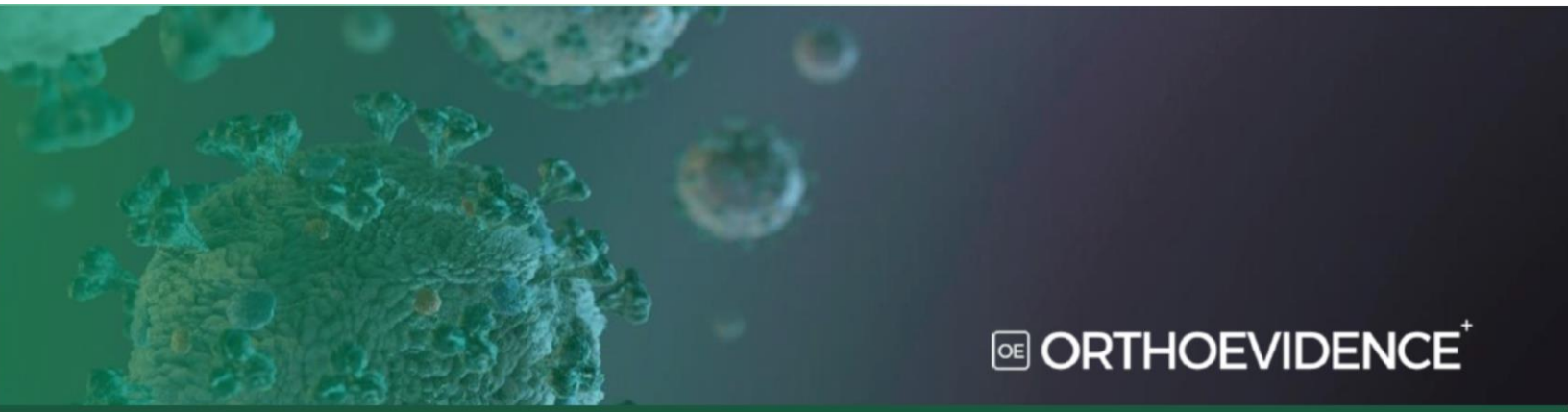

Best Practices for Surgeons

COVID-19 Evidence-Based Scoping Review

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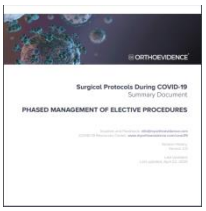
Key Clinical Topic Summaries



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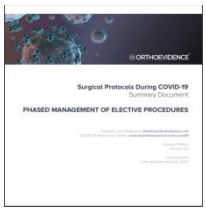

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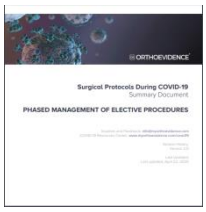

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INTRODUCTION

Version 3.0 New Evidence and Insights

Rapidly evolving pandemics require recommendations that are responsive to fast-changing disease treads and health care system challenges. Version 1.0 of this document was published April 12, 2020, and version 2.0 of this document followed shortly after on April 22, 2020. This latest update (version 3.0) comes as a large-scale response to the multitude of rapidly emerging guidelines and recommendations for surgical practices throughout the pandemic and recovery periods.

What's New In Version 3.0

A total of **150 publications**, with **67 newly added documents** to version 2.0. These continue to inform and shape previous versions by providing guidelines and recommendations from a total of 18 countries on multiple aspects of surgical practice. The compositions of recommendation development bodies (associations, institutions, or public health entities), and approaches (expert opinion, evidence-based, or both) remain similar but now include contributions from over 600 experts. Moreover, we have incorporated best practices from multiple recent publications focusing on the safe reopening of surgical care, including recently released recommendations from the International Consensus Group and Research Committee of the American Association of Hip and Knee Surgeons (AAHKS) and multiple additional health authorities.

Phased Re-introduction of Non-urgent Surgery: *refining the way forward*

Key updates continue to overwhelmingly focus on the increasing need for guidance on the phased resumption of "elective" procedures introduced in Version 2.0. As many countries have reached and moved beyond initial peaks of pandemic severity, the best approach to the reintroduction of non-urgent surgical activity has been central to the discussion for policy makers, providers and patients. To ensure that the impact of delay is adequately understood, the restorative nature of orthopaedic procedures must be communicated. Language has shifted away from the term "elective", as the majority of orthopaedic procedures are associated with necessity relative to the widespread negative functional implications of MSK injuries and conditions. The goal of orthopaedic surgical management is to *restore* function and mobility and return patients to important activities including employment, care-giving and fundamental functions of daily living (i.e. walking, reaching, lifting). In this respect, orthopaedic procedures are best categorized by overall urgency and impact on function. Priority should continue to be placed on urgent and emergent procedures, followed by semi-urgent and non-urgent procedures based on the time-dependent nature of negative functional implications of delay.

With respect to procedural steps, multiple stakeholders continue to tentatively describe a path along easing surgical restrictions in response to decreasing pandemic burden, including: governments, health systems, hospitals and associations. The AAHKS provides one of the most in depth set of consensus recommendations (full details here: **CLICK HERE**), however an overall lack of clear evidence based direction continues to exist. Ongoing global uncertainty and fears of secondary waves require that recommendations be based on underlying COVID-19 risks and threats to fragile patients and supply chains. As non-urgent surgery is reintroduced and expanded, a balance must be struck between demand and risk mitigation to protect patients, contain pandemic spread and maintain health-system capacity. Version 3.0 provides an updated summary of strategies for care to protect constrained resources, including recommendations for care pathways, risk stratification and the optimal use and reuse of PPE. Fundamental to moving forward is the successful screening and detection of COVID-19 positive patients. Previous guidelines have shifted away from the use of chest CT as a screening tool and promote COVID-19 PCR of deep nasopharyngeal swab as the most reliable. However, issues with sample collection and delays in test processing have driven the fast-paced development and introduction of additional screening tools. Rapid RT-PCR tests have become more widely available and their diagnostic properties have improved. This, in addition to quick turn-around time for test results has led to rapid RT-PCR tests becoming the diagnostic and screening tool of choice for many patients and healthcare personnel. Many updated resources support the routine screening of surgical staff, using either RT-PCR or antibody testing as re-opening protocols emerge.

These and other new considerations are reviewed and implemented in *Best Practices Version 3.0,* as we collectively acknowledge that risk and resource will continue to shape surgical decision making, and the way forward is to ***PREPARE NOW.***

PART 1: BEST PRACTICES
OBJECTIVES, METHODS AND KEY FINDINGS

THE PROBLEM

In the midst of the rapidly unfolding COVID-19 pandemic[1], public initiatives and solutions need to be continuously identified and implemented on a large scale. There remains an urgent need for protocols to guide clinical decision-making in settings around the world focused on keeping the burden of a pandemic illness within the capacities of health-systems, and limiting the impact of secondary pandemic waves[2]. However, the haste to disseminate information threatens the overall quality of recommendations, limiting confidence in their potential impact. Ideally, surgeons are enabled to make clinical decisions based on the best available evidence, local resource availability and patient values, all of which may be quite dynamic as the coronavirus pandemic continues to evolve (Figure 1).

Figure 1. Impact of the COVID-19 pandemic on evidence-based decision making.

THE APPROACH

To help navigate this challenge, we examine and continue to update recommendations relevant to orthopaedic management during the COVID-19 pandemic. Through critical-review, we aim to put forth evidence-based principles to guide musculoskeletal (MSK) care decision making in the face of acute resource scarcity and substantial opportunity costs to health-systems. We provide updated peer-reviewed recommendations from our ongoing systematic mapping review of the published information, intended to guide key areas of orthopaedic management during the COVID-19 pandemic, and its wake.

THE SEARCH

We considered a wide spectrum of evidence sources: peer-reviewed articles identified through a systematic search of MEDLINE, EMBASE, Global Health and Emcare, major public health entities (WHO, US CDC, European entities, regional health authorities), websites of the major surgical and orthopaedic societies/associations (AAOS, COA, and BOA), and documents available from major academic and non-academic health care institutions (Figure 2).

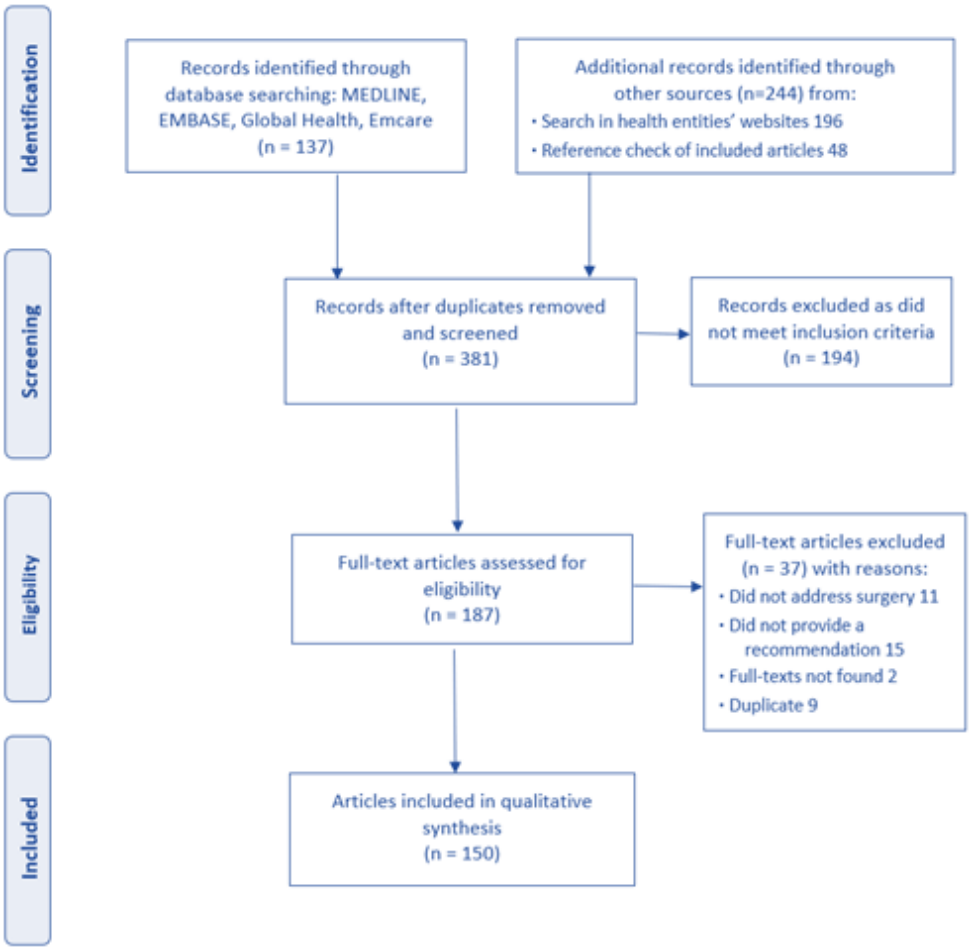


Figure 2. Eligibility assessment PRISMA flow diagram.

We identified 150 eligible publications that reported on recommendations for orthopaedic surgeons during the COVID-19 pandemic (Figure 1). Publication/Pre-publication dates ranged from February 29 to June 1, 2020 (search conducted May 25, 2020). One hundred and thirty-nine publications were from 18 countries (USA, N=72; Australia, Canada, N=12; United Kingdom, China, N=8; Singapore, N=5; Spain, Italy, N=4; India, N=3; Iran, Malaysia, N=2; The Netherlands, Chile, Portugal, Mexico, Brazil, Turkey, Germany, N=1, Figure 3). Eleven publications were collaborations from multiple countries. The publication lag (from date of first COVID-19 case recorded in the region[3] to date of recommendation publication) varied from 31 days (Brazil) to 87 days (China). We found reference to earlier departmental protocols in China, however, these were not available online.

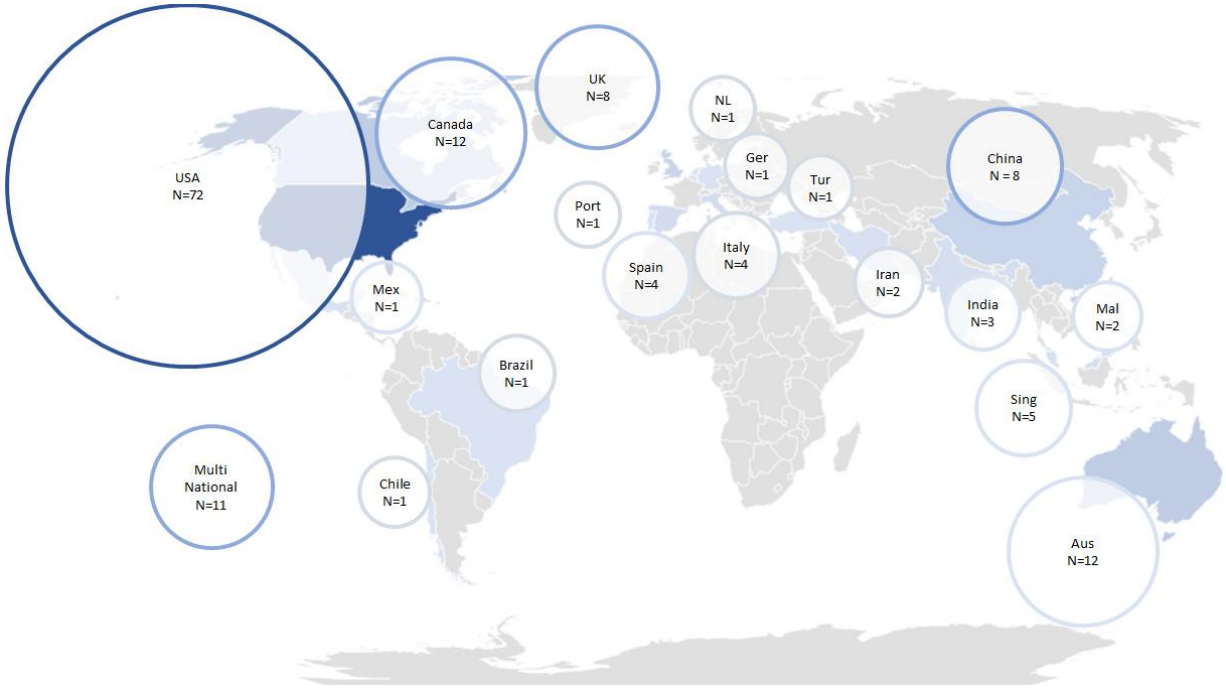


Figure 3. Country of origin for included guidelines and protocols

THE EVIDENCE BASE

Of the 150 publications, 43 (28.7%) were developed by surgical or orthopaedic societies/associations, 64 (42.6%) were developed by academic health care institutions/hospitals, and 43 (28.7%) were developed by international /national/ local public health entities. In 41 publications, the authors within the working groups were not reported. One hundred and nine publications (72.7%) provided contributor lists, which consisted of 625 clinical experts or researchers in total.

Of the 150 publications, 94 (62.7%) were developed based on expert opinion and/or clinical experience, 17 (11.3%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 39 (26.0%) were developed based on a combination of both evidence-based methods and expert opinion (Figure 4).

