

GENERAL ORTHOPAEDICS

DEFCON 5: The Chris Hani Baragwanath Academic Hospital orthopaedic department's COVID-19 proactive action plan

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Abstract

Background: On 11 March 2020 the World Health Organization (WHO) declared COVID-19 a worldwide pandemic and a threat to global public health. In this paper we aim to describe the measures implemented to combat the COVID-19 pandemic in the Department of Orthopaedic Surgery at Chris Hani Baragwanath Academic Hospital (CHBAH), Soweto, Johannesburg, the largest hospital in Africa with approximately 3 200 beds and about 6 760 staff members. At the time of writing this report, we have transitioned from level 5 to level 3 lockdown.

Methods: We performed a literature review and drew on the experiences of previous pandemic response plans worldwide. A working group comprising all relevant disciplines was created to develop standard operating procedures in line with governmental policy.

Results: We found that by developing a multi-phase plan, we were able to maintain service delivery to all emergent patients while protecting medical staff and patients alike. This plan also allowed coordination with other disciplines and made provision for staff from within the Department of Orthopaedic Surgery to be made available to work within other departments as and when required. The implementation of this plan had to evolve constantly, adjusting to the changes in the national lockdown level and the demands of the developing situation.

Conclusion: We hope that by sharing our plan with our colleagues domestically and abroad, we can promote discussion and improve our ability to better prepare and deal with this unprecedented healthcare scenario. In order for us to win as individuals, we must fight as a team.

Level of evidence: Level 5

Keywords: COVID-19, orthopaedics, plan, response, Baragwanath

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Introduction

In this paper we aim to describe the measures implemented to combat the COVID-19 pandemic in the Department of Orthopaedic Surgery at Chris Hani Baragwanath Academic Hospital (CHBAH), Soweto, Johannesburg. With the growing threat of this global pandemic, the authors would like to provide a transparent action plan that can be discussed, criticised, partially/wholly implemented and, most importantly, promote safety among all parties while allowing optimal service delivery to our patient population. We used the term DEFCON which is the **defense readiness condition** – a state of alertness used by the United States armed forces. There are five levels. Level 5 is lowest state of readiness and implies that there may be necessary preparations for war.¹

It is essential that, despite this growing invisible threat, patient care is not compromised, including those patients who may not be COVID-19 afflicted. This principle was a driving force for the development of a comprehensive standard operating procedure (SOP) that would allow for the emergent treatment of both COVID-19 positive and COVID-19 negative orthopaedic patients (Figure 1). The SOP is structured such that we would be able to provide staff members to assist in other departments that may be overrun with medical patients and require additional human resources in response to the expected overwhelming patient influx² while still preserving staff to provide optimal patient care for those patients requiring orthopaedic management.

During these exceptional times, it is imperative to consider the possibility that surgical facilities become hampered by staff sickness, reduced supply of surgical materials, and the use of operating rooms (ORs), facilities, and even anaesthesiologists for improvised intensive care unit (ICU) ‘pods’ for patients with COVID-19.^{3,4}

Background

COVID-19 (**CO**rona **VI**rus **D**isease 2019) is the disease caused by the SARS-CoV-2 virus, which belongs to the coronaviridae family.⁵ On 11 March 2020 the World Health Organization (WHO) declared COVID-19 a worldwide pandemic and a threat to global public health.⁶

The Chris Hani Baragwanath Academic Hospital (CHBAH) is the largest hospital in Africa (and third largest hospital in the world), occupying around 173 acres (0.70 km²), with approximately 3 200 beds and about 6 760 staff members.⁷

The Department of Orthopaedic Surgery at CHBAH sees an average of 246.8 patients per day (five days a week) in the outpatient department (OPD), admitting 5.6 patients per day (Table I). The 2019 orthopaedic OPD monthly average was 1 353 patients consulted. There is an additional daily average of 45 emergent patient consultations (Table II) in orthopaedic intake (OPIT) via the accident and emergency (A&E) unit with 15 average admissions daily (seven days per week).

