syndrome – coronavirus 2 (SARS-CoV-2).<sup>1</sup> The new condition was called coronavirus disease 19 (COVID-19).<sup>2</sup> As a result of the appearance of cases in other countries, the World Health Organization (WHO) declared a SARS-CoV-2 pandemic on March 11, 2020.<sup>3</sup> Up to March 30, 2020, there were 784,738 COVID-19 cases and over 37,774 deaths worldwide.<sup>4</sup>

In Brazil, on February 26, the first case, a person who had recently traveled to Italy, was confirmed in the city of São Paulo.<sup>5</sup> On March 17, 2020, a state of emergency was declared by the mayor of São Paulo;<sup>6</sup> at the following day, a state of public calamity was declared by the São Paulo state governor.<sup>7</sup>

In this context, the Orthopedics and Traumatology Department (OTD) realized the need to establish a COVID-19 Crisis Management Committee (COVID-19 CMC) to quick-

ly create interventional protocols to suit to the pandemic the actions of the entire orthopedic team for our reference hospital.

The primary objective of the present study is to describe the protocols implemented to adapt the orthopedic team to the COVID-19 pandemic and, secondarily, to assess the behavior of hospital and departmental variables when implementing such measures.

## Materials and Methods

The present study was registered at the Ethics on Research Committee of Universidade Federal de São Paulo (Unifesp) under number 4560090420. It is a retrospective study describing protocols created by the OTD from March 17, 2020, and analyzing the variables affected by them. Data were collected from administrative and hospital records from March 3 to 16, 2020 (period A), and from March 17 to 30, 2020 (period B), that is, 14 days before and after the beginning of the intervention.

The COVID-19 CMC was created on March 17, 2020, and it consists of 7 OTD members. The committee was responsible for the development of pandemic interventional protocols, based on recent publications on the topic.<sup>8-17</sup> The following protocols were established:

- **Protocol 1:** reduction in the risk of infection for patients and healthcare workers;
- **Protocol 2:** adaptation of work, academic and scientific activities;
- **Protocol 3:** adaptation of the orthopedic treatment during the pandemic.

The interventions from each protocol are described in ►Tables 1, 2 and 3. Personal protective equipment (PPE) guidelines for each hospital sector are listed in ►Table 4.

Protocols and their updates were released daily by the COVID-19 CMC using the WhatsApp application (Facebook, Inc., Menlo Park, CA, US) to all OTD members, including 57 residents, 41 specialization students and approximately 150 teachers, educational administrative technicians (EATs) and collaborating physicians, totaling approximately 250 people.

The interventions in protocol 1 were assessed by the following variables:

- Variation in the number of patients seen at the emergency room (ER) and outpatient clinics;

- Variation in the number of patients admitted to the OTD, assessed by the percentage of bed occupancy at the ward;
- Number of patients transferred to the Infectious Diseases ward;
- Variation in the number of people in academic rounds;
- Number of days with no proper PPE at the ER;
- Suspected cases, confirmed cases, deaths and contaminated healthcare professionals (both confirmed and suspected cases).

The interventions in protocol 2 were assessed by the following variables

- Number of orthopedists trained to care for flu-like syndromes;
- Reorganization of the working shifts of chiefs and physicians;
- Variation in the weekly number of residency classes and scientific meetings;
- Number of suspended teaching tests;
- Number of teaching tests carried out.

The interventions in protocol 3 were assessed by the number of surgical procedures performed, divided into urgent and elective surgeries. For purposes of data analysis, in our service, all surgeries occurring after 24 hours of hospitalization are considered elective procedures.