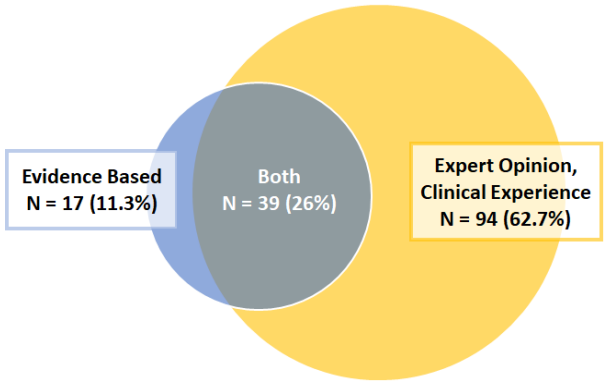


Figure. 4 Method of recommendation development for included guidelines and protocols

THE TOOLS

We assessed the strength and quality of each recommendation using the GRADE (Grading of Recommendations, Assessment, Development and Evaluation)[4] approach. There are four possible categories for strength of recommendation evidence: 1) strong recommendation for; 2) weak recommendation for; 3) weak recommendation against; and 4) strong recommendation against. Figure 5 illustrates the GRADE strength categories and outlines the clinical application of recommendations based on level of strength.

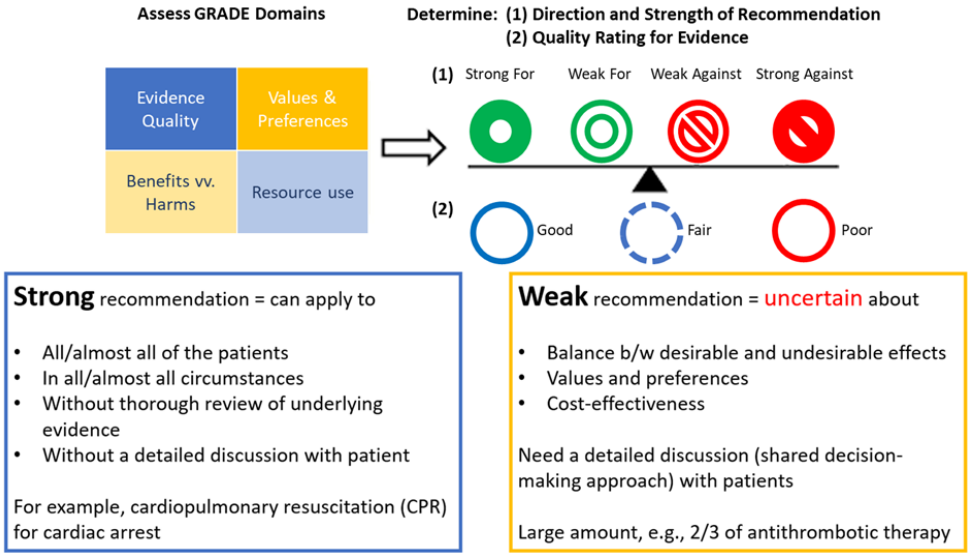


Figure 5. Illustration of strength and quality assessments for individual recommendations.

Using the GRADE approach to evidence quality assessment, we assessed the evidence to be overall of fair quality and strong for the recommendations made (Table 1). We summarized our main quality findings below, and present them along with strength for the main key recommendations made throughout this review.

Table 1. Rating of Recommendations:
Overall

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

THE TRADE-OFFS - BENEFITS AND HARMS

Large scale policy measures such as travel restrictions, self-quarantine and curfews have disrupted nearly every aspect of society and have upheaved economies around the world. However, these life altering changes appear to have had the desired impact. The measures seem to have not only flattened the pandemic curve in several countries, but have also led to a lower burden of motor vehicle related high-energy trauma and injuries related to work and sports-related activities while in place[97]. One retrospective study found that in Hong Kong, an area with 7.5 million inhabitants, an overall decrease of 25% was noted in upper and lower extremity fractures requiring surgical management since pandemic related restrictions began[150]. Additionally, elective joint replacement and ligamentous reconstruction decreased about 80%.

While health systems face peak pandemic activity, we suggest against the continuance of non-urgent ("elective") procedures. Some systems have chosen to continue with regular or limited non-urgent procedures during initial phases of the pandemic[5], however, this may pose substantial harm and compromise a health system's response to large-scale resource challenges posed by COVID-19. In confronting the pandemic, each system is primarily focused on the preservation of key items such as personal protective equipment (PPE)[6,24], inpatient beds and critical care resources. The diversion away from non-urgent procedures assists in resource reallocation to areas responding to pandemic burden, and limits patient traffic from potential asymptomatic carriers which may act as a source of unknown transmission in clinical settings.

If non-urgent procedures are to continue, ensure that the scale of surgical activity is linked to pandemic severity in your region. Singapore provides an example, as their health system is guided by the Disease Outbreak Response System Condition' (DORSCON) scale, which consists of 4 different levels (Green, Yellow, Orange and Red)[5]. While under "orange" status (severe but contained outbreak) during the COVID pandemic, orthopaedic procedures in Singapore were limited to musculoskeletal trauma or tumor care, however still included non-urgent procedures that could be done as outpatient surgery (such as arthroscopy). In the event of escalation to "red" status (severe and uncontained outbreak), orthopaedic procedures can be rapidly scaled down to urgent or emergent trauma or tumor cases only. While various health systems differ in their ability to continue with non-urgent orthoaedic services, to limit harm to health-care capacity during the pandemic, rapid cessation of non-urgent/emergent procedures should be strongly considered as severity escalates or rebounds, and is supported by most guidelines[10,18,22,23,27,32-34,41,43,44,46,48-77,83,85,86]. As pandemic burden peaks regionally, and COVID-19 cases, hospital admissions and mortality trajectories plateau, decision-makers plan towards the phased re-introduction of non-urgent procedures[87,88,91,102,120,145,146]. The impact of COVID-19 will fall along a spectrum in each country, making the promotion of

specific recommendations a challenge. Understanding local hospital capacity (i.e., beds, testing, operating room [OR] availability), constraints (i.e., workforce, supply chain), and pandemic activity (including subsequent waves) is of paramount importance[91,102]. These factors need to be carefully considered and balanced along with demand for increased surgical activity, impact on surgical outcomes and risk of COVID transmission for patients[87,88,91,102,120].

Further to this, when considering the management of orthopaedic issues, it is imperative to only perform surgical interventions with documented superior treatment effects over non-operative management[121]. This is of primary importance considering that every decision to perform surgery or admit a patient comes with resource implications that will impact the health system's capacity to confront priority conditions during the pandemic; as well as high-stake exposure risks for both the patient and providers. In a review of orthopaedic surgeons working in Wuhan, China as the novel coronavirus emerged, up to 20% of orthopaedic departments became infected with COVID-19, with the most common sources of infection coming from hospital wards, common areas and operating rooms[33]. Patients face a similar threat, and often have comorbidities placing them at increased mortality risk from severe acute respiratory syndrome-2 (SARS-2). Therefore, steps must be taken to limit and eliminate risk of hospital-based infection; including ensuring that operative options presented are expected to result in outcome benefits important enough to justify the substantial (and potentially fatal) risk of coronavirus exposure to the patient and team.

To facilitate distancing measures and ensure uninterrupted orthopaedic care, we support the implementation of rotating orthopaedic teams during the pandemic, particularly during surge stages. These teams may also be applied to separated care pathways that emerge for COVID-negative and COVID-managed procedures during the recovery period. Each team should consist of several surgeons and health-care team members available to provide orthopaedic care for 1 to 2 weeks, ideally allowing for a 14-day isolation period between clinical rotations[36,45]. This will be dependent on the number of teams and availability of members for each team. As the pandemic severity fluctuates, team members will inevitably become exposed and quarantined, therefore these teams should be developed with redundancy and adaptability in mind. If thoughtfully constructed, this measure can help limit the impact of any potential contamination, respect recommended periods of social distancing, and facilitate time away from stressful clinical settings.

THE NEED FOR FURTHER RESEARCH

Amongst the areas in need of further research to provide scientific direction for the decision-making and inform future clinical guidelines, we find:

- Determination of the structure of surgical teams to ensure safe care in a pandemic situation (i.e. how to optimize rotating, isolated teams and care pathways).
- Identification of the ideal screening process for asymptomatic surgical patients as well as healthcare staff, including the timing and use of tests.
- Determination of duration of aerosolization following intubation/extubation of a patient.
- Examination of aerosolization or potential blood-borne transmission of COVID-19, and if/when there is a concern during orthopaedic procedures (e.g.: using cautery, reamers, saws, drills, etc.).
- To determine optimal treatment strategies for urgent/emergent orthopaedic issues.
- To develop validated, modified examination techniques that incorporate technology to allow for improved interactive physical examinations, as we rapidly move forward into the realm of telemedicine due to unexpected necessity. Standardization of virtual examinations and the validation of measurements are important to improve the utility of telehealth in the field of orthopaedic surgery.
- To determine an evidence-based process for the reintroduction of scheduled non-urgent surgery following the pandemic.

THE WAY FORWARD: ***PREPARE NOW***

As the global orthopaedic community continues to search for direction during the evolving pandemic, we provide a general approach to ensure surgeons are poised to provide safe and timely care in this challenging environment:

Protocol development at the local/hospital level *(part 3: General Considerations, Part 5: Phased Management of Urgent/Non-urgent Cases)*

Re-evaluate the backlog from your surgical waitlist (confirm that the risks/benefit ratio for the procedure is still favorable) *(Part 5: Phased Management of Urgent/Non-urgent Cases)*

Existing patient care optimization: maximize non-operative management for patients who remain delayed/waitlisted *(Part 2: Outpatient Care, Part 5: Phased Management of Urgent/Nonurgent Cases)*

Prioritize patient urgency based on known prognostic factors *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 6: Urgent/Emergent Surgery)*

Assess patient readiness for safe surgery *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 7: Perioperative Risk Mitigation)*

Resume pre-op evaluations for priority delayed or waitlisted patients *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 7: Perioperative Risk Mitigation)*

Ensure COVID status has been confirmed, appropriate precautions taken and tests done in the lead up to surgery *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 7: Perioperative Risk Mitigation)*

Notify suppliers of planned changes in case volume to ensure supply chain security, for both PPE and equipment *(part 3: General Considerations, Part 5: Phased Management of Urgent/Non-urgent Cases)*

OR readiness check for equipment, staff and resources to ensure ongoing maintenance of safe surgery *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 7: Perioperative Risk Mitigation)*

Work Collaboratively with the perioperative team and decision makers to ensure safe patient management *(Part 5: Phased Management of Urgent/Non-urgent Cases, Part 7: Perioperative Risk Mitigation)*

PART 2: BEST PRACTICES
OVERARCHING RECOMMENDATIONS

Current guidelines and recommendations provide the following overarching principles that should guide care during the COVID-19 pandemic:

- Ensure patient and staff safety.
- Keep up-to-date regarding evolving clinical guidelines, local institutional capacity, and regional pandemic severity.
- Prevent unnecessary use of PPE and prepare for shortages.
- Ensure that surgical activity is linked to pandemic severity and hospital capacity
- Prioritize urgent and emergent surgical cases throughout the pandemic, particularly during surges.
- Non-urgent “elective” cases require tiered prioritization, responsive to dynamic trends in health system pressures
- Only perform interventions with expected superior treatment effects over non-operative management for priority outcomes.
- Utilize effective non-operative treatments for patients triaged to delayed surgical or conservative management.
- Discuss semi urgent or other controversial cases among your team prior to determining definitive management.
- Prevent unnecessary follow-up visits.

PART 3: BEST PRACTICES GENERAL CONSIDERATIONS

Key Findings

- The COVID-19 pandemic is a rapidly evolving situation. Surgeons' should stay updated on local indicators of pandemic severity, as well as best practices, policies and protocols. [Weak recommendation for, fair quality]
- Ensure patient and staff safety. Provide psychological support for healthcare personnel and promote initiatives for their well-being. [Strong recommendation for, fair quality]
- Individuals and institutions should follow general hygiene and social/physical distancing measures to limit disease spread. [Strong recommendation for, fair quality]
- Be prepared for supply shortages and develop contingency plans and policies to preserve personal protective equipment (PPE) and surgical supplies. [Strong recommendation for, fair quality]
- Clear and effective leadership is crucial. Experienced surgeons should take leading roles to guide their teams. [Strong recommendation for, fair quality]
- Establish rotating teams that can work in isolation of each other. Plan for redundancy as some personnel may need to be quarantined due illness or exposure. [Strong recommendation for, fair quality]
- During surge stages, surgeons may be asked to redeploy into unfamiliar (non-orthopaedic) roles. Prepare for this scenario, be willing to collaborate and stay updated on COVID-19 patient management recommendations. [Weak recommendation for, fair quality]
- Tele-health should be used where possible to limit exposure risk. Tele-health can be used for new consultations, follow-ups, and/or rehabilitation guidance. [Strong recommendation for, fair quality]
- Surgical training programs should implement technology to help trainees engage in remote knowledge and skill acquisition*. [Strong recommendation for, fair quality]

*Further details in full report.

System-level Measures

1. The constantly evolving COVID-19 situation requires surgeons to stay updated on best practices in pandemic environments[24,91,113,140,156]. Frequently check and follow national and institutional guidelines[21,41,80,91,113,156].
2. Access centralized, online resources utilized by health care authorities to disseminate information, policies and procedures. Stay informed regarding local and regional disaster plans and resources[16].
3. Stay situationally aware regarding patient load and other indicators of institutional capacity and resource needs during the pandemic[16,102].
4. Hospitals need to be prepared to transfer patients between institutions and share resources in order to optimize the care of regional populations[23].

Institutional and Individual measures

1. Institutions should promote individual behaviors that limit the risk of disease transmission: hand washing, avoiding handshakes, covering the mouth when coughing, working remotely (as able), and staying home when feeling unwell[16].
2. Limit/restrict patient visitors in clinical settings, and screen all patients and personnel entering clinics and hospitals using questionnaires and/or temperature scans[91,102].
3. Separate known or suspected COVID-19 patients from other patients (i.e. designating either COVID-19 institutions or specific clinic areas, wards, and ORs)[17,18,102,108,115].
4. Ensure that all surgeons working undergo personal protective equipment (PPE) fit testing and are reviewing up-to-date sources for training in its appropriate use[6,16,21,23,91,93,108,113,132,139].
5. Standard surgical masks may provide enough fit protection for the prevention of influenza and other viral respiratory infections in healthcare, and their 'fit factor' may increase by adding additional surgical masks or taping the mask to the face[45]. However, they are still not as effective as the N95/FFP3 respirators at blocking contaminants and better prevent the transmission of COVID-19 in high-risk exposure settings[45].
6. Barriers such as glass or plastic windows can be an effective solution for reducing exposures among personnel to potentially infectious patients. This approach can be effective in clerk/reception areas[79].
7. Develop protocols for preserving supplies of PPE[6,88], and be prepared for potential PPE and other supply shortages[18,92]. Avoid taking care of patients without appropriate PPE[103]. Develop contingency plans for supply chain issues[26,92,113].

a. In times of shortage, only personnel working in a sterile field or who may be exposed to high-velocity splashes, sprays, or splatters of blood or body fluids should be provided with surgical N95 (medical respirators). Other personnel can use standard N95 respirators. A face shield should be used in addition[79].
b. Given the concern for continued availability of PPE, considerations and recommendations on the reuse of N95 respirators should be in place[45,79,92]. There are ongoing efforts to identify safe and effective ways to disinfect N95 respirators to allow their reuse, including ultraviolet light and heat reprocessing[92].
c. When practicing extended use of N95 respirators, the maximum recommended extended use period is 8–12 hours[92]. Accounting for breaks in continual care (meals, etc.), extended use beyond 4 hours might be impractical in some cases[92].
d. Respirators grossly contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients should be discarded. Consider using a face shield or facemask over the respirator to reduce/prevent contamination of the N95 respirator[79].
e. One effective PPE preservation strategy that mitigates contact transfer of pathogens from N95 respirators to wearers could be to issue each staff potentially exposed to COVID-19 patients a minimum of 5 respirators. Each respirator will be used on a particular day and stored in a breathable paper bag until the next week. This amount of time in between uses should exceed the 72-hour expected survival time for the virus[79].
f. As in certain countries physicians themselves are at risk of becoming a scarce resource, for a physician without appropriate PPE to risk caring for a patient is irresponsible rather than heroic[103].