Table I: Column chart comparing the 2014–2019 orthopaedic OPD total patient volume

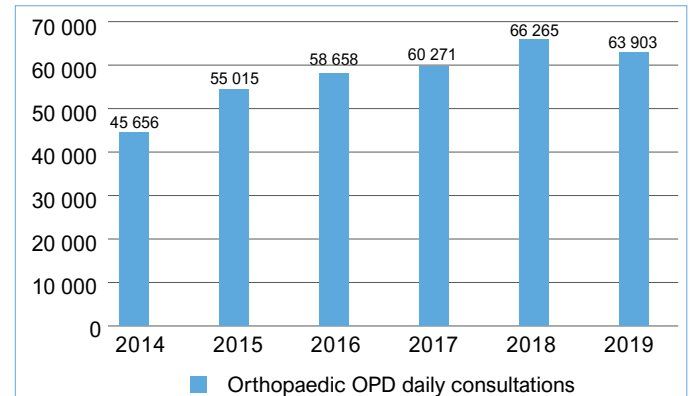


Table II: Column chart comparing the 2015–2019 orthopaedic OPIT total patient volume

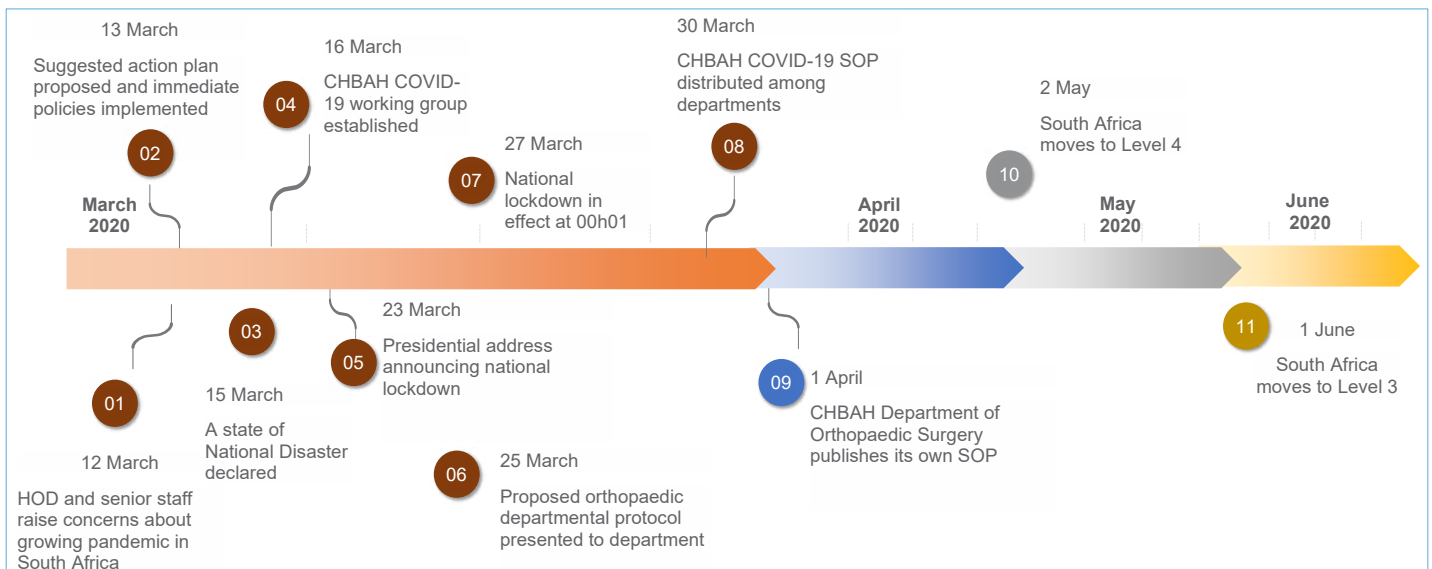
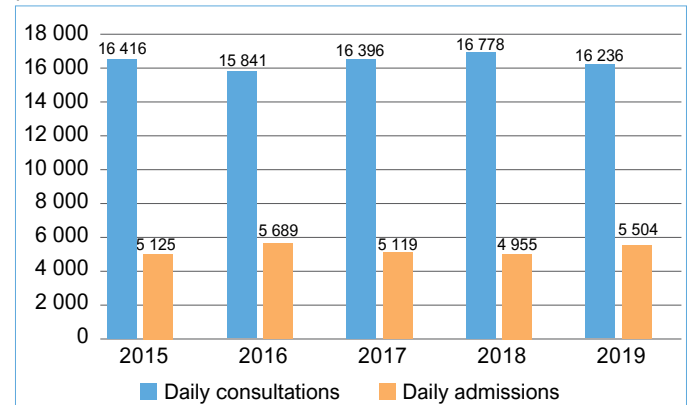