**Table 1** Protocol 1—reduction in the risk of infection for patients and healthcare workers

<b>Emergency Room</b>	<ul style="list-style-type: none"> <li>• Installation of alcohol-based hand sanitizer dispensers throughout healthcare sites;</li> <li>• Patient education on the pandemic (hygiene measures, importance of social isolation, warning signs and symptoms, when to seek medical and hospital care);</li> <li>• Reduction in the number of visit numbers.</li> </ul>
<b>Outpatient clinic</b>	<ul style="list-style-type: none"> <li>• Same measures implemented at the Emergency Room;</li> <li>• Scheduling only recent postoperative consultations or cases that require close monitoring;</li> <li>• Non-urgent appointments rescheduled for 6-12 months through telephone contact by professionals and secretaries from the group responsible for the outpatient clinic;</li> <li>• Appointments scheduled at spaced times to avoid crowding</li> <li>• Orientation of only one support person per patient.</li> </ul>
<b>Surgical ward</b>	<ul style="list-style-type: none"> <li>• Installation of alcohol-based hand sanitizer dispensers at the entrances of the rooms and strategic sites at the ward</li> <li>• Patient education on the pandemic (hygiene measures, importance of social isolation, warning signs and symptoms, when to seek medical and hospital care);</li> <li>• Identification and isolation of suspected and confirmed cases;</li> <li>• Nasal swab test and chest computed tomography scan for suspected cases;</li> <li>• Referral of confirmed cases to the infectious diseases ward;</li> <li>• Reduction in the number of people in academic rounds;</li> <li>• Reduction in the number of patients per room;</li> <li>• Surgical masks on all patients.</li> </ul>
<b>Surgical center</b>	<ul style="list-style-type: none"> <li>• Surgical masks on all patients;</li> <li>• Attention to the sequential removal of personal protective equipment: gloves, followed by goggles, apron and, finally, mask;</li> <li>• Adequacy of the structure of the operating room and anesthetic procedures;</li> <li>• Preparation of a large operating room to receive suspected or confirmed cases;</li> <li>• Negative pressure at the operating room and terminal cleaning at the end of each surgery;</li> <li>• Anesthetic equipment and machinery specifically prepared to be used exclusively in this group of patients;</li> <li>• Preference for anesthesia with peripheral and spinal blocks to avoid aerosol-releasing procedures;</li> <li>• Intubation for general anesthesia, when required, aided by a visualizer and with only one assistant with the anesthetist during the procedure; anesthetic team education on the use of acrylic protection cubes to intubate and extubate to reduce aerosol dispersion.</li> </ul>

**Table 2** Protocol 2—adaptation of work, academic and scientific activities

<b>Work activities</b>	<ul style="list-style-type: none"> <li>• Reorganization of the shifts of chiefs and physicians in adaptation to the reduced care demand;</li> <li>• Education of employees older than 60 years of age and/or those in risk groups on not going to the hospital;</li> <li>• Administrative personnel working in home office using phone, e-mail and WhatsApp;</li> <li>• Orthopedists training on the care and treatment of low-complexity flu syndromes, as well as on the management and education of patients with mild clinical conditions and suspicion of COVID-19 by the Infectious Diseases and Hospital Infection Control Service teams.</li> </ul>
<b>Academic and scientific activities</b>	<ul style="list-style-type: none"> <li>• Reduction in the number of people in academic rounds;</li> <li>• Classes and on-site scientific meetings for undergraduate students and residents suspended until further notice;</li> <li>• Scientific meetings and classes by videoconference using the Google Hangout Meets or Zoom applications after educating all members of the Orthopedics and Traumatology Department on their use through a booklet prepared by the COVID-19 Crisis Management Committee and sent through WhatsApp;</li> <li>• Study schedule available through WhatsApp and e-mails to guide the home study;</li> <li>• Testing through the Socrative and Google Meets or Zoom applications.</li> </ul>