8. Be alert to the fact that viral contamination of surfaces is a known means of transmission within, and outside of clinical settings[92] as the virus has been shown to survive on surfaces for 2 to 48 hours:
    a. Ensure operating room (OR) surfaces, as well as common clinic space items such as desks, computers and phones are frequently wiped down and cleaned with an effective disinfectant solution (e.g. 60% alcohol)[7].
    b. Clean cell phones frequently before, during, and after patient care activities. Many phones may be kept in a Ziploc bag during work and still remain functional[6].
    c. If possible, have individual clinical work stations to avoid potential spread of the virus between the staff[91].

9. While at home[6]:
    a. Consider removing clothes and washing them upon arrival.
    b. Consider reducing physical contact with family members and wash hands frequently.
    c. Clean hard surfaces with an effective disinfectant solution (e.g. 60% alcohol).
10. Physically isolate – stay home. Avoid any activity that brings you in contact with others to prevent contagion[41]. If you develop symptoms, immediately inform the hospital and your Surgeon-in-Chief. Remain home and follow the advice of Infection Protection and Control (IPAC), or equivalent authority.

Human resources management and well-being

1. Put an emphasis on personnel safety and slowing the spread of the virus while allowing staff maintain vital functions[91,108,111,112,132,143]. Encourage regular personnel temperature checks and influenza vaccination[132].
2. Individuals should work out of one institution, if possible, to avoid potential spread between hospitals[41].
3. When dealing with a clinically controversial situation use the 4 principles of medical ethics to analyze ethical dilemmas. Beneficence, nonmaleficence, and autonomy should be considered in the context of a specific patient-physician interaction, whereas social justice is usually considered at a societal or public-health level and should also be taken into account[104].
4. Allow providers not on service and non-clinical staff to work from home[156]. Support schedules and team culture to optimize wellness and maintain resilience[39,91].
5. Clinical team leadership should be effective and clear[33]. Experienced surgeons should take the lead in decision-making[86,91,108,132].
6. Hold frequent (daily/weekly) strategy meetings with an OR coordinator, nursing representative, consultant from anesthesia, as well as one from each relevant surgical specialty[21]. All should understand the issues their own specialty faces prior to the meeting, including workload, relevant clinical details, ICU bed status, staffing issues due to illness, and need for redeployment of team members[21]. Resource allocation and patient prioritization should be agreed upon together.
7. Surgeons should try to avoid long-term overwork and fatigue, which could compromise immunity against COVID-19[33,140].
8. Establish isolated, rotating orthopaedic teams, consisting of surgeons and other health care members of the team as able[5,141,156]. These teams are responsible for clinical duties as needed; ideally rotating every 2 weeks to facilitate recommended isolation periods[36,45,91,108].

   a. When/if a subspecialist is required, they can be mobilized into and remain part of these teams until they are cleared to return to normal clinical duties, or have gone through a period of isolation[5].
   b. To minimize cross-contamination teams should not come into contact with each other, and should alternate on a weekly or bi-weekly basis[5,45,91,108,131,132].
   c. Trainees (residents and fellows) should also follow a team structure, as able[45,91].
   d. A specified COVID-19 orthopaedic team that would perform surgery exclusively on COVID-19 positive patients in dedicated operating rooms in selected hospitals to provide safer access for patients without the virus who require urgent and non-urgent surgery during pandemic and recovery periods[148].
9. Healthcare institutions and systems may make housing accommodations available for healthcare workers who cannot/prefer not to go home following patient care activities[139].
10. Provide support strategies for healthcare professionals, mainly those with young children, and offer them psychologic support to ensure they can provide good quality care[85,91,102,132,156]. The previous SARS epidemic left an impact on healthcare workers' mental health, with high rates of anxiety even after the outbreak was over. Psychological support is important to keep team mental wellbeing during and following the pandemic[91,92,102,106,113,140,156].
11. If the workforce is reduced due to spread of illness during surge stages, it may be necessary to move to a generic surgeon care model, where a single surgical team covers multiple specialties. One suggested break down is into torso/cavity surgeons (vascular, general, urology) and extremity surgeons (orthopaedics, plastics)[14]. If able, create several teams that are completely insulated from each other[24].
12. Clinicians may need to work in unfamiliar environments or outside of their specialty/subspecialty areas[26,109]. An estimated 14.7% of physicians were reallocated from orthopaedic and trauma surgery departments to other areas of clinical service in Germany[147]. Additionally, in a survey answered by 102 orthopaedic surgeons in 19 countries in Europe, 49% declared that at least one orthopedic colleague redeployed to other COVID-19 patient management activities[148]. Those selected or who volunteer will need to be supported and deployed judiciously[148].
13. Be available to be part of the institution healthcare team as a whole. Being a good team member requires the willingness to fill in where needed[99].
   a. Depending on the local pandemic situation, different strategies have been put in place where surgeons and trainees may help by organizing into teams to help with prone positioning [109,134] or invasive procedures[105].

b. Due to the pressure on emergency departments (EDs), non-respiratory emergencies may be triaged to an alternate pathway which may need support from surgeons (i.e. Non-COVID ED, emergency fracture clinic)[14].

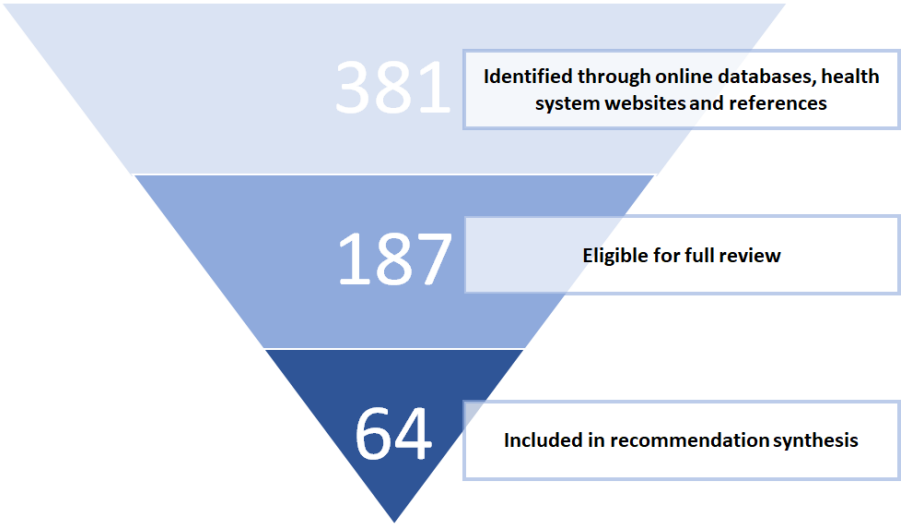
Implementation of technology

1. During the pandemic, tele-health should be used where possible to limit exposure risk[88,91,92,98,102,115,116,132,141,155,156,157]. Different aspects of care may utilize this strategy[37,45,91,92,98,117,119,142,155,157]
    a. Virtual visits with smartphones or computers may be used for new consults, peri-operative visits and follow-up[20,21,24,117,131].
    b. Virtual consults from specialists may be required by on-call clinicians/surgeons[14].
    c. Necessary in-person rounds, conferences, courses, panels, and meetings should transition to online/virtual platforms (including fracture rounds and departmental meetings)[21,24, 36, 41,45,132].
2. Develop protocols to help patients at the time of scheduling to prepare for their virtual visit[98]. Include specific instructions on camera positioning, body positioning, setting, and attire to improve the efficiency of the visit. During the examination, digital tools and questionnaires can be utilized as needed.
3. Practices are encouraged to utilize alternatives to face-to-face visits[10,15,119,155]. This is particularly useful for vulnerable or quarantined patients, who can be monitored remotely. Digital assessment and outcome tools and can be used as an adjunct to telephone calls for[26,34,45,119,155]:
    a. Triaging new consults.
    b. Monitoring postoperative patients[26,34].
    c. Providing treatment recommendations for patients with chronic diseases[27,34].
4. Telerehabilitation initiatives may allow patients to be reviewed in the comfort of their own homes, and may be useful beyond the pandemic[5,139].
    a. Technologies such as wearable sensors and videoconferencing tools can be adopted to monitor patient outcomes remotely (i.e., knee range of motion after knee arthroplasty), without subjecting patients to cumbersome hospital visits[5].
    b. Technology-assisted rehabilitation (i.e., online educational platforms or game-based therapy) has been demonstrated to result in significantly improved patient satisfaction, pain, and outcome scores compared to conventional therapy.
5. The pandemic has generated a rapid escalation of telehealth usage. Currently, 63.1% of the academic orthopaedic institutions in the US are providing telehealth services with an additional 22.5% currently setting up telehealth capabilities[157].

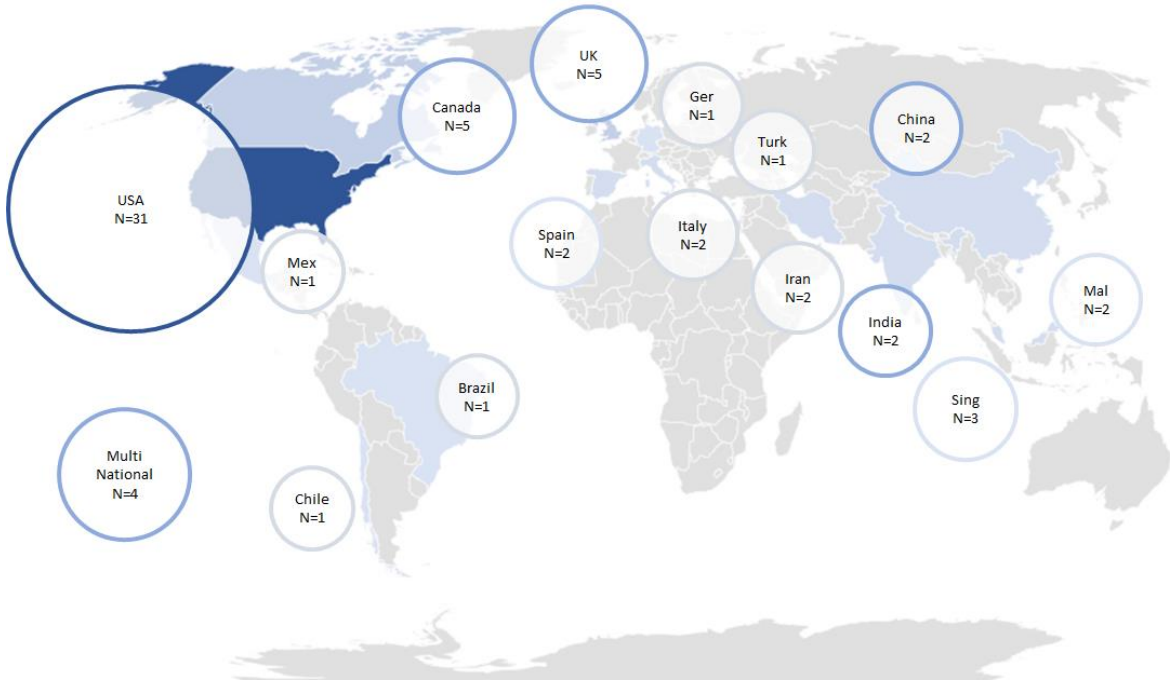
Impact on surgical trainees

1. Technology should be integrated for training needs[5,40,45,110,139].
2. In-person teaching unrelated to direct patient care may need to be suspended during pandemic surge stages[5].
3. Cancelation of non-urgent surgical procedures will have repercussions on resident training, requiring adaptive strategies for knowledge and skill acquisition[40,41,42,44,97]:
    a. Use of various e-learning and videoconferencing platforms.
    b. Faculty and residents may remotely log on for online scheduled teaching sessions using handheld devices or laptops.
    c. E-learning resources may provide a “virtual OR”, where trainees may be able to review and walk-through surgical simulations outside of clinical settings.
    d. Integration of online webinars and surgical videos into training programs. This can be supplemented by faculty-led online discussions to further consolidate resident learning.
4. The pandemic yields important lessons in teamwork, empathy, compassion, systems-based practice, organization, and leadership education related to[5]:
    a. Rational management of limited resources.
    b. Versatility, and being rapidly adaptable to an ever-changing, fluid situation.
    c. Need for understanding of fundamental medical and public health concepts in the management of a contagious, viral pandemic.
5. Boards certification requirements may need to be closely monitored and flexible. Board members should work with Orthopaedic Residency Program Directors as this situation will continue to evolve to better understand innovative ways to meet educational requirements and competency evaluations[154]. This is particularly important for those in their final stage (year) of training, as testing and certification procedures will need to adapt to restrictive policies and exceptional circumstances.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 64 publications that addressed the topic.



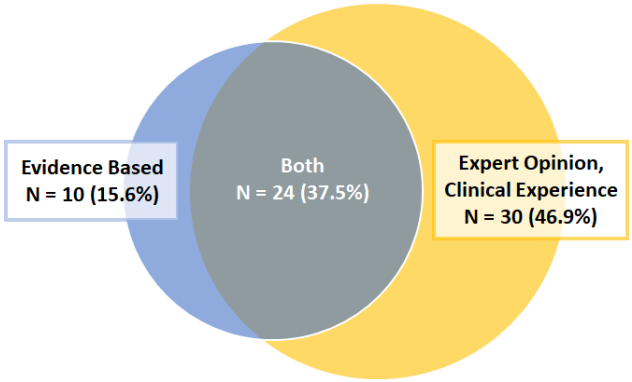
Publication dates ranged from February 29 to June 1, 2020 (search conducted May 25, 2020). Recommendations were from 14 countries (USA, N=31; United Kingdom, Canada, N=5; Singapore, N=3; Spain, Iran, India, Malaysia, China, Italy, N=2; Chile, Mexico, Brazil, Germany, N=1; multiple countries, N=4).