Figure 1. Timeline of relevant events in the development and implementation of CHBAH Department of Orthopaedic Surgery COVID-19 response standard operating procedure (SOP)

Table III: Description, bed allocation and ward number of orthopaedic surgery beds at CHBAH

Ward	Patient category	Total no. of beds
9	Male septic	40
11	Male trauma/hands	43
12	Female trauma/hands Female septic	38
47	Elective cases (male)	24
48	Elective cases (female)	24
49	Paediatric trauma/hands Paediatric septic	28
50	Paediatric elective cases (including spine)	28
Total		225

Table IV: CHBAH Department of Orthopaedic Surgery staff contingent and risk stratification

	Total	High risk	Low risk
Consultants	23	9	14
Registrars	22	1	22
Medical officers	7	0	7
Interns	16	1	15
Total	68	11	58

The 2019 monthly orthopaedic OPD and OPIT average was 5 325 and 1 353 patients, respectively. Given that public gatherings and close-quarter contact increases the spread of the SARS-CoV-2 virus,⁸ it was imperative for us to implement an urgent strategy to reduce these numbers, thereby protecting our patient population and staff contingent.

The Department of Orthopaedic Surgery at CHBAH has 225

beds (96–112% average daily occupancy with patients also allocated to outlying wards) available among seven dedicated orthopaedic wards (*Table III*). At the time of this action plan, there were 68 members of the doctor staff, of which 53 are considered permanent staff (*Table IV*).

Measures

Staffing considerations

We developed an unvalidated scoring system (*Table V*) that allowed us to categorise staff into low, increased, moderate and high risk (*Table IV*) based on articles by Yang *et al.*⁹ and Guan *et al.*,¹⁰ the CHBAH SOP and the Centers for Disease Control and Prevention (CDC) published guidelines.¹¹ All increased and moderate risk personnel would be classified as low risk in the initial phases of the department SOP. Once the admitted population of COVID-19 positive patients is >10% and >20%, the increased and moderate risk personnel, respectively, would fall under the high-risk category.

Table V: Scoring system for human resource risk stratification in the Department of Orthopaedic Surgery at CHBAH

CHBAH orthopaedic staff COVID-19 risk stratification score	
Risk factor	Score
Age >50 years	1
Living in a nursing home or long-term care facility	1
Chronic lung disease	1
Moderate to severe asthma	1
Immune-compromised state: Chemotherapy, smoker, bone-marrow/organ transplant recipient, immune deficiencies, poorly controlled HIV, AIDS, prolonged use of corticosteroids or other immune-weakening medications	1
Severe obesity: BMI=40 or higher	1
People with type 1 or 2 diabetes	1
People with chronic kidney disease	1
People with liver disease	1

Scoring: 0: low risk; 1: increased risk; 2: moderate risk; 3 or greater: high risk

Table VI: Table showing the comparison of daily consultations/admissions between orthopaedic OPD and OPIT from the 2019 average and the current national lockdown average

	2019 average	2020 level 5 lockdown daily average (27/03/2020 to 01/05/2020)	2020 level 4 lockdown daily average (02/05/2020 to 30/05/2020)	2020 level 3 lockdown daily average (01/06/2020 to 10/06/2020)
Daily orthopaedic OPD consultations	246.8	112.7	135.4	124.6
Daily orthopaedic OPD admissions	5.6	0.3	0.65	2.1
Daily orthopaedic OPIT consultations	45	19.7	24.6	35.9
Daily orthopaedic OPIT admissions	15	6.8	9.9	13