**Table 3** Protocol 3—adaptation of the orthopedic treatment during the pandemic

<b>Emergency room</b>	<ul style="list-style-type: none"> <li>• Preference for non-surgical treatment in borderline surgical/non-surgical orthopedic cases;</li> <li>• Preference for immobilization with orthoses instead of plastered splints or plaster for better hygiene. Alternatively, use of removable plaster splint;</li> <li>• Written and verbal guidance to patients on injury evolution, onset of movement, loading and rehabilitation to reduce visits motivated by doubts and other reasons;</li> <li>• Performance of fracture reduction and minor procedures at the Emergency Room, under controlled aseptic conditions, using antisepsis and sterile fields, instead of hospitalization and intervention in the operating room;</li> <li>• Scheduling of surgeries in a day-hospital regimen whenever possible.</li> </ul>
<b>Outpatient clinic</b>	<ul style="list-style-type: none"> <li>• Same measures implemented at the emergency room.</li> </ul>
<b>Surgical ward</b>	<ul style="list-style-type: none"> <li>• Scheduling of surgeries in a day-hospital regimen whenever possible.</li> </ul>
<b>Surgical center</b>	<ul style="list-style-type: none"> <li>• Suspension of elective surgeries until further notice;</li> <li>• Maintenance of emergency, urgency and neoplasms surgeries that require early intervention;</li> <li>• Performance of the surgeries as quickly as possible and with the least number of professionals in the room;</li> <li>• Attention to the use of devices such as hammers or cutters that can spread bodily fluids. These procedures must be performed using the refined technique, with sharp blades and drills; in addition, the surfaces to be used must be kept clean of blood with the aid of an aspiration device;</li> <li>• Electric scalpels must be carefully used due to the release of heat-generated aerosols. When required, including for dissections, the settings of the electric scalpels must be adjusted to the lowest power while maintaining the desired efficiency;</li> <li>• No burial of percutaneous fixations, enabling their future removal at outpatient clinics and avoiding another procedure in the operating room.</li> </ul>

## Results

### Protocol 1

The number of visits to the ER and outpatient clinics fell 74.1% and 60.7%, respectively, between the periods studied. ▶**Table 5** and ▶**Figures 1** and **2** summarize data from these two sectors.

As for the number of patients admitted to the OTD, the daily average of occupied beds was 21.8 (maximum: 30; minimum: 16) in period A, representing 87% of occupancy. In period B, the daily average number of beds occupied was 16 (maximum: 23; minimum: 10), representing 71.4% of occupancy.

During the study, two suspected cases were reported and put in isolation at the Orthopedics ward; in addition, there was one confirmed case, which was transferred to the Infectious Diseases ward, and no deaths. Among the 250 OTD members, 6 tested positive for COVID-19, including 2 residents. In total, 12

members were sent home due to suspicion of COVID-19, including 5 residents. One OTD member with confirmed COVID-19 presented severe dyspnea and remained at the intensive care unit (ICU) for 7 days before discharge.

In period A, the academic rounds at the ward included nine people: two chief physicians, five Orthopedics and Traumatology first-year residents (R1), one second-year resident (R2) and one physician specializing in Orthopedics and Traumatology. During period B, the rounds were performed only by six people: two chief physicians, two R1, one R2, and one physician specializing in Orthopedics and Traumatology.

Considering the complete adaptation to PPE protocols at the ER, two days had passed before the on-duty team received all of the equipment. In those two days, there were fewer goggles or face shields than working physicians; but the remaining PPEs were available. During this period, only residents with complete PPEs had direct contact with patients.

**Table 4** Guidance on personal protective equipment for each sector

SECTOR	PERSONAL PROTECTIVE EQUIPMENT
Emergency room and outpatient clinic	<ul style="list-style-type: none"> <li>• Specific clothing;</li> <li>• Single-use apron;</li> <li>• Goggles or faceshield;</li> <li>• Gloves;</li> <li>• Surgical mask.</li> </ul>
Surgical ward	<ul style="list-style-type: none"> <li>• Specific clothing;</li> <li>• Single-use apron;</li> <li>• Goggles;</li> <li>• Gloves;</li> <li>• Cap;</li> <li>• Surgical or N95 mask (N95 is mandatory when caring for COVID-19-suspected or confirmed cases).</li> </ul>
Surgical center	<ul style="list-style-type: none"> <li>• Specific clothing;</li> <li>• Single-use apron;</li> <li>• Goggles or faceshield;</li> <li>• Gloves;</li> <li>• Cap;</li> <li>• N95 mask.</li> </ul>

**Protocol 2**

In total, 18 EATs from the OTD, who provide medical care to patients at the reference hospital, were trained in the care and management of low-complexity flu syndromes and COVID-19.

At the ER, the shifts were reorganized from three R1, two R2 and one third-year resident (R3), in period A, to two R1, one R2 and one R3 in period B. Professionals put on leave could be called in if required to assist in surgical procedures or medical care.