EVIDENCE BASE

Of the 64 publications, 19 (29.7%) were developed by surgical or orthopaedic societies/associations, 39 (60.9%) were developed by academic health care institutions/hospitals, and 6 (9.4%) were developed by national/local public health entities. In 16 publications, the authors within the working groups were not reported. Forty-eight publications (75.0%) provided contributor lists, which consisted of 268 clinicals experts or researchers in total.

Of the 64 publications, 30 (46.9%) were developed based on expert opinion and/or clinical experience, 10 (15.6%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 24 (37.5%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE[4] approach:
General considerations

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

PART 4: BEST PRACTICES

OUTPATIENT CARE

Key Findings

- Schedule clinics in line with social/physical distancing principles. [Strong recommendation for, fair quality]
    - Fewer patients.
    - More time between patients.
    - Decreased frequency of visits.
    - Postpone or cancel non urgent/emergent visits during pandemic surges.
    - Limit patients in waiting areas to as few as possible, with safe spacing in-between. Keep wait times to a minimum by having patients arrive immediately prior to appointments.
- Help diminish emergency department (ED) workloads by extending operating hours of outpatient trauma/fracture clinics to assess patients presenting to the ED with orthopaedic issues. [Weak recommendation for, fair quality]
- Aim for definitive decision-making and treatment from surgeons at initial visit. [Strong recommendation for, fair quality]
- Minimize impact on radiology services by avoiding non-essential imaging. [Strong recommendation for, fair quality]
- Discuss benefits and harms of treatment options with patients. Treatment preferences may differ from non-pandemic times due to surgical constraints and dynamic patient priorities non-operative treatment, removable splints and/or injections may be preferred where possible. [Weak recommendation for, fair quality]
- Optimize follow-up requirements by reviewing recommended schedules based on injury/condition, with the aim of reducing unnecessary appointments. Implement virtual/tele-medicine options. [Strong recommendation for, fair quality]
- Screen all patients attending outpatient clinics for risk factors and COVID-19 related symptoms (i.e. fever). Separate patients into COVID managed and COVID negative clinics based on risk of exposure and urgency of visit. [Strong recommendation for, fair quality]
- Set up barriers at check in desks, safely spaced waiting areas and segregated assessment rooms. When assessing patients suspected of or diagnosed with COVID-19, wear full PPE for droplet precautions. [Strong recommendation for, fair quality]

*Details in full report.

New consultations

1. Clinics should be scheduled in line with principles of social/physical distancing. Options may include longer clinics or multiple clinics throughout the week with fewer patients (i.e. spreading out patients over time) to allow safe spacing/separation between patients in clinic. Minimize time in waiting areas and have patients arrive immediately before appointments. If distancing is not feasible due to waiting room size, patients should have the option to wait in their car, or other less crowded location, and be called when ready for their visit[45,116]. Decrease the overall frequency of visits per patient. During pandemic surge periods, postpone or cancel non-urgent visits and avoid booking consults that will not require surgery within 90 days[10].
2. Patients should receive definitive management plans from consultant surgeons at their initial visit. Patients should not be scheduled for surgery without consulting surgeon input[21,26].
3. Emergency Departments (EDs) come under intense and sustained pressures during pandemic surges. Orthopaedic surgeons can reduce ED MSK workload, and allow emergency clinicians to focus on COVID-19 patients[21,26]:
    a. Extend operating hours of orthopaedic trauma/fracture clinic for patients who attend ED with minor musculoskeletal injuries, and otherwise do not require procedural sedation. Patients can be directed there from ED triage.
        i. Timing of the clinic will depend on local resources and requirements. It would ideally be able to offload/support the ED daily during pandemic surges.
        ii. If possible, arrange for availability of a mini C-arm in the clinic to facilitate access to imaging for diagnostics and minor procedures.
4. Regular, non-trauma/fracture orthopaedic clinics will likely be suspended during surge periods, and sub-specialty consultants should have access to orthopaedic trauma clinics for urgent consultations (i.e. patients with infected prosthesis, cauda equina, tumors)[26].
5. Impact on radiology services should be minimized[21,36,41]. Limit repeat imaging and use of multiple imaging modalities unless necessary for decision making. Consider immediate use of the most advanced modality needed for definitive diagnosis and treatment guidance. CT scanning should be minimized as this is the investigation of choice for coronavirus pneumonitis[26].
6. Decision making should be guided by evidence surrounding the risks and benefits of orthopaedic management, in light of shifting patient and provider values related to limited resources and additional risks posed by pandemic severity[127]. This may result in treatment recommendations that differ from standard orthopaedic management outside of a pandemic surge periods[35,41].

7. When possible, use non-operative treatment[35,41] and removable splints to minimize exposure risk[156], follow-up frequency and resource utilization (e.g.: most upper limb fractures have high rates of union and may be managed nonoperatively). Recognize that some injuries initially treated non-operatively may require later reconstruction following the pandemic.
    a. Temporary measures such as steroid or nerve block injections should be considered where appropriate to postpone interventions[118,126,133].

Follow-up consultations

1. Consider cancelling or postponing long-term follow-ups during pandemic surge periods, and until recovery phases are entered[24,112].
2. To prioritize bookings, review and classify follow-ups as those that can be delayed versus those that cannot[27,37].
    a. Identify patients with injuries or follow-ups that do not require in-person visits, and instead can be completed remotely (tele-health/virtual visit) [26,27,37,45,108,149].
3. Limit in-person postoperative visits to the following[45]:
    a. Immediate post-op visit for wound-check/suture removal (when non-absorbable suture used and unable to remove elsewhere)
    b. Fracture reduction check for non-operatively managed fractures that had a reduction and splint/cast applied.
    c. Symptomatic patients requiring physical examination and/or imaging to assess for healing/treatment related complications.
    d. Patients with potential weight bearing/activity status change, requiring imaging and/or cast removal/physical examination prior to making clinical decisions
        i. Consider ordering x-rays to be done at a remote location (especially if closer for the patient) with review and treatment recommendations provided during a subsequent telehealth visit.
    e. Visits with follow-up imaging where imaging is likely to result in a significant change in management[21,45,156]. There is no role for imaging to check for fracture union or implant position in most cases if the patient is otherwise asymptomatic.

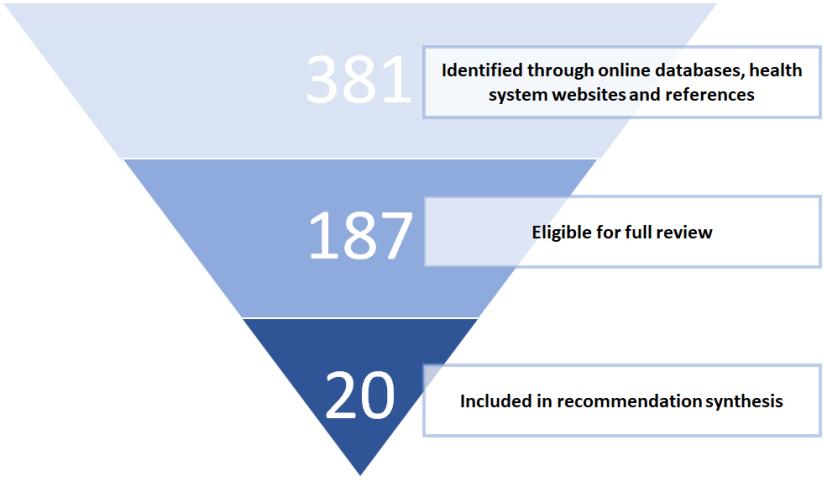
Personal protective equipment (PPE) and patients screening

1. Screen all patients, providers and staff attending outpatient clinics (before entering the facility) for risk factors, and have their temperature checked with a thermal scanner[5,45,46]:
    a. Febrile patients with respiratory tract symptoms, especially those with a positive travel/contact history, should be referred to the ED for further evaluation.
    b. Exclude additional visitors who are not required as an approved support person[92].
2. When managing patients suspected of or diagnosed with COVID-19, all providers must wear full PPE (droplet precautions)[5,13,28,108]. Strict compliance with hand hygiene is crucial[45,108].
    a. Droplet precautions include: Face shield or goggles, N95/FFP2 respirator (or medical facemask if respirator unavailable), isolation gown, clean non-sterile gloves.
3. If possible, arrange facilities to provide barrier shields at check-in desks, safely-spaced waiting areas, and separated assessment and treatment rooms. Plan for a space to store, don and doff personal PPE.

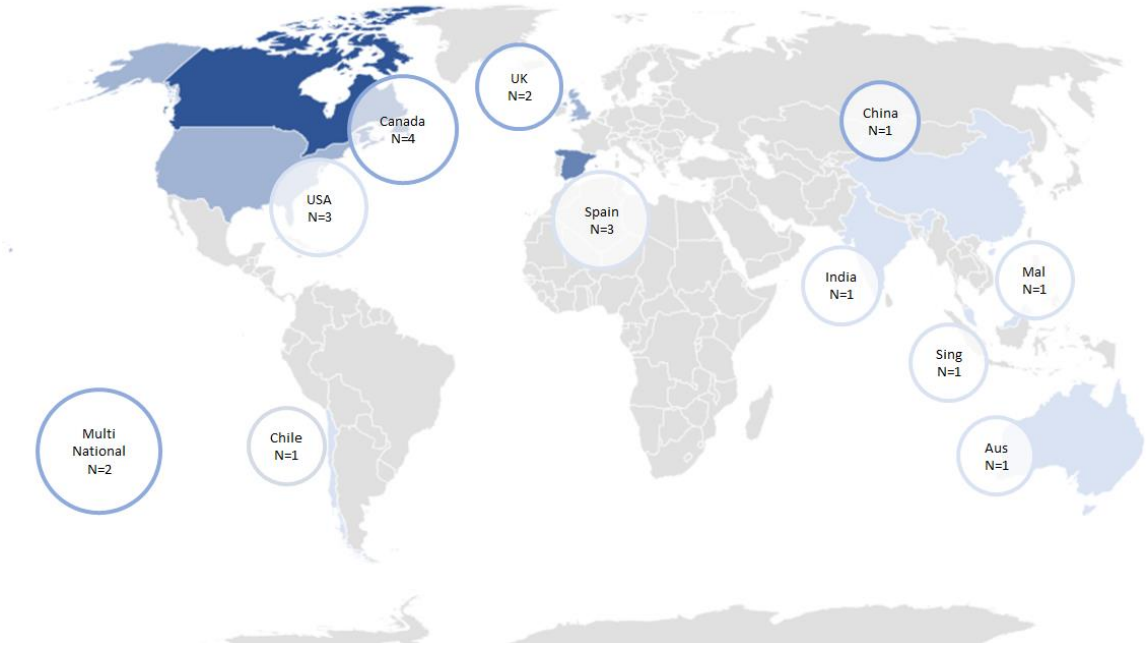
Outpatient facilities

1. Trauma/fracture clinics should be accessible throughout the day/week to facilitate urgent/emergent orthopaedic consults from the ED. This will reduce the need for repeat visits to amend casts or splints[26].
2. Use removable casts or splints when able to reduce follow-up requirements[21,26].
3. A temporary minor procedure room/theatre and dressings clinic may need to be set up in the fracture clinic to allow for suturing of wounds and other procedures[26].
4. In-person rehabilitation services are very limited during pandemic surge periods. Adaptive measures include providing written instructions or access to virtual/tele-rehab resources[2]

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 20 publications that addressed the topic.



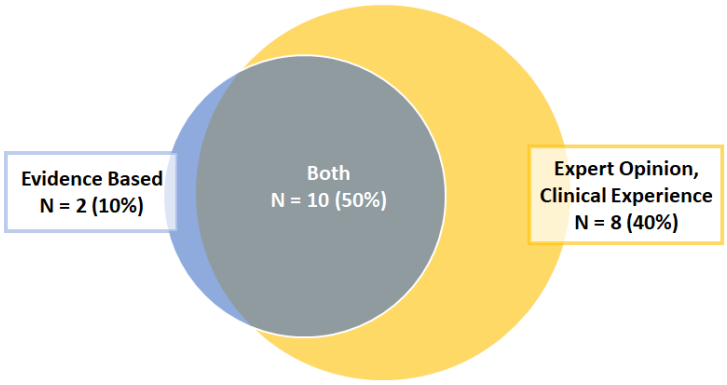
Publication dates ranged from March 16 to June 1, 2020 (search conducted May 25, 2020). Recommendations were from 10 countries (Canada, N=4; Spain, USA, N=3; United Kingdom, N=2; China, Chile, Singapore, Malaysia, India, Australia, N=1; multiple countries, N=2).



EVIDENCE BASE

Of the 20 publications, 8 (40.0%) were developed by surgical or orthopaedic societies/associations, 9 (45.0%) were developed by academic health care institutions/hospitals, and 3 (15.0%) were developed by national/local public health entities. In 7 publications, the authors within the working groups were not reported. Thirteen publications (65.0%) provided contributor lists, which consisted of 79 clinicals experts or researchers in total.

Of the 20 publications, 8 (40.0%) were developed based on expert opinion and/or clinical experience, 2 (10.0%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 10 (50.0%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE[4] approach:

Outpatient care recommendations

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

PART 5: BEST PRACTICES
PHASED MANAGEMENT OF NON-URGENT CASES

KEY FINDINGS

- During pandemic surges, non-urgent, function restoring surgeries should be postponed to reduce resource burden and preserve health system capacity. [Strong recommendation for, fair quality]
- Decisions regarding semi-urgent surgeries should be reviewed by a committee of perioperative departmental chiefs or peers to provide defined, transparent, and responsive oversight. [Strong recommendation for, fair quality]
- The decision to proceed with any semi-urgent surgery should take into account patient and injury/condition characteristics, expected benefits and potential harms of surgery, regional pandemic severity and institutional resources. [Weak recommendation for, fair quality]
- There is controversy regarding which orthopaedic function-restoring procedures are designated as non-urgent [Weak recommendation for, fair quality].
    - A rational, data-driven process is needed to assess and determine which non-urgent procedures should be allowed to proceed during pandemic surge periods and subsequent recovery phases.
    - To optimize orthopaedic surgical access and manage health-care resources throughout and following the pandemic, detailed criteria are needed to define which patients are deemed priority candidates for non-urgent procedures.
- Local pandemic severity and resource availability must also be considered when planning a phased resumption of non-urgent, restorative surgical activity. Develop protocols for safe surgery, be cautious and prepare for a rapid scale-down in case pandemic severity worsens. [Strong recommendation for, fair quality]
    - Know local COVID-19 rates (incidence, hospitalization) and be aware of any subsequent waves of infection.
    - A sustained decrease in severity measures for at least 14 days is recommended prior to any phased scale-up.
    - Be aware of any defined thresholds in severity measures acting as gating criteria for phases of resumption of non-urgent, restorative surgical activity.
    - Know health system capacity (including PPE, hospital bed and staffing availability).
- Non-urgent procedures being phased in should be done in COVID-free (“Green”) care pathways, with separate infrastructure, diagnostics and staff from COVID-

managed care. [weak recommendation for, fair quality]

- Develop and operationalize screening and testing policies for patients and healthcare personnel [Strong recommendation for, fair quality]
- COVID-19 screening measures in asymptomatic surgical patients is recommended. Limited test availability and diagnostic properties (sensitivity/specificity) should be weighed against the key information gained by clinical providers. [Weak recommendation for, fair quality]
- Currently, the most reliable screening/testing for COVID-19 remains a SARS-CoV-2 PCR of a deep nasopharyngeal swab, but RT-PCRs testing reliability is improving and it may be preferred due to its speed and convenience. [Weak recommendation for, fair quality]
- Access to outpatient rehabilitation services may be useful in temporizing demand for non-urgent procedures, and decreasing in-patient length of stay for any post-operative semi-urgent patients. [Weak recommendation for, fair quality]
    - Online/ tele-rehabilitation platforms facilitate remote access while distancing measures are in place.
    - This is beneficial in maximizing non-operative treatment for non-urgent patients who are awaiting restorative procedures and face prolonged delay.