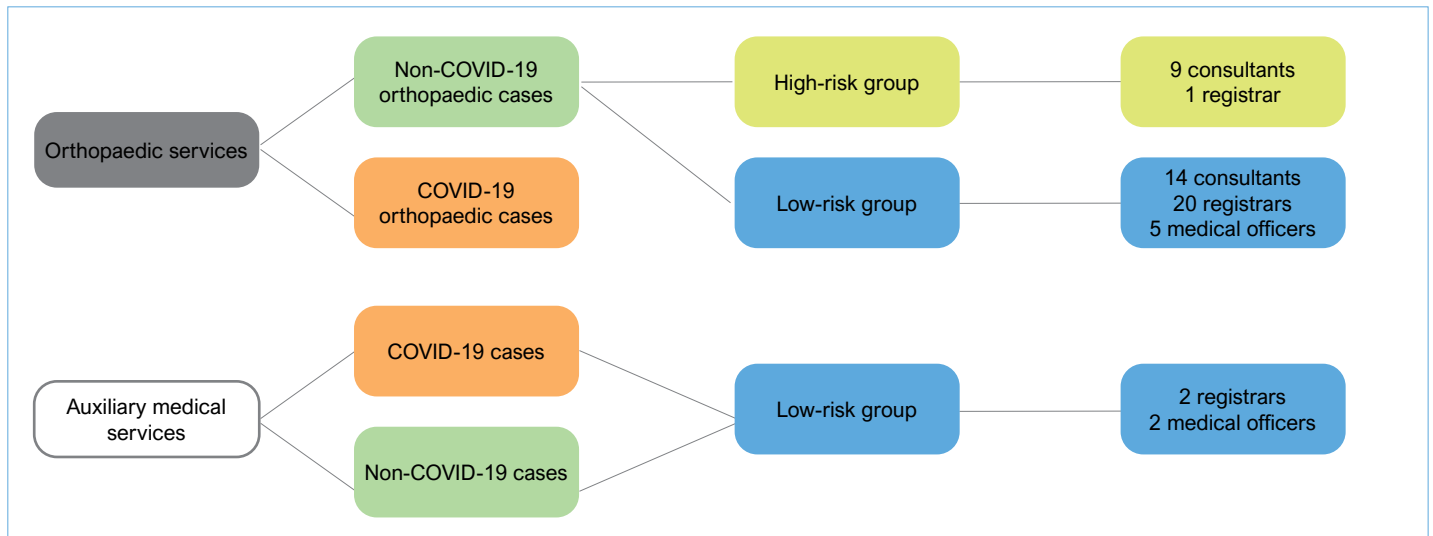


Figure 2. Organogram of staff allocation to the COVID-19 auxiliary medical services, COVID-19 orthopaedic services and the non-COVID-19 workstreams

Internationally, orthopaedic surgeons have already been infected by COVID-19 in the workplace.¹² The goal of this risk stratification system was to protect staff members considered to be at higher risk of severe disease while maintaining staff numbers for as long as possible.

Workstreams

Workstreams were broadly divided into 'non-COVID-19' and 'COVID-19' (Figure 2). The concept of splitting the workstreams was to both protect the high-risk staffing contingent from exposure to COVID-19 positive patients as well as to maintain service delivery to all orthopaedic emergency patients. This system of workstream allocation would also provide a team to care for COVID-19 positive orthopaedic emergency cases as the number of infected patients grows domestically.

- Workstreams are divided into COVID-19 and non-COVID-19:
 - COVID-19 workstreams were further divided into:
 - a. COVID-19 auxiliary medical support for non-orthopaedic COVID-19 patients admitted under internal medicine (to bolster the work force and provide operational support to the potentially hardest hit departments)
 - b. COVID-19 suspected/confirmed patients requiring orthopaedic care
 - Non-COVID-19 workstreams (routine orthopaedic patients)

The allocation of staff to the auxiliary medical support workstream as well as the separation of non-COVID-19 and COVID-19 orthopaedic workstreams was set to occur in an incremental fashion according to a phased response depending on the need. The secondary objective was to also try allocating expertise accordingly to optimise care provided in the relevant group. This dynamic construct was assessed on a daily basis by the CHBAH COVID-19 working group and the phases published in the CHBAH SOP. The interns rotating through orthopaedic surgery at the time were allocated to non-COVID-19 workstreams based on their temporary presence within in the department and subsequent rotation to other healthcare facilities. We felt it would not be wise to expose them thereby not only risking their well-being but also possibly increasing risk of transmission to the subsequent healthcare institutions.

The preservation of a designated COVID-19 orthopaedic workstream was based on contingency measures in the event we experience civil unrest during this period which would allow us to effectively deploy staff to address the potential influx of orthopaedic trauma.

A decision was taken to maintain consultant orthopaedic surgeons within the department at all times. This was to ensure maximum service delivery and maintain leadership within the respective units as the situation unfolds and the health system becomes more constrained. Medical officers and junior registrars (who had volunteered) were initially identified as better candidates for the auxiliary medical services workstream given the more recent rotation through intensive care units (ICU) and current ventilation practices thereby also preserving the low-risk groups of surgically proficient registrars and consultants for management of the COVID-19 afflicted orthopaedic patients.