The weekly number of residency classes and scientific meetings was changed and adapted from on-site attendance to videoconferencing. The Google Hangout Meets (Google, Inc., Mountain View, CA, US) or Zoom (Zoom Video Communication, Inc., San Jose, CA, US) applications were used. The members of the OTD received guidance on the use of the applications through a booklet produced by the COVID-19 CMC and made available through WhatsApp. This adjustment took a week. After this period of platform definition, technical guidance and adherence, the residency classes were maintained at a rate of 16 per week, while the scientific meetings decreased from 10 to 7 per week. Only one teaching test was canceled during period B, with two tests being carried out

through the Socrative (Showbie, Inc., Edmonton, Canada) application associated with Google Meets or Zoom.

**Protocol 3**

The number of surgeries decreased by 65.8% between both periods. The number of elective and urgent surgeries was reduced by 71.7% and 52.2%, respectively. ►Table 5 and ►Figure 3 summarize data from the surgical center.

**Discussion**

The COVID-19 CMC has become a reference group not only for the OTD, but also for other departments and the hospital board. Thus, it centralized the availability of information and helped in the pandemic-related decision making process.

**Protocol 1**

The number of ER visits was importantly reduced in period B. This result reflects the measures taken by the state and municipal governments, which instituted social isolation.<sup>6,7</sup> It is not a direct reflection of protocol-related measures. We assumed that users started to seek ER care mainly for urgent cases. Department members also contributed to this reduced flow by guiding patients and their support people on the importance of social isolation.

At the outpatient clinics, the reduction in the number of visits was a result of the direct participation of the team, with non-urgent visits being rescheduled and with prioritization of recent postoperative visits. ►Figure 2 shows this reduction, although in the first two days of period B there still were a high number of visits. This is due to the difficulty in canceling and rescheduling appointments without previous notice. The following days witnessed an important decrease in the number of visits.

Despite the measures in protocol 1, 6 people from the team contracted COVID-19, and 12 others were put on leave due to suspicion. However, these data do not indicate a failure of the protocol, since it is not possible to define whether the contamination occurred at our hospital, at another facility, or in a non-hospital environment. In addition, due to the incubation period of the disease, there is a possibility that the contamination occurred before the implementation of the protocol.

Healthcare professionals are protagonists in this battle, and they are on the front lines, directly suffering the consequences of the pandemic. In addition to the constant risk of

**Table 5** Number of visits and surgeries before and after the implementation of the protocols

Sector	Period A		Period B		
	Total	Mean/day (minimum-maximum)	Total	Mean/day (minimum-maximum)	
Emergency room visits	1.136	81.1 (38-110)	294	21 (10-48)	
Outpatient visits	1.575	157.5 (81-209)	619	61.9 (30-123)	
Surgeries	Elective	74	5.3 (0-8)	21	1.5 (0-8)
	Urgent	32	2.3 (0-3)	15	1.1 (0-3)
	Total	106	7.6 (2-13)	36	2.6 (0-10)