*Details in full report.

Initial approach to Semi and Non-urgent procedures:

1. As pandemic severity escalates, non-urgent, "elective" (aka restorative) surgery may need to be postponed for several key reasons: [10,18,22,23,27,32-34,41,43,44,46,48-77, 83,85,86,112,118, 122-125,129,131,141,150,153]
    a. Reduction of unnecessary patient traffic in the hospital. This decreases the introduction and spread of COVID-19 among patients and health care staff who may be asymptomatic carriers.
    b. Preservation of capacity through elimination of non-essential consumption of vital resources including hospital beds, PPE, and healthcare staff[86]. This aids in the ability to confront COVID-19 and maintain surgical access for essential time-sensitive procedures (i.e. trauma and cancer surgery)[10,32].
2. For semi-urgent restorative procedures, a process should exist at each institution, by which a committee of perioperative peers or departmental heads provides guidance.
3. The committee should be structured with representation from surgery, anesthesia and nursing[19,22]. Preferably, senior consultants should be part of this committee[91].
    a. Decisions should be made on a daily basis, no later than the day before surgery[22].
    b. The committee is essential to provide defined, transparent, and equitable oversight while being responsive to regional pandemic severity and care capacity. The following factors should be taken into consideration prior to deciding to proceed with semi-urgent, restorative procedures[19,91]:
        i. Current and projected COVID-19 cases in the facility and region.
        ii. PPE supply security.
        iii. Staffing availability.
        iv. Bed availability, including critical care beds.
        v. Ventilator availability.
        vi. Patient age and comorbidities.
        vii. Urgency of the procedure based on the nature of injury/disease and functional limitations.
        viii. Benefits and harms of treatment relative to risks of COVID-19 transmission/infection.
4. Across various guidelines recommending the postponement of "elective" procedures, there is little initial direction provided specific to orthopaedic surgery. "Elective" procedures have been broadly defined as any non-trauma or non-oncology related procedure. Given that the majority of orthopaedic procedures focus on the restoration of musculoskeletal function essential to daily living, designation of orthopaedic procedures as "elective" threatens to undervalue their need to proceed from a patient perspective. These procedures are often necessary to restore function, however are "non-urgent" relative to their associated decline in function over the period of delay. Limited included references designate the following orthopedic specific procedures as "elective" or non-urgent[17,44,48-78,122,123,124,128]:

   a. Primary and revision arthroplasties (hip/knee/shoulder/elbow/ankle) for chronic degenerative conditions.
   b. ACL Reconstruction with intact meniscus or undisplaced meniscus tears.
   c. Spine surgery (i.e., laminectomy, fusion) for degenerative neck and back conditions.
   d. Closed fractures >4 weeks old that do not lead to loss of function or permanent disability if left untreated.
   e. Procedures for chronic neurologic compression syndromes (i.e. carpal tunnel).
   f. Sports procedures to address chronic joint pain.
   g. Shoulder and elbow procedures for chronic pain with retained function (including chronic cuff disease).
   h. Oncologic procedures for benign soft tissue masses or bone tumors that can wait.
   i. Foot and ankle procedures other than fracture or achilles tendon ruptures.
   j. Procedures for tendonitis or chronic soft tissue conditions of the hand.
5. The Centers for Medicare Medicaid Services (CMS) has used a tiered approach to define surgical services[19,44].
   a. Tiers 1, 2, and 3 designate low, intermediate, and high-acuity procedures, respectively; with designations “a” or “b” to denote healthy or unhealthy patients.
   b. The CMS recommends postponing Tier-1 operations (i.e. carpal tunnel procedures, Tier-1a), consider postponing Tier-2 operations (i.e. hip and knee replacement and “elective” spine surgery, Tier 2a), and continue to perform Tier-3 operations (i.e. most cancers and highly-symptomatic patients).
   c. No guidance is provided on what is considered a “highly symptomatic patient”, adding ambiguity as patients with chronic or degenerative orthopaedic conditions (normally needing “elective surgery”) may have severe symptoms.
6. A rational, data-driven process is needed to assess and communicate which non-urgent procedures should be allowed to be performed. To limit orthopaedic surgical procedures and best manage health-care resources throughout and following this public health emergency, detailed criteria are needed to indicate which patients should be prioritized for non-urgent procedures[46,90,102].
7. Proceed with caution for any procedures during the pandemic, especially in the elderly[102]:
   a. High complication rates have recently been published in patients undergoing surgery while in the incubation period of the illness. A Chinese series of 34 patients receiving a surgical procedure while in the viral incubation period reported that 15 patients (44.1%) needed ICU stay post-operatively and 7 patients (20.5%) died[47].

8. As local pandemic severity fluctuates and outbreaks are contained, “non-urgent” day surgical cases (requiring <23 hours of hospital stay) may be allowed to continue/resume earlier. This may include arthroscopies (shoulders, knees, and ankles) and simple day procedures (e.g., soft-tissue surgical procedures and implant removals)[5,91]. This is based on the following rationale:
    a. Day cases come with limited impact on inpatient capacity, and hospital inpatient beds are readily available for emergent admissions.
    b. Patients are discharged expediently and are at low risk for nosocomial COVID-19 infections, particularly if day-surgical cases are done at a separate facility from inpatient units.
    c. Pandemic severity is within the health system response capacity, and vital resource supplies are secure.
9. If/when pandemic severity escalates, (i.e. rapidly spreading, uncontained outbreaks) a staged closure of all restorative procedures (including semi-urgent) may need to proceed or be repeated. An example triage guideline table for the rescheduling of orthopaedic procedures based on pandemic response stage is available here: COVID-19 Guidelines for Triage of Orthopaedic Patients[17].
10. When ambulatory patients present to the clinic with semi-urgent conditions or injuries that require operative treatment to avoid significant morbidity due to a delay of greater than 30 days (ie. wrist fractures, ankle fractures, acute major tendon ruptures, displaced meniscal tears etc), surgeons should be aware of additionally available local resources (if any) to perform surgery outside of hospital settings with inpatients (ie. Ambulatory Surgery Centers [ASC]). Several cities in the US and Australia are already using this strategy[45].
11. For any surgical procedures done, equipment and room decontamination will drastically slow down turnover and limit surgical capacity as services resume[25,102,139,151]. At the Galleazi institute in Italy the turnover time between cases has almost doubled from 19.5 minutes to 36 minutes during the pandemic for the non-COVID ORs and a mean turnover time of 142 minutes for the designated COVID-19 OR[151].
    a. Reusable surgical instruments require steam-sterilization,
    b. Heat-resistant items heat-sensitive items may be sterilized with ethylene oxide gas, hydrogen peroxide gas plasma, ozone, or liquid chemical sterilant.
12. For certain semi-urgent procedures (including single-limb trauma in ambulatory patients: i.e. ankle and wrist fractures, arthroscopy) there is the option of surgery being performed in ASCs. These facilities should follow protective guidelines for staff during procedures[46]:
    a. Ensure adequate safety measures are followed (outlined below) including protection during intubation and extubation and ensuring access to appropriate PPE.

   b. Ensure that terminal cleaning of all ORs and equipment is performed between cases.

13. Perioperative COVID-19 screening in asymptomatic surgery patients is recommended[28,29,45,91,92,102,131,151,152,153]. Limited test availability and diagnostic properties (sensitivity/specificity) needs to be considered against key information that may be gained from testing:
    a. COVID-19 patients may be in the incubation phase of the infection at the time of the procedure, and may develop symptoms and adverse outcomes in the postoperative period [29].
    b. Patients may be asymptomatic/mildly symptomatic COVID-19 carriers, placing caregivers at risk of transmission, particularly during intubation and other aerosol generating medical procedures (AGMPs). They may also place other hospitalized patients at risk, if not identified[29].
14. The Dutch Surgical Association[29] and Tan et al[84] recommend that all adult patients requiring a surgical procedure under general anesthesia undergo preoperative screening for COVID-19 infection using a SARS-CoV-2 PCR of a deep nasopharyngeal swab in conjunction with a low-dose chest CT (without iv contrast)[29,84]. However, the American College of Radiology informs that the findings on chest imaging in COVID-19 are not specific, and overlap with other infections, including influenza, H1N1, SARS and MERS and do not recommend it as a standard screening tool[82].
15. As the test of choice, PCR of nasopharyngeal swabs are being replaced by RT-PCRs testing of a combination of saliva, sputum and even the use of oropharyngeal swabs as RT-PCR test reliability continues to improve[102]. These are less painful and less invasive. Next generation sequencing (NGS), CRISPR/Cas, and other molecular techniques can be used as an adjunct, when available[102].
16. Access to outpatient rehabilitation services and infrastructure may be useful in temporizing demand for non-urgent procedures, and decreasing in-patient length of stay for any postoperative semi-urgent patients[26, 145].
    a. Online/ tele-rehabilitation platforms facilitate remote access while distancing measures are in place.
    b. This is beneficial in maximizing non-operative treatments for non-urgent patients who are awaiting restorative procedures and face prolonged delay.
    c. Information for self-guided and supported rehabilitation should be used to minimize the need for direct patient contact postoperatively[145].

Phased reintroduction of non-urgent/restorative surgical procedures

17. As the pandemic peaks and plateaus, most healthcare systems are preparing for the resumption of non-urgent procedures[102,120,145,146,151]. To do so safely, it is important to consider the following principles and to continuously monitor pandemic severity[142,149]. Creating a COVID-19 Surgical and Procedural Oversight Committee is desirable to monitor the situation on at least a weekly basis[142].
18. Know your community's COVID-19 epidemiology before resuming non-urgent surgeries[87,88,91,102,120,139,149]
    a. A decrease in measures of COVID-19 incidence for at least 14 days has been recommended before phasing in non-urgent surgeries[87,102,120,136,142,144,149].
    b. Continually follow local COVID-19 rates (e.g. incidence rates, hospitalizations), as there is a threat of subsequent waves of infection[120,149].
    c. Consider defining specific criteria and/or threshold COVID-19 incidence rates for re-entering mitigation phases, aligned with local/national guidelines.
    d. The Ontario provincial guidelines (Canada)[142] suggest to preserve at least a 15% of acute care hospital capacity (i.e. maintaining max hospital capacity below 85%).
    e. Anoushiravani et al.[149] suggest that inpatient COVID-19 census must comprise <15% of hospital beds and <10% of ICU beds before non-urgent surgeries ramp-up.
19. Health systems should aim to create a "COVID-free" ("Green") pathway for all patients receiving non-urgent surgery. Patients and providers should take measures to ensure all involved in this pathway are COVID negative. To facilitate this, know your COVID-19 diagnostic testing availability, and develop operational testing policies for patients and healthcare personnel[87,88,101,102,120,136,137,142,144,145,149,151].
    a. Know, understand, and update your local COVID-19 diagnostic testing capabilities and turnaround times.
    b. Develop diagnostic testing policies. Rapid testing through real-time reverse transcription polymerase chain reaction (RT-PCR) testing should be considered for all patients undergoing planned surgery, or for selected patients after screening with or without mandatory preoperative quarantine. Some organizations advocate for preoperative testing (48-72 hrs prior to surgery) even for patients who have undergone preoperative quarantine[145].
    c. COVID-free ("green") care pathways should have their own clinics, wards, ORs, transport routes, diagnostic facilities and staff.
    d. Ideally, 14 days prior to the procedure the patient should stay at home and reduce the exposure to COVID-19 with any of the following two approaches:
        i. Self-isolating along with their entire household.
        ii. Shielding within their household.

e. Postoperatively, an isolation period of 14-days is also recommended[145,151].
f. Staff involved in patient care should be tested for SARS-CoV-2 (RT-PCR) regularly and/or undergo serum antibody testing for the virus[101,102,115,120,131,149,151].
g. Staff should avoid transitioning between COVID-free and COVID-managed care paths without adequate testing or isolation periods[151].
h. Consider false negative test rates and need for retesting[102]. False negatives have been reported as high as 30 percent.
i. Consider guidelines for postoperative testing of symptomatic patients/patients under investigation. Atelectasis, fevers, etc., are not uncommon in the postoperative course.

20. Consider your local PPE availability and develop local policies for your personnel and procedures [87,88,91,114,120,137,139,142,144]. Ideally, have a 30-day stock of PPE for a 30-day[142].
21. Be aware of your healthcare facility capacity (e.g., beds, ICUs, ventilators, blood products), including capacity in expansion strategies[87,91,102,114,120,136,137,139,142,149,151].
    a. The approach to restoring the non-urgent surgical caseload depends on the hospital's available resources, including OR capacity and alternative sites for care.
    b. Spaces for patient care should comply with social distancing principles. Do not contemplate or rely on the delivery care in hallways to facilitate the resumption of non-urgent cases.
    c. Ensure that a post-pandemic increase in non-urgent surgery will not overwhelm the local facility throughout preoperative, intraoperative, postoperative care phases.
    d. Other areas of the hospital that support perioperative services must be ready to commence operations, including the clinical laboratory, diagnostic imaging, and sterile processing.
    e. Facility capacity and expansion should include estimating the anticipated demand, and take into consideration the looming backlog of cases that are expected to present.
22. Be aware of your workforce staffing issues [87,88,102,114,120,142,144,145]:
    a. Ensure multidisciplinary staffing coverage for routine and “expanded” hours.
    b. Consider levels of stress and fatigue in otherwise healthy workers. Workers returning to work following a COVID-19 infection may especially be at risk for physical and emotional exhaustion.
    c. Have policies in place to support the health and well-being of the staff.
    d. Staff may need additional assistance with childcare, particularly with expanded hours, and resumption of surgical loads prior to the full re-opening across society and support services.
    e. Institutions may consider mitigating workforce shortages through creative staffing, (e.g., retired surgeons may be available to work as assistants).