Theatre

All non-urgent elective cases were postponed in keeping with the published national directive on 22 March 2020. From this date onwards, elective lists would be populated with semi-urgent elective cases involving trauma/sepsis/malignancy or patients booked on the emergency clean or septic lists respectively. All surgeons were advised to be hypervigilant at all times in theatre, especially with regard to using appropriate PPE¹³ when indicated and to be aware of airway-related risks regarding intubation/extubation and the potential of aerosolisation of the virus.¹⁴

As per the CHBAH SOP, two theatres were identified as COVID-19 specific theatres to be used for both elective and emergent surgeries across all disciplines in the event of a highly suspicious or confirmed COVID-19 positive patient. These theatres would either be cleaned with a medical fogging machine or a LightStrike™ Germ-Zapping™ Robot between cases, and preventive measures were implemented as per the CHBAH SOP. The use of additional theatres would be available once the numbers necessitate the change.

Training by the Infection Prevention and Control (IPC) Unit, Infectious Diseases (ID) Unit as well as the Department of Anaesthesia in donning and doffing procedures and safe intubation technique (for absolute emergencies and where the dedicated COVID-19 airway team was not available) was available to all Department of Orthopaedic Surgery personnel on a daily basis.

Initially, our SOP stated that once a member of the orthopaedic department operates on a known COVID-19 positive patient, they would become part of the COVID-19 orthopaedic workstream. They would then remain on the workstream for the remainder of the COVID-19 protocol, or if they complete a two-week period where they have no contact with any COVID-19 patients and need to be

moved onto the non-COVID-19 workstream. Staff members from the two workstreams would not be permitted to work together or in the same environment at the same time. This was unfortunately limited by the lack of availability of tests for all patients requiring surgery resulting in a number of low-risk 'unknown' exposures to asymptomatic COVID-19 positive patients. The doctors exposed to these patients would then continue to work in their workstream because at the time of writing this, our COVID-19 positive orthopaedic patient population is still relatively low and a dedicated COVID-19 workstream has not been implemented.

Outpatient department

The average number of patients seen at the orthopaedic OPD at CHBAH in 2019 was 246.8 patients per day across all units with an average of 5.6 admissions from OPD daily. Given the estimate of a similar volume of patients daily as per the trend in *Table I* since 2014, the department needed to aggressively implement a system to debulk the OPD. During level 5 lockdown, the daily orthopaedic OPD average dropped to 112.7 patients per day (with 0.3 admissions per day) with a steady increase in both patients seen and admitted as the lockdown level changed to level 4 and 3 respectively (*Table VI*). The higher number of patients in lockdown level 4 may be attributable to the backlog during level 5 lockdown and the associated difficulties in terms of public and private transport.

On arrival at the hospital, all OPD patients across all disciplines should be directed to be screened for COVID-19 (by means of a questionnaire and basic vitals if indicated) at any one of the three large screening marquees being managed by the Department of Medicine and the Department of Emergency Medicine. Only low-risk patients would be allowed to proceed to the orthopaedic OPD, while moderate- or high-risk patients would undergo further screening and/or testing under the CHBAH SOP. The triage nursing staff in OPD then complete another COVID-19 screening questionnaire to ensure patients are redirected appropriately as mentioned above, or if COVID-19 is not suspected, patients would be advised by clinic staff and signage to drop off their OPD cards/files at the OPD for internal orthopaedic screening.

While cards/files are screened, patients are advised to wait in the corridor outside the OPD or in the erected marquee for the orthopaedic OPD in which all chairs are at least one metre apart and many signs regarding social distancing are posted in multiple languages.

Cards/files are triaged into patients who could be provided with a follow-up date without having to be seen (elective patients arriving for admission, patients arriving for cold case follow-up or patients seeking prescription renewal for chronic medications) and patients who need to be seen (blood/tissue results, wound reviews, control X-rays and physical examination reviews). In the event that patients need to be reviewed in the OPD, only ten patients are allowed into the OPD at a given time, only one patient is allowed in a consultation room with one doctor at a time, all patients are asked to sit at least one metre apart and strict hand sanitisation is required before entering and exiting the OPD.

With the increasing numbers seen during level 3 lockdown, a decision to adapt the SOP was taken and all the staff of a specific unit whose clinic was running on the given day were asked to attend the clinic.