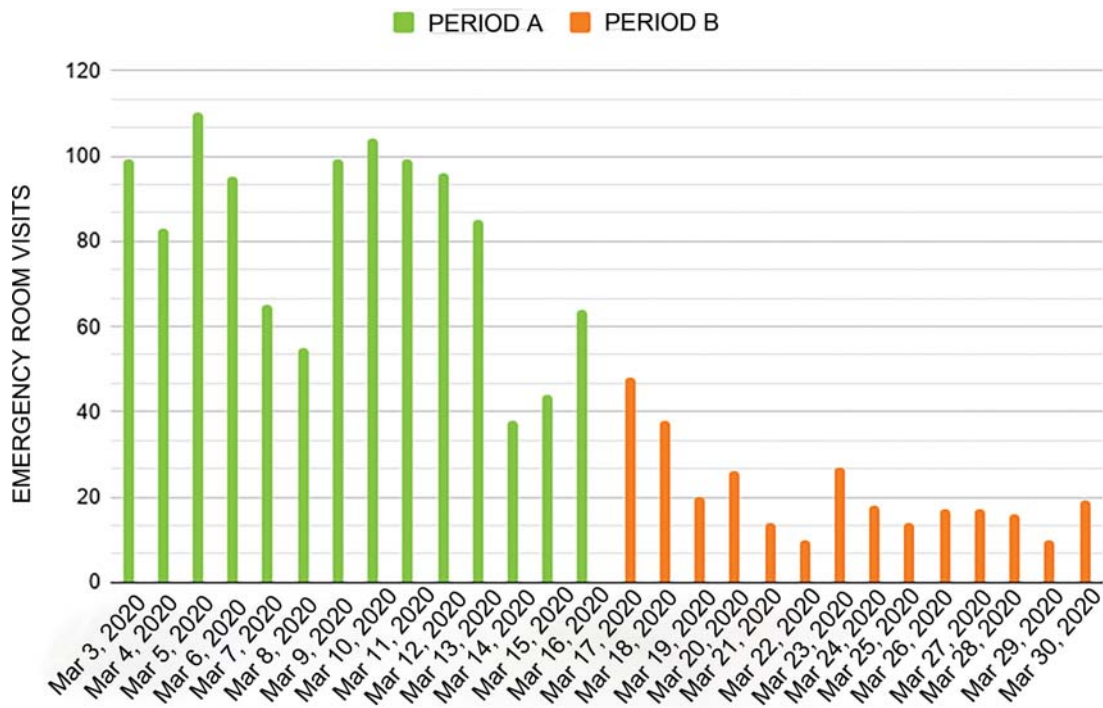


Fig. 1 Number of patients seen at the orthopedics emergency room of Hospital São Paulo during the two studied periods.