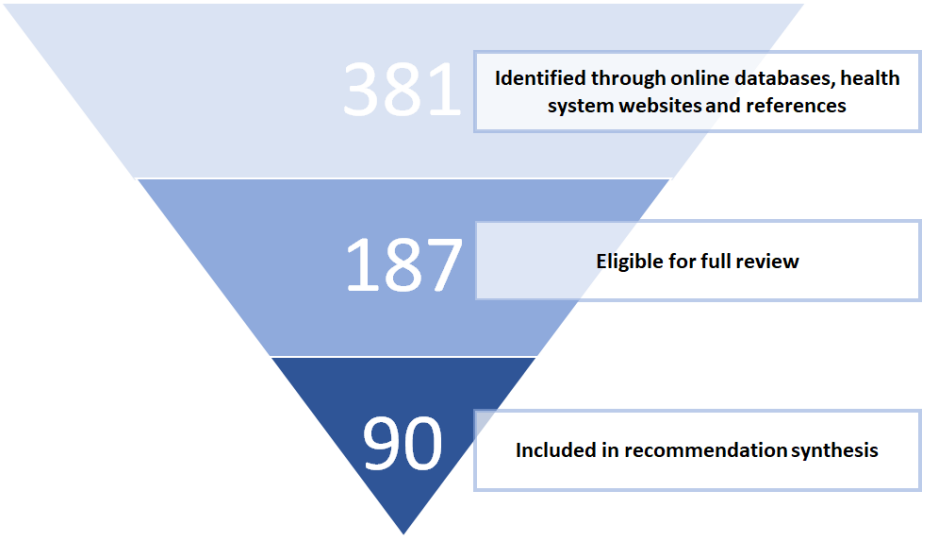
    f. Ensure adequate healthcare worker staffing to accommodate a COVID-19 surge if new waves occur. Plan ahead, and consider the hiring and training of new staff.

23. Before resuming restorative procedures ensure safe, high-quality and high-value care for surgical patients; ensure the risk/benefit ratio of surgical treatment remains in the patients' favor[87,102,114,138,149].
24. Have a prioritization protocol/plan[89,91,102,137,139,142,144,145]. The prioritization of surgical procedures should follow a collaborative process to identify principles and a framework for prioritization[139,144]. Input should be considered from surgery, anesthesia, nursing, administration and others[87,139,142,144].
    a. Some organizations (Australian Orthopaedic Association) consider prioritization tools/strategies to be unhelpful, as surgeons take these factors into account when making treatment decisions[114].
        i. If no new prioritization is done, at minimum treatment decisions should be reassessed to ensure the same factors (risks and benefits) that led to initial treatment decisions are still relevant for patients awaiting non-urgent procedures.
        ii. The prioritization plan should be guided by the following principles[142]: a) Relevance; b) Transparency; c) Revision; d) Engagement; and e) Enforcement.
25. Consider classifying non-urgent procedures based on whether they can be performed as an outpatient versus inpatient[91].
26. Initially, schedule low risk procedures in lower risk patients to monitor the system response[120,145,151].
27. Methicillin-resistant Staphylococcus aureus (MRSA) and Methicillin-sensitive Staphylococcus aureus (MSSA) swabbing should be done several days prior to surgery. All patients, regardless of test results, should be given an antimicrobial body wash at the preoperative visit[120].
28. Use of operating rooms should be optimized. Surgeries should be performed by staff/consultant surgeons (i.e. non-trainees) as much as practically possible, and all efforts should be made to use OR resources wisely and efficiently[114,133,137].
29. Counsel patients about the pandemic situation and add COVID-19 as a risk on the informed consent form[145,153]. This is particularly important during transition periods in care[120,137]. The risk associated with COVID-19 infection in the postoperative period should be discussed as well as the risks of delaying the treatment until a time when COVID-19 risks are lower[145].
30. Hold interdisciplinary (or COVID-19 Surgical and Procedural Oversight Committee) meetings to monitor the system response and tackle eventual issues that may arise during this period[120,136,142,144]. It is important to collect the appropriate data at the local level and have it constantly available to inform the decision-making process[144].

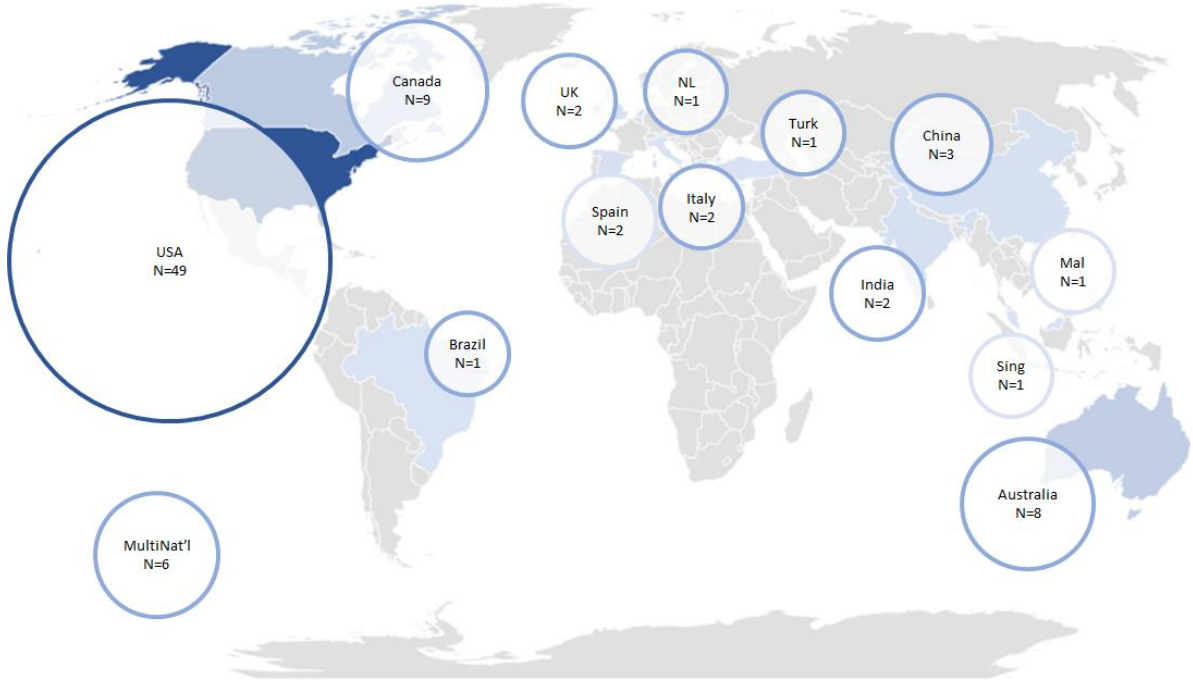
31. When resuming non-urgent surgeries, the British Orthopaedic Association recommends to initially use full PPE for AGMPs (regardless of COVID status) given the lack of evidence that exists around transmission and asymptomatic patients, and limited reliability of tests. For non-AGMPs the appropriate PPE should be used, and a higher throughput may be expected relative to AGMPs, however this will still remain below pre-COVID levels due to additional cleaning and infection control measures in operating theatres affecting turnover times[145].
32. As non-urgent surgery resumes it may be useful to have more than one consultant/staff "double scrub" in for cases, as it is possible that some degree of skill-loss may have occurred with the lack of operative volume over the past several weeks or months[145].
33. Orthopaedic surgeons should keep in mind that support in the OR from implant companies is unlikely to be available in the short term, which may impact the planning and performance of more complex cases[145]
34. If phased reintroduction of non-urgent procedures is successful, the next step will be addressing the surgical backlog, and when/how to increase surgical capacity to confront the growing list of patients awaiting surgery[142,146]. Evidence-based guidelines are desperately needed.
35. If any of the following "stop-guidelines" are triggered for 3 consecutive days during the ramp up phase, inpatient and outpatient elective surgical procedures should be reevaluated:

    a. Increase in COVID-19 cases.
    b. Increase in total COVID-19 hospitalizations.
    c. A substantive increase in the COVID-19 ICU census within the hospital[149].

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 90 publications that addressed the topic.



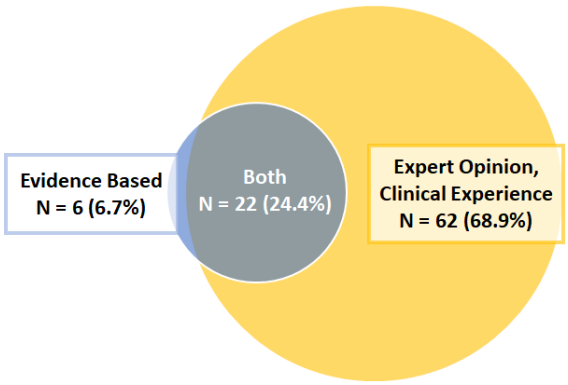
Publication dates ranged from February 29 to May 21, 2020 (search conducted May 25, 2020). Recommendations were from 13 countries (USA, N=49; Canada, N=9; Australia, N=8; Singapore, China, N=3; United Kingdom, India, Spain, Italy, N=2; The Netherlands, Malaysia, Turkey, Brazil, N=1; multiple countries, N=6).



EVIDENCE BASE

Of the 90 publications, 29 (32.2%) were developed by surgical or orthopaedic societies/associations, 23 (25.6%) were developed by academic health care institutions/hospitals, and 38 (42.2%) were developed by international/national/ local public health entities. In 26 publications, the authors within the working groups were not reported. Sixty-four publications (71.1%) provided contributor lists, which consisted of 359 clinicals experts or researchers in total.

Of the 90 publications, 62 (68.9%) were developed based on expert opinion and/or clinical experience, 6 (6.7%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 22 (24.4%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE[4] approach:

Non-urgent procedure recommendations

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

PART 6: BEST PRACTICES
URGENT AND/OR EMERGENT SURGERY

Key Findings

- Urgent and emergent surgery should be prioritized during pandemic surge and recovery periods. [Strong recommendation for, fair quality]
- Decisions regarding semi-urgent surgeries should be reviewed by a committee of perioperative Departmental chiefs or peers to provide defined, transparent, and responsive oversight. [Strong recommendation for, fair quality]
- Aim to complete procedures as day-surgery cases (or same-day admissions) for ambulatory patients. [Strong recommendation for, fair quality]
- Emergent surgery is warranted for life and limb threatening injuries, including [Strong recommendation for, good quality]:
    - Polytrauma patients or pelvic/acetabular fractures with major hemorrhage.
    - Open fractures.
    - Compartment syndrome.
    - Exsanguinating injuries.
    - Necrotizing fasciitis.
- The definition of urgent orthopaedic procedures is subject to ambiguity, and broadly includes select closed fractures that may lead to loss of function of permanent disability if left untreated for >30 days. Evidence to base definitions for treatment and timing for surgery is needed to guide surgical decision making, as controversy continues to exist. [Weak recommendation for; poor quality evidence]
    - Suggested categorization for timing includes the need for surgery within 24-72 hours, 2 weeks, 6 weeks and 12 weeks to help with prioritization for urgent cases.
- Hip and femoral fractures remain a surgical priority. In very frail patients with multiple comorbidities at high-risk of COVID-19 related mortality, consider non-op care/palliation. [Strong recommendation for, fair quality]
- Aim to make surgically treated patients with fractures of the pelvis, acetabulum or lower limb immediately fully weight bearing to allow rehabilitation and reduce inpatient load. [Strong recommendation for, fair quality]
- Plan complex fractures surgeries in advance, and aim for single-staged surgery (i.e. Early Total Care) where possible. [Weak recommendation for, fair quality]
    - If a staged approach is chosen, aim to discharge and readmit the patient between stages if possible.
- Consider alternative techniques or surgical solutions for orthopaedic injuries with soft-

tissue defects*: [Strong recommendation for, fair quality]
    - Avoid multiple operations for patients requiring soft tissue reconstruction.
    - Consider early amputation if limb salvage is unlikely.
- Prefer non-operative treatment of specific orthopaedic injuries if surgical benefits do not outweigh the risks, and if delayed reconstruction is an option*. [Strong recommendation for, fair quality]
- Consider performing simple procedures in the ED or a minor procedure room in the fracture clinic*: [Strong recommendation for, fair quality]
    - Reductions of native or prosthetic joint dislocations.
    - Suturing of penetrating injuries to the limbs.
    - Abscesses drainage in patients without sepsis.

*Details in full report.

General aspects

1. Prioritize time-critical urgent or emergent surgery where known or expected significant deterioration in life or limb function will occur within hours, days or weeks[130,131].
2. A Surgical Review Committee composed of surgery, anesthesiology, and nursing personnel should be in place to decide on prioritization of cases[22].
3. Classification for different prioritization of surgical cases is advised. All bookings must be given a rationale, which is reviewed by the Surgical Committee[22].
4. Decisions regarding semi-urgent surgeries should be reviewed by a committee of perioperative Departmental chiefs or peers to provide defined, transparent, and responsive oversight[22].
5. Patients should only be admitted to hospital if there is no alternative. Procedures should be done as day-cases for ambulatory trauma patients whenever possible[21].
6. For semi-urgent procedures, schedule patients for same-day admissions where possible[5].
7. Contact any day-surgery or same-day admission patients the day before the procedure for COVID-19 screening. On arrival to the surgical unit, perform a secondary screen and check for fever[5,12,131].

Orthopaedic Surgery

1. Emergent surgery is warranted for life and limb threatening injuries[21,41,91,126,130,131,133]:
    a. Polytrauma patients or pelvic/acetabular fractures with major hemorrhage.
    b. Open fractures.
    c. Compartment syndrome.
    d. Exsanguinating injuries.
    e. Necrotizing fasciitis.
    f. Spinal injuries with acute neurologic compromise (i.e. cauda equina).
    g. Septic arthritis, prosthetic joint infections, infected non-unions or osteomyelitis with systemic sepsis (consider outpatient management with suppressive therapy for non-septic patients).
2. The definition of urgent orthopaedic procedures is subject to ambiguity, and broadly includes select closed fractures that may lead to loss of function of permanent disability if left untreated for >30 days. Evidence to base definitions for treatment and timing for surgery is needed to guide surgical decision making[45].
    a. A potential way to further classify procedures is by separating them into categories:
        i. Those that need to be performed within 24-72 hours (Emergent/Urgent)
        ii. Those that need to be performed within 2 weeks (Expedited semi-urgent)
        iii. Those that need to be performed within 6-12 weeks (semi-urgent)
        iv. Those that need to be performed beyond 12 weeks (non-urgent).
3. A suggested table for prioritization of orthopaedic procedures is available in “Part 9: Tables and Figures”. In addition to the above emergent procedures, suggested surgical urgency is outlined for urgent and semi-urgent procedures, as recommended by several sources. [21,41,46, 91,114,126,130,131,133, 136]. Special consideration should be given to the following cases:[46]:
    a. Acute and/or disabling injuries to health-care workers, first responders, and members of the military and police and fire departments.
    b. Osseous fractures and/or irreducible joint dislocations.
    c. Wound/joint infections or postoperative wound dehiscence.
    d. Severe/ intolerable radicular pain (unresponsive to nerve root block injections)[111].
    e. Pathologies that could lead to long-term disability and chronic pain if acute surgical management is delayed (for further detail see Table 1 https://journals.lww.com/jbjsjournal/Documents/P-DePhillipo-Final.pdf)[46]:
        i. Irreducible joint dislocations, or injuries with high risk of recurrent instability/dislocation causing further damage.

   ii. Young patients with chondral injuries that are repairable or large tendon ruptures that are susceptible to retracting and becoming irreparable with delayed surgical treatment.
   iii. Certain fractures susceptible to nonunion with conservative treatment.
   iv. Meniscal tears that would lead to long-term decreased function (i.e. meniscal root tears at risk for cartilage wear progression, bucket-handle meniscal tears).
   v. Spine disorders which could lead to permanent dysfunction (i.e. cauda equina syndrome, loss of bladder/bowel control, unstable vertebral fractures or spondylolisthesis).
4. Decision making should be guided by evidence surrounding the risks and benefits of surgical management in the context of shifting patient and provider values related to limited resources and risks posed by pandemic severity. This may result in treatment recommendations that differ from standard orthopaedic management outside of a pandemic environment[35,41,118].
5. Conservative treatment of fractures should be considered if there is no clear superiority of surgical management. Temporary measures such as steroid or nerve block injections should be considered where appropriate to postpone interventions[118,126,133].
6. When managing fractures (both closed and open), definitive external fixation should be considered given its minimal invasiveness and the relative ease in performing it[133].
7. Hip and femoral fractures remain a surgical priority[96]. Higher short-term mortality has been reported during the pandemic[96] but also substantial respiratory improvement[135]. It is reasonable to offer hemiarthroplasty rather than total hip replacement if suitable surgeons are not available, in order to facilitate early surgery[21]. In very frail patients with multiple comorbidities at high-risk of COVID-19 related mortality consider palliative care[135].
8. Aim to make surgically treated patients with fragility fractures of the pelvis, acetabulum or lower limb immediately fully weight bearing to allow rehabilitation and reduce inpatient stays/coronavirus exposure[21].
9. Patients with complex fractures should have surgery planned to minimize length of stay. Aim for single-stage surgery (i.e. Early Total Care) where possible. If a staged approach is used, aim to discharge and readmit the patient between stages if possible.
10. It may be necessary to explore different surgical solutions when facing specific circumstances[21]:
    a. Consider alternative techniques for patients who require soft tissue reconstruction to avoid multiple operations or the need for critical care input (local flaps, intentional deformity, skin grafting for fasciotomy wounds).
    b. Consider early amputation in patients for whom limb salvage has an uncertain outcome and is likely to require multiple operations and prolonged stays[126].

    c. Surgeons may need to base decisions about vascular injuries on clinical assessment alone if imaging is not readily available.
    d. Reconsider typical indications for which fractures necessitate fixation in the short term. It is very likely that in the event that resources become scarce, surgeons may be required to postpone treatments beyond what we would consider usual[44].

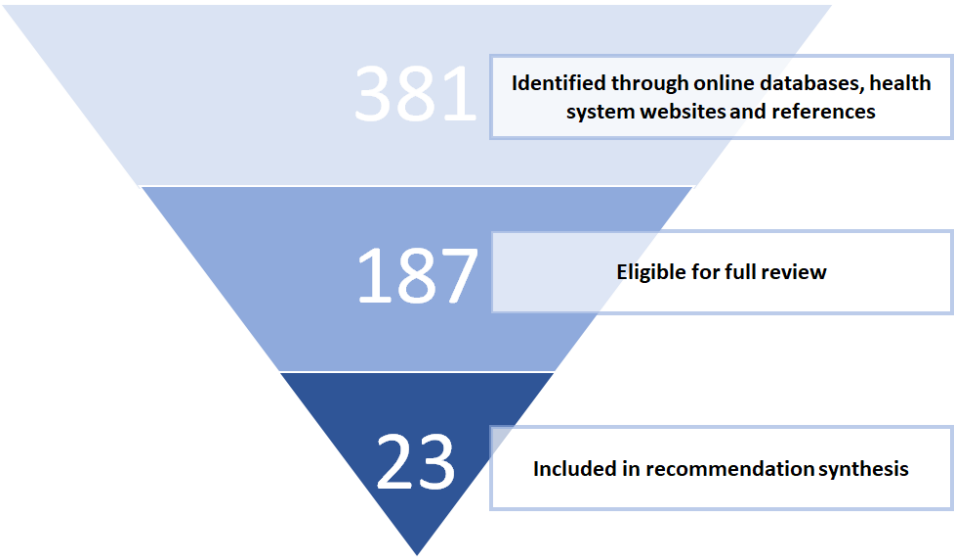
11. Consider day-case treatment when feasible[26]:
    a. Lower limb simple peri-articular fractures.
    b. Upper limb fractures (e.g. forearm fractures).
    c. Most pediatric fractures (i.e. reduced joint dislocations, fractures with-out abnormal neurology or soft tissue compromise, simple periarticular fractures, extra-articular femoral fractures in children aged under six years in a spica cast, displaced forearm fractures).
12. Non-union of lower limb fractures with failed implants or increasing deformity and a significant impact on daily function may require relatively urgent treatment. Non-union of upper limb fractures may be managed in a delayed fashion.
13. Wrist fractures may be treated with removable casts or splints to reduce follow-ups[35].
14. Consider non-operative management and bracing of patients with spinal fractures without progressive neurologic symptoms.
15. Dislocations of native and replaced joints should be reduced in the ED, minor procedure area or fracture clinic as soon as possible. If the joint is stable after reduction, the patient should be discharged with appropriate follow-up.
16. Initial non-operative management with appropriate immobilization/splinting should be considered for the following:
    a. Proximal humerus fractures (including elderly displaced fractures).
    b. Clavicle fractures.
    c. Humeral shaft fractures.
    d. Scapula fractures.
    e. Distal radius fractures (including displaced fractures in the elderly).
    f. Stable malleolar ankle fractures.
    g. Achilles tendon ruptures.
    h. Rotator cuff injuries.
    i. AC joint disruptions.
    j. Radial head fractures (without block to motion).
    k. Ankle sprains.
    l. Reducible joint dislocation.
    m. Metacarpal/metatarsal injuries.
    n. Calcaneus fractures.
    o. Ligamentous knee injuries (with reduced knee).

p. Meniscal tears (nondisplaced).
q. Stable pelvic ring injuries.
r. Non-displaced scaphoid fractures.
s. Non-displaced tibial shaft fractures.

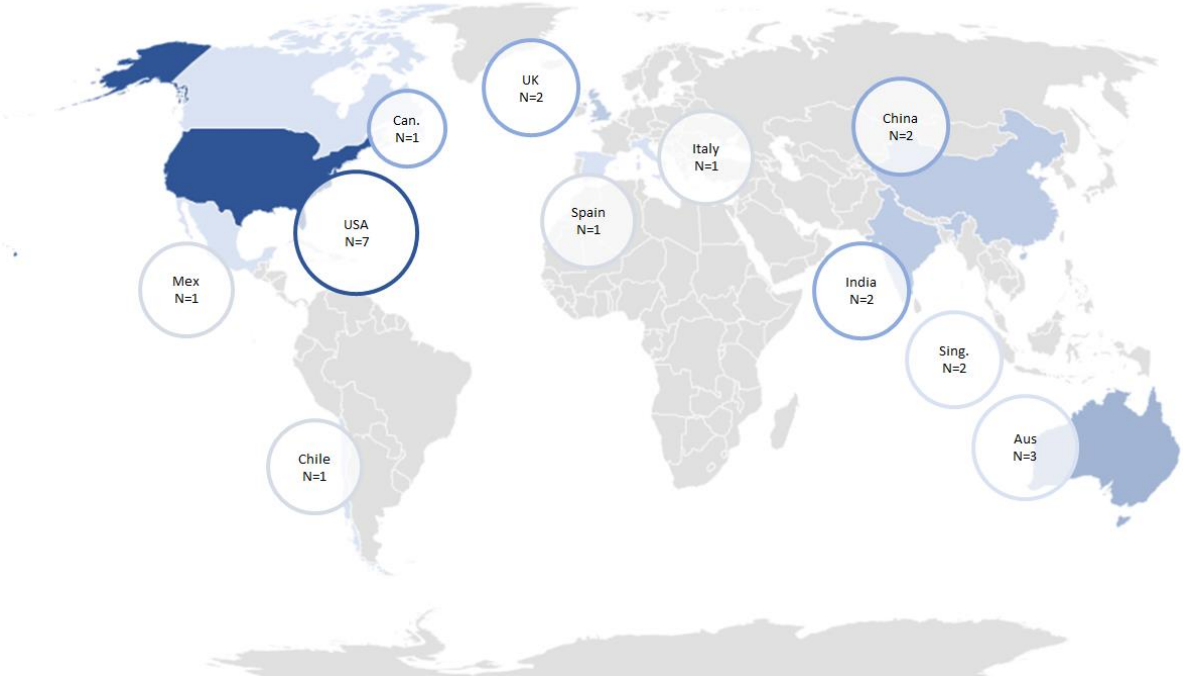
17. Penetrating injuries (stab wounds) to the limbs that are not contaminated and have no neurological or vascular deficit may be sutured in the ED, minor procedure area or fracture clinic.
18. Abscesses in patients without systemic sepsis may be incised and drained under local anaesthetic in the ED, minor procedure area or fracture clinic.
19. Specific to Hand injuries[21]:
    a. If possible, arrange additional outpatient or minor operations space to perform manipulations and surgeries under local anaesthetic.
    b. Aim to perform all hand and wrist surgery under local anaesthetic block or "wide-awake local anaesthetic no tourniquet" (WALANT).
    c. Consider leaving K-wires un-buried to reduce the need for an additional procedure for wire removal.
20. Specific to Pediatric injuries[21,36,115]:
    a. Consider the possibility of non-accidental injury[115].
    b. Children with the following suspected diagnoses may be managed without radiology at presentation: Soft tissue injuries; wrist, forearm, clavicle and proximal humeral fractures; long bone fractures with clinical deformity; foot fractures without significant clinical deformity and swelling.
    c. The following injuries may be managed without a cast at presentation: Knee ligament and patellar injuries may be managed with bracing; stable ankle fractures may be managed with a fixed ankle boot or softcast; hindfoot, midfoot and forefoot injuries may be managed with a fixed ankle boot or plaster shoe.
    d. A single follow-up appointment at 4 to 12 weeks, depending on the limb or bone fractured, is acceptable for the majority of injuries. Patient-initiated follow-up is appropriate for the following conditions[21]: Patellar subluxations and dislocations, knee ligament and meniscal injuries, excluding locked knees; lateral malleolar fractures and suspected ankle avulsion fractures; foot injuries, except suspected mid- and hindfoot injuries; wrist, forearm, clavicle and humeral fractures, including proximal humerus and; Gartland type 1 and 2 supracondylar fractures.
    e. Many children's injuries may be definitively managed in a cast at presentation. Wherever possible, use reinforced Softcast for home removal.
    f. Consider sedation for reduction of clinically important deformity.
    g. Accept that residual deformity or malunion may require corrective surgery.

21.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 23 publications that addressed the topic. Publication dates ranged from March 16 to April 28, 2020 (search conducted May 25, 2020).

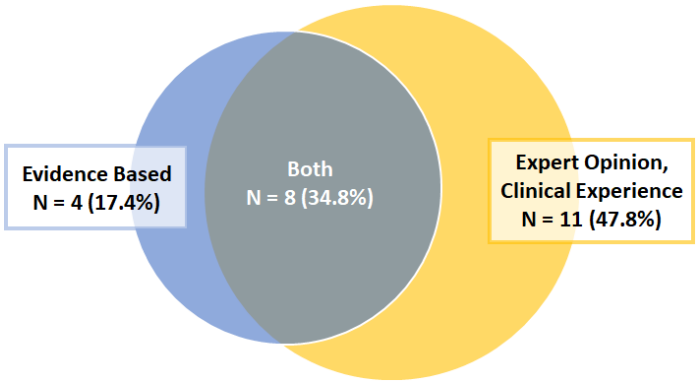


Recommendations were from 11 countries (USA, N=7; Australia, N=3; United Kingdom, China, India, Singapore, N=2; Canada, Chile, Spain, Italy, Mexico, N=1).



EVIDENCE BASE

Of the 23 publications, 9 (39.1%) were developed by surgical or orthopaedic societies/associations, 12 (52.2%) were developed by academic health care institutions/hospitals, and 2 (8.7%) was developed by a national public health entity. In 5 publications, the authors within the working groups were not reported. Eighteen publications (78.3%) provided contributor lists, which consisted of 113 clinicals experts or researchers in total.



Of the 23 publications, 11 (47.8%) were developed based on expert opinion and/or clinical experience, 4 (17.4%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 8 (34.8%) were developed based on a combination of both evidence-based methods and expert opinion.

The Rating of Recommendations using a GRADE[4] approach:

Urgent/Emergent inpatient and surgical care recommendations

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

PART 7: BEST PRACTICES
PERI-OPERATIVE CARE

Key Findings

[Strong recommendation for, fair quality] for every recommendation in this box

- Utilize COVID-free (for non-urgent patients) and COVID-managed (for urgent/emergent patients) care pathways, each with its own infrastructure diagnostics and staffing.
- Develop a dedicated operating room to manage COVID-19 patients (designated OR)*:
    - Away from high traffic areas.
    - With a physical anteroom or taped-off area.
    - With strictly minimal traffic within the designated OR.
    - Set up with negative pressure ventilation. If not available, turn off the positive pressure system and air conditioning.
- For patients with suspected or confirmed COVID-19 requiring urgent surgery, ensure there is clear physical access from specific waiting area to the designated OR (designated transport pathways)*.
- Donning and doffing of PPE should be done in the anteroom before entering the OR.
- Allocate time between procedures to allow staff and the operating room to go through proper decontamination procedures.
- Ensure clear channels of communication between the anesthesia and infectious disease teams to discuss any potential or confirmed COVID-19 patients.
- Develop clear policies and procedures for airway management for known or suspected COVID-19 patients requiring intubation.
    - Follow precautions for aerosol generating medical procedures (AGMP)
- Utilize regional anesthesia whenever possible. If a general anaesthetic is the only option, ensure that only the minimal number of personnel needed to safely intubate/extubate the patient are in the OR during induction and reversal of anesthesia. All personnel should be in appropriate PPE for AGMPs (including N95/FFP2 masks).
    - Controversy exists regarding the time required for the remaining staff to re-enter the OR after intubation/extubation if not wearing N95/FFP2 masks.
- There is controversy regarding AGMPs and COVID-19 transmission for orthopaedic surgery on the extremities involving high-speed devices (e.g., saw, reamer, drill).

    - Although there is potential for aerosolization, blood-borne transmission of COVID-19 has not been shown to occur.
- Utilize absorbable sutures and removable splints and discharge information packages where possible to limit need for postoperative follow-up.
- COVID-19 patients should be recovered in the OR until they can be transferred to an isolation room, bypassing the post anesthesia care unit.
- Perform a thorough terminal disinfection of the designated COVID OR after each case.
- Stagger surgical teams to reduce the number of surgeons simultaneously clinically active in the hospital to decrease exposure risk and preserve staff. Have separate staff for COVID-free and COVID-managed care pathways if possible. Develop redundancy in backup schedules for providers in COVID-managed pathways who may become ill or exposed, and require quarantine.

*Details in full report.

The NHS recommends the separation of care paths for COVID-free ("Green") and COVID-managed ("Blue") based on COVID status, and urgency of procedures. All non-urgent procedures should receive care in the COVID-free pathways following appropriate testing/isolation measures. Each pathway should have its own infrastructure, diagnostics and staff. Those patients requiring urgent/emergent procedures of unknown COVID status (or are COVID-positive) receive care in the COVID-managed pathways, with risk mitigation as outlined in this section[145].

Risk mitigation pre-operatively

1. When preparing surgical operations for suspected or confirmed patients, the ORs and staff PPE recommendations are to:
    a. Develop a dedicated operating space to manage COVID-19 patients[23,45,86,92,94,113,133,145,153]. The development of a dedicated COVID-19 OR may help to contain the spread of disease. An optimally designed dedicated OR would have the following key features[23,94]:
        i. Away from high-traffic areas and be completely emptied of all non-essential materials[30,102].

ii. When an anteroom is available, this should be used as an area for donning and doffing of PPE and exchange of equipment, medications and materials for the case[133]. Instructional posters on appropriate procedures should be prominently displayed[38]. If an anteroom is not available, a taped-off area should be clearly marked for these activities just outside of the OR door.

iii. No unnecessary items should be brought into the OR (e.g.: pagers, cell phones, pens). Disposable pens should be provided in the room. Disposable caps and shoe covers should be worn and discarded after each case. Only the materials necessary for the case should be within the OR and all disposables should be discarded at the end of the case.

iv. Traffic in and out of the OR should be minimized[24,85,92,94,102]. A "runner" or support staff should be dedicated to the OR to provide all materials needed throughout the case, with exchanges performed using a material exchange cart placed immediately outside of the OR or in the anteroom[31].

b. Patients should wait in an isolation waiting area, and be transferred from there directly to the dedicated OR[12,86].

c. Ensure clear channels of communication between the anesthesia and infectious disease teams to discuss any COVID-19 transferred to the dedicated OR[12].

d. Normally, within the ORs the direction of airflow should be from the OR to the hallway (positive pressure) to minimize contamination of the surgical field. In some hospitals, there are ORs with reversible airflow or pressure, whereas others have positive-pressure rooms with a negative pressure anteroom. Conversion of the OR to negative pressure will likely require consultation with the OR engineering and maintenance team[45].

e. The dedicated OR and anteroom should be equipped with a negative pressure system, and an appropriate level of negative pressure must be ensured[12,24,30,38,45,86,92,94,100]. This negative pressure OR should have a minimum of 6 air changes per hour[25]. Air from the OR should be exhausted to the outside or filtered through a high-efficiency particulate air (HEPA) filter before recirculation[25,38,92,94,100].

f. Verify the temperature, humidity and air pressure in the OR. If negative pressure ORs are unavailable, the positive pressure system and air conditioning must be turned off[8,12,30].

g. All surgical personnel should put on their PPE in the anteroom before entering the OR. Put on double caps, medical mask or respirator (N95/FFP3), goggles or face shield, protective isolation gown, boot covers, latex gloves, and powered air-purifying respirator (PAPR) as needed for droplet or aerosol

precations[8,30,38]. When long surgeries are plannified (> 3-4 hrs), prefer the use of PAPR[139].

h. The surgeons and scrub nurses should wear disposable sterile operating gowns and gloves in addition to the PPE[8].
i. Patients should wear disposable caps and disposable surgical masks[8,86].
j. The current surgical helmets are not protective against spread of virus, as learnt during the 2012 SARS epidemic[100,131].

2. Allocate time between procedures to allow staff and the operating room to go through proper decontamination procedures.
3. The path of the patient to and from the operating theater should be kept clear[133]. This can be done using either security or a surgical team member travelling in advance of the patient to clear the way.

Anesthesia procedures

1. An anesthesia machine should be designated for a dedicated COVID OR. Replace the circuit filter after every 3 to 4 h of anesthesia use[12].
2. Develop policies and procedures for airway management for potential COVID-19 patients requiring emergent intubation[16].
3. Aerosolization and droplet transmission of the COVID-19 virus are important hazards for surgical personnel, with increased risk during endotracheal intubation[6,27,119]. Whenever possible, regional or local anesthesia is preferable[92,101,133].
4. A powered, air-purifying respirator (PAPR) should be worn during induction and reversal of anesthesia for all personnel within 2 m of the patient[31,133].
5. Surgeons and personnel not needed for intubation should remain outside the OR (only the anesthesiologist and the assistant in the OR) while intubating patients with or suspected COVID-19 infection[6,45,108,131].
6. Controversy exists regarding the time required for the remaining staff to re-enter the OR after intubation/extubation[43,45]. Waiting times recommendations should be reviewed locally based on the rate of air exchange of the OR's to address any viral particles that could be released into the air[45] (most guidelines/institutions recommend between 15-20 minutes)[136,140].
7. In the event that the surgeon feels that the patient would be harmed by this waiting outside, they should enter the OR with appropriate PPE.
8. During the procedure, a runner is stationed outside the OR if additional drugs or equipment are needed. These are placed onto a trolley that will be left in the anteroom for the OR team to retrieve. This same process in reverse is used to send out specimens such as arterial blood gas samples and frozen section specimens. The runner wears PPE when entering the anteroom.

During surgical procedures

1. A thorough timeout must be done that includes the COVID-19 status of the patient[28,133].
2. In patients without suspected COVID-19, N95/FFP3 masks are not required to be worn by anyone in the room other than the anesthesiologist and the person assisting with intubation[93], unless the surgical procedure itself is an aerosol-generating medical procedure (AGMP). A regular surgical mask is appropriate when entering the OR following intubation in patients without suspected COVID-19 infection. However, in areas of high prevalence of COVID-19 infection (> 100 cases per 100.000 people) a N95/FFP3 mask or PAPR should be worn even in asymptomatic patients[131].
3. Consideration should be given to surgical approaches that could decrease operating staff exposure and shorten case duration[28].
4. For all procedures in the OR, donning an additional pair of gloves is recommended, as resources allow[38,92].
5. There is controversy regarding AGMPs and COVID-19 transmission for orthopaedic surgery on the extremities involving high-speed devices (e.g.: saw, reamer, drill)[21,38,92,102,119].
    a. Although there is potential for aerosolization, blood-borne transmission of COVID-19 has not been proven to occur (despite RNA virus has been detected in blood samples)[92,131].
    b. The use of high-speed devices generates a significant amount of aerosols, increasing the risk of viral contamination of the environment[95,101,119,131].
    c. Until further evidence is available, it has been suggested that decreasing saw or drill velocity may be beneficial to reduce bone aerosols[84,102,131]. Alternatively consider using Gigli saw, sharp osteotomes, and manual reaming[102].
    d. Consider placing transparent plastic covers over wounds when drilling to reduce blood and fluids splatter and avoid pulsatile lavage[133,156].
6. Use a smoke evacuator when electrocautery is used[6,11,30,31,102,131]. Power settings of electrocautery should be as low as possible[113,131]. Avoid long dissecting times on the same spot by electrocautery or ultrasonic scalpels to reduce the surgical smoke[11,102].
7. When handling surgical instruments[28]:
    a. Avoid sharp objects to a maximum, manipulation will be done with instruments, never directly with the hands.
    b. Use verbal cues for transferring instruments, avoid hand to hand transfers, use the mayo tray or a magnetic sheet. Do not place sharp objects on the mayo tray unless previously deemed a neutral zone.
    c. Maximize the use of alternative cutting mechanisms such as the electrocautery.
    d. Dispose of sharp objects in a designated container.

8. Use absorbable sutures to avoid unnecessary visits[21,28,45,102,115,156]. Consider using transparent film dressings (i.e. Tegaderm) to facilitate checking the wounds post-operatively remotely or in person[36].
9. Use easily removable post-operative dressings and splints[45,118] so remote follow-up may be performed by rehabilitation team[21].
10. Provide discharge packs for patients with dressing packs, dressings, antibiotics, analgesia, written self-follow-up instructions on wound care and where to find on-line therapy resources[21].

After surgical procedures

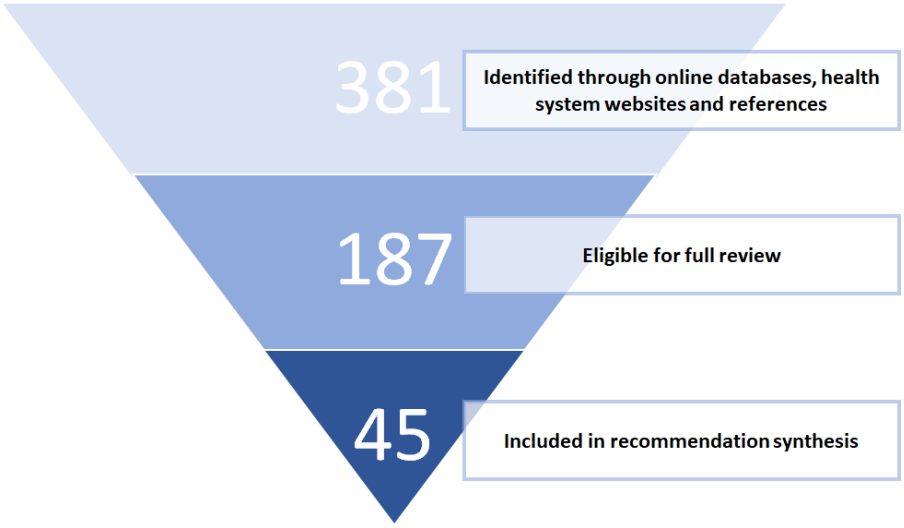
1. Patients with COVID-19 should be recovered in the OR with dedicated staff until they can be transferred to an isolation room on the ward or in the intensive care unit (ICU) bypassing the post anesthesia care unit[12,83,92,102,107,133]. During transfer, minimize the staff needed and wear different PPE from that worn during the procedure[6,86].
2. Known or suspected COVID-19 patients must wear a surgical mask or N95/FFP2 mask and be covered with a disposable operating sheet[139]. They should be transferred through dedicated corridors and elevators[139]. The surfaces of passageways and the elevators should be cleaned and covered[12,86].
3. Procedures for Final Disinfection of the designated OR[8,28,94,102,140]:
    a. Medical waste shall be disposed of as COVID-19 related medical waste.
    b. Reusable medical devices shall be disinfected according to the disinfection procedures of COVID-19 related reusable medical devices.
    c. Medical fabrics shall be disinfected and disposed of according to the disinfection procedures for COVID-19 related infectious fabrics.
    d. Surfaces of objects (instruments and devices including device table, operating table, operating bed, etc.): Visible blood/bodily fluid pollutants shall be completely removed before disinfection; all surfaces shall be wiped with a disinfectant containing 1000 mg/L active chlorine and allowed to sit for 30 minutes with the disinfectant; all unused items on the drug tray and airway trolley should be assumed to be contaminated and discarded.
    e. As an added precaution, after confirmed COVID-19 cases, a hydrogen peroxide vaporizer may be used to decontaminate the OR[30].
    f. Floors and walls: Visible blood/bodily fluid pollutants shall be completely removed before disinfection; all surfaces shall be wiped with a disinfectant containing 1000 mg/L active chlorine and allowed to sit for 30 minutes with the disinfectant.
    g. Indoor air: Turn off the fan filter unit (FFU). Disinfect the air by irradiation by ultraviolet lamp for at least 1 hour. Turn on the FFU to purify the air automatically for at least 2 hours.

4. Personnel exiting the OR should discard their used gowns and gloves in the anteroom and perform hand hygiene before leaving the anteroom. Any PAPR or N95/FFP3 masks will be removed outside the anteroom[30].

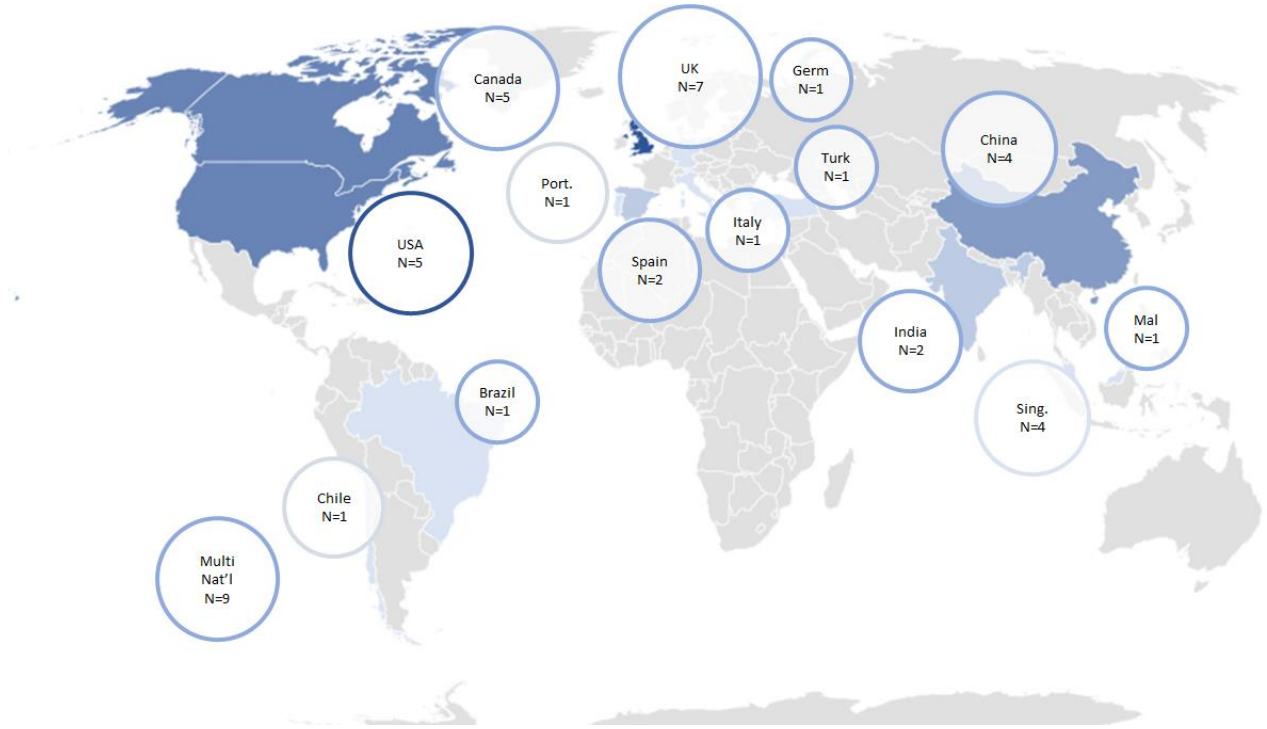
Human resources

1. Surgical assists should be kept to an essential minimum[5,30,45,86,91,102,107,108,118,136] as should the practice of any team member scrubbing in and out of a case in an effort to preserve OR resources. Trainees, in particular, should not be involved with cases unnecessarily[23].
2. Consider discouraging sales representative presence in the OR unless critical for patient care[45].
3. When possible, restructure trauma teams and stagger cohorts to reduce the number of providers exposed in COVID-managed care pathways. This measure can decrease exposure risk and preserve staff[16]:
    a. Develop redundancy in backup schedules for providers who may be ill or exposed[141]. A survey conducted in Germany showed that on average, 2.1% ± 5.8% of the orthopaedic surgeons became infected with SARS-CoV-2[147].
    b. Develop a mechanism to monitor the well-being of team members who have had potential COVID-19 exposure or who are on quarantine.
4. Consider the designation of a “lead consultant”[26].
    a. This duty can be for one day, a few days or even five days in small units. This is an essential role during crisis management. It cannot be performed by the consultant ‘on-call’ or the consultant in the fracture clinic or the consultant