Orthopaedic intake (OPIT) via the Accident and Emergency Department (A&E)

The average number of patients seen at orthopaedic OPIT at CHBAH in 2019 was 45 patients per day with an average of 15

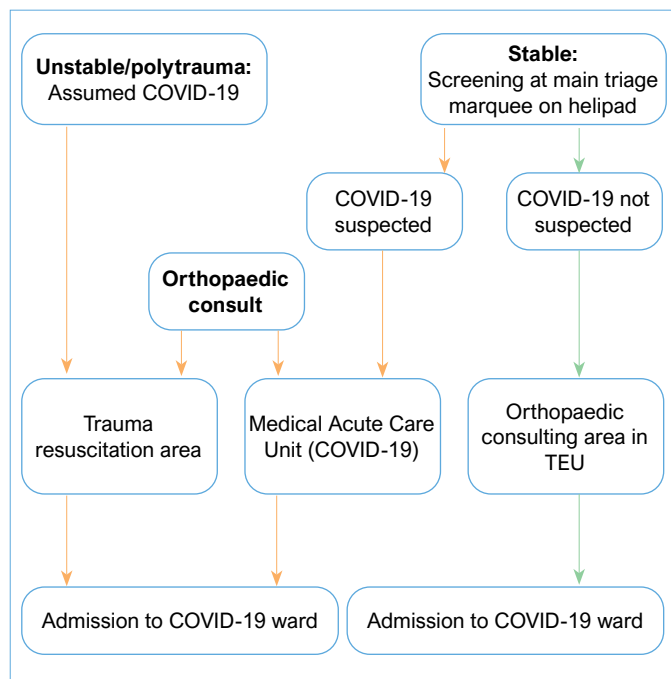


Figure 3. Patient assessment and admission organogram

admissions from OPIT daily. During level 5 lockdown, the daily orthopaedic OPIT average dropped to 19.7 patients per day (with 6.8 admissions per day) with a steady increase in both patients seen and admitted as the lockdown level changed to levels 4 and 3 respectively (*Table VI*).

The physical location of where our staff members would review patients was moved to allow for the development of a suspected COVID-19 positive holding area in the Medical Acute Care Unit (MACU). The new area is within the Trauma Emergency Unit (TEU) allowing close proximity to the most common referral source.

Any patient, including polytrauma patients who were not screened would be suspected as COVID-19 positive until proven otherwise. Any confirmed or suspected COVID-19 positive patient would be initially treated with isolation procedures and adequate PPE worn in the TEU resuscitation area or the MACU if they were stable enough from an orthopaedic/trauma perspective. All suspected cases would be tested and if found to be positive, admitted to a COVID-19 dedicated ward where ongoing orthopaedic and medical care would be administered (please see organogram in *Figure 3*).

In-patient management

All personnel are to implement social distancing, improved hand sanitisation and vigilance in terms of appropriate PPE use as and when required. Clerking of patients is to be done with a one-metre distance for history-taking. Where possible, a single physical examination is undertaken to reduce patient–doctor contact. All pens, surfaces such as desks/tables are to be regularly cleaned with appropriate cleaning products to reduce fomite contact.

Any resuscitation of a patient with respiratory symptoms, pyrexia or any COVID-19 suspicious symptomology necessitates contacting the anaesthetic COVID-19 airway response team and alerting the infectious diseases team on call as per the CHBAH SOP. In the initial phases, all orthopaedic COVID-19 positive patients would be admitted to one of the COVID-19 designated medical wards. As the number of COVID-19 positive patients increased, the plan to differentiate medical and surgical designated wards would be implemented.

Table VII: Departmental restructuring in a phased response system

Phase	Criteria	Implication
Phase 1	Declaration of national disaster	<ul style="list-style-type: none"> All morning handover meetings, academic and group meetings suspended All non-urgent elective cases cancelled OPDs triaged and numbers limited Wards filled to half capacity
Phase 2	Admission of confirmed case to CHBAH	<ul style="list-style-type: none"> Limited on-site staff complement per unit (one registrar and one consultant on site per unit) Afterhours shift system (12-hour shifts vs the previous 24-hour call system) One auxiliary member deployed to COVID-19 workstream
Phase 3	Suspected orthopaedic COVID-19 case CHBAH COVID-19 case prevalence >25%	<ul style="list-style-type: none"> Unit re-organisation into damage-control firms Internal workstreams allocated to firms COVID-19 orthopaedic workstream activated Afterhours shift system (8-hour shifts)
Phase 4	Confirmed COVID-19 orthopaedic staff CHBAH COVID-19 case prevalence >75%	<ul style="list-style-type: none"> Staff and firm treatment and quarantine according to NICD HCW guidelines Limited orthopaedic theatre – emergent cases only OPD shutdown