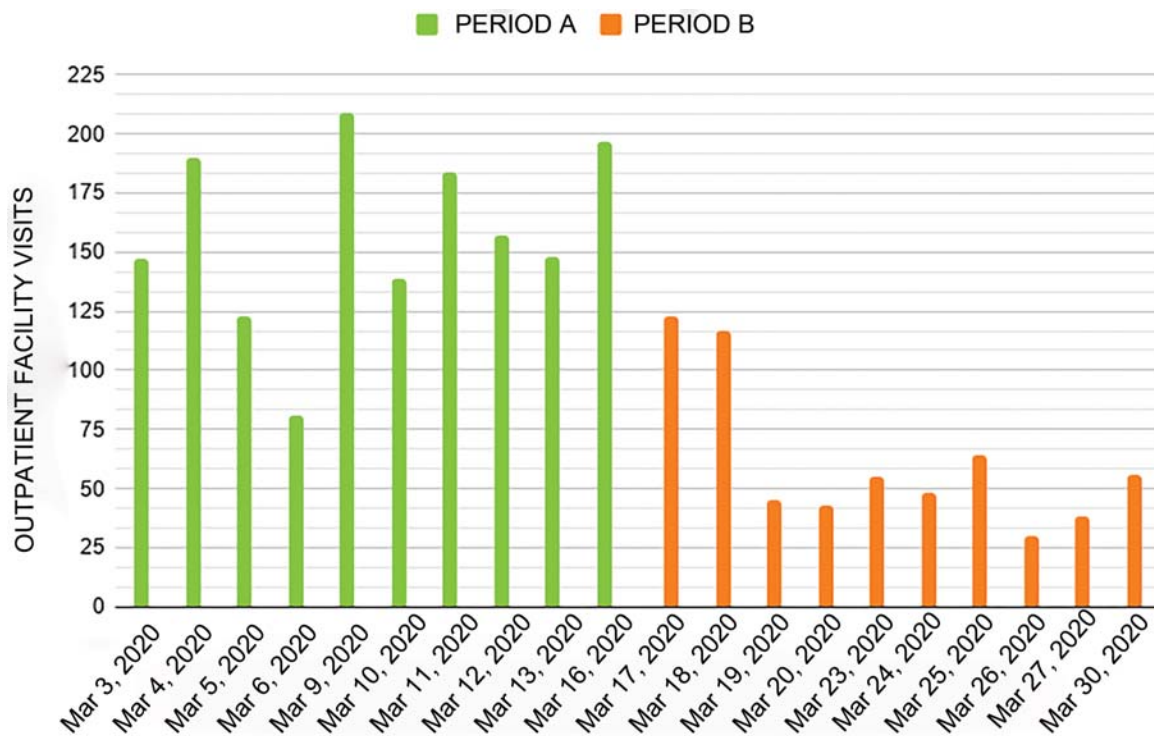


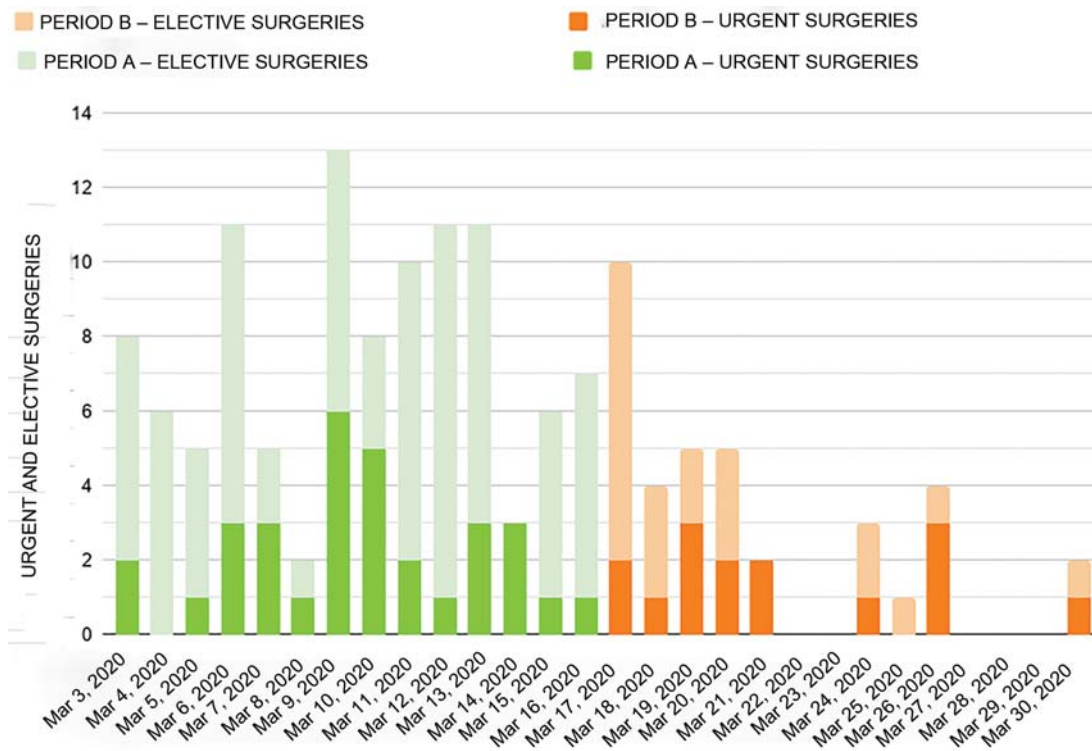
Fig. 2 Number of patients seen at the orthopedic outpatient facility of Hospital São Paulo during the two studied periods.

contamination and disease transmission to other people, healthcare workers are at a great mental stress that also needs to be addressed.<sup>12</sup>

A study performed with 24 COVID-19-infected orthopedists from the city of Wuhan, China, showed that 15 of them required hospitalization.<sup>13</sup> The same study indicated that the most likely place of disease transmission is the ward and that the main risk

factors for contamination included the non-use of an N95 mask, the lack of adequate PPE and inadequate hygiene measures. Thereafter, the COVID-19 CMC prioritized the distribution of N95 masks and other PPEs to all residents.

In Italy, 20% of healthcare professionals were infected and some perished. Medical reports describe physical and mental exhaustion, the dilemmas of a difficult screening process,



**Fig. 3** Number of elective and urgent surgeries at the orthopedics department of Hospital São Paulo during the two studied periods.

the pain of losing both patients and colleagues, and the risk of infection. “Unlike ventilators and ICU beds, healthcare professionals cannot be built urgently and cannot function 100% for long periods of time”.<sup>17</sup>

We believe that the rapid implementation of protocols before the peak of transmission and hospitalized patient numbers can be a determining factor for the preparation of the entire team, both from technical and emotional points of view, having greater efficiency than when applied and built in urgency during the worst crisis periods.

## Protocol 2

Even though only 18 EATs participated in the training given by the Infectious Disease discipline, the COVID-19 CMC provided articles, studies and online courses about COVID-19 to the rest of the team. Regardless of the surgical essence of Orthopedics, training departmental members is essential in order to face the pandemic. Other services are already summoning orthopedists and other specialized physicians to act on the front line against the pandemic, which reinforces the need for staff training.

The reorganization of the residents' shift was a strategy to adapt the service to the pandemic scenario without jeopardizing care, as demand in all hospital sectors was reduced. With two fewer residents per shift, but maintaining at least one resident from each year, the teaching structure and experience exchange is sustained, whereas the risk of contamination is decreased.

Our department has an extensive teaching program, and the adequacy of academic activities is challenging. Some meetings were canceled, but residency classes were carried out in their entirety. In addition, videoconferences from

classes and meetings with different OTD groups are being made available to everyone, enabling a greater interaction among team members and expanding learning opportunities. As for the tests, each discipline has a way of evaluating their residents, and three tests would be performed during the studied period. Two were carried out by videoconference, whereas the other, on general propedeutics, was canceled while the preceptorship analyzes the best way to apply it during the pandemic.

In general, the number of hours of practical activities decreased, but the syllabus of the theoretical classes was maintained, with the opportunity for additional classes. However, it is still too early to define whether these adjustments in the teaching method will have an impact on the learning experience of residents and specializing physicians.

## Protocol 3

Measures were implemented to reduce the number of elective orthopedic surgeries and, thus, minimize the in-hospital contact of patients without COVID-19 with suspected or confirmed cases. The reduction in surgical procedures was possibly influenced by the decreased demand generated by social isolation and the option for non-surgical treatment in borderline surgical/non-surgical cases.

In our service, elective procedures usually represent a considerable part of the total number of surgeries. ▶ **Table 5** and ▶ **Figure 3** show that, in period B, the total number of surgeries was reduced considerably, mainly due to the reduced number of elective procedures. Since elective surgeries at the day of the implementation of the protocols were not canceled, a high number of procedures were performed on March 17. However, the following days reflect protocol

implementation, with a significant decrease in the number of surgeries.

These actions allowed the redirection of hospital resources to more severe cases, and resulted in hospital beds being cleared at a higher speed, reducing the risk of viral spread in the ward and the relocation of suspected COVID-19 cases to isolated beds.

### Adaptation of other Specialties to the Pandemic

There are already in the literature some articles reporting the experience of other specialties during the pandemic, suggesting measures to adapt medical services to this scenario. Urologists and dermatologists are taking measures similar to ours, including suspending elective surgeries, decreasing patient flow in outpatient clinics and adequate use of the PPE.<sup>18–20</sup> Anesthesiologists are adapting their procedures and equipment to assist patients with COVID-19, and they are also suggesting new routines for surgical centers.<sup>14–16</sup> We hope that our report and suggestions for intervention measures will help other Orthopedics services and encourage other specialties to share their experiences and develop new protocols to fight this pandemic.

### Study Limitations

The present study comparatively analyzed a short time between the protocol implementation and the pre-pandemic period. Thus, it is not yet possible to know the long-term impacts of such measures, and further studies are required.

The department's activities do not occur only in the hospital presented in this study. The department has a multi-center operation in several facilities, and its central coordination is at the studied hospital. The experience and knowledge generated at the reference hospital were partly expanded to affiliated facilities, but the impact of these changes in such locations was not assessed in the present study.

### Conclusions

The present study demonstrated the feasibility and efficiency of the rapid implementation of intervention protocols in the midst of the COVID-19 pandemic. Adapting the department's activities, the protocols reduced the risk of infection for patients and healthcare professionals. Their application kept the assistance, academic and scientific activities functioning, despite the prioritization of anti-COVID-19 measures.

#### Conflict of Interests

The authors have no conflict of interests to declare.

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