NICD: National Institute for Communicable Diseases; HCW: healthcare worker

To date, with the increasing number of COVID-19 positive patients, the initial number of dedicated COVID-19 wards have been inundated. This has resulted in one of the orthopaedic department wards being taken over by internal medicine as more wards are required to manage COVID-19 admissions. This has placed strain on the ability to create in-patient social distancing (by having one to two metres between patients' beds) despite the department's best efforts.

Departmental restructuring

We developed a phased system to restructure the Department of Orthopaedic Surgery in response to the demands and challenges of this unprecedented dynamic situation. The goals of this system are to protect healthcare workers and mitigate the risk of transmission as far as possible (*Table VII*).

Discussion

As the number of cases continues to rise rapidly across the world, there is growing concern that healthcare systems will quickly become saturated and unable to adequately respond to the outbreak.¹⁵ While our fellow South Africans are mostly being instructed to stay home, we as medical practitioners have a professional and moral duty as essential services workers to do the opposite.

When this SOP was drawn up, we were in the most stringent form of lockdown (level 5). This allowed us time to develop an SOP based largely on international experiences and data. The SOP remained unchanged until the last week of level 4 lockdown where we made a decision that we would have to make changes in anticipation of the level 3 lockdown (*Figure 1*). We identified the trend of increasing emergency admissions and established that the on-call team would have to revert to phase 1 implementation (two registrars and two interns on site for 24 hours at a time) in order to provide adequate service delivery to the increasing number of patients. From 1 June 2020, phase 1 was implemented for OPIT management (*Table VII*).

Presently, the infection rate continues to climb with new national record highs being reported almost daily. Despite being in the midst of battle, we hope to be able to adapt our SOP to the evolving challenges we face on a daily basis. The goal of sharing this SOP is to allow it to be evaluated, criticised, developed and hopefully improved with the sole objective of protecting service delivery to our patients and saving more lives.

The effects on orthopaedic surgery departments are predominantly indirect, with widespread cessation of all non-essential orthopaedic care. While this is vital to system-sustaining measures of isolation and resource re-allocation, there is profound detriment to orthopaedic training programmes and a risk to maintaining service delivery.¹⁶ We promote online learning platforms and other means to provide ongoing academic programmes during this unprecedented situation. We advocate that every hospital should create a contingency plan and develop SOPs suited to their requirements and conditions.¹⁷ Orthopaedic surgeons are at risk and have to become increasingly vigilant and take more precautions to avoid infection with the SARS-CoV-2 virus.¹²

We took advantage of the level 5 nationwide lockdown as an opportunity to devise and implement a battle plan to face this invisible enemy. We have had to make changes to the implementation of our SOP based on the increasing patient volumes in both the orthopaedic OPD and OPIT. Challenges along the way have included the shortage of COVID-19 tests, PPE shortages, delays or decreased access to theatre/wards due to decontamination procedures following confirmed exposure to a COVID-19 patient, indirect staff shortages (increased absenteeism in other departments that directly affect orthopaedic surgery) and direct staff shortages (increased absenteeism within the orthopaedic department).

Conclusion

We hope that by sharing our plan with our colleagues domestically and abroad, we can promote discussion and improve our ability to better prepare and deal with this unprecedented healthcare scenario. Victory loves preparation. In order for us to win as individuals, we must fight as a team.

Ethics statement

The authors declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Prior to commencement of the study ethical approval was obtained from the following ethical review board: Wits HREC (Medical) Clearance M170415.

Declaration

The authors declare authorship of this article and that they have followed sound scientific research practice. This research is original and does not transgress plagiarism policies.

Author contributions

AH contributed to the conceptualisation, methodology, original manuscript preparation and revision of the study.

TP contributed to the conceptualisation and original manuscript of the study.

KF contributed to the conceptualisation and original manuscript of the study.

MR contributed to the conceptualisation and supervised the study.


CF contributed to the conceptualisation, manuscript revision and supervised the study.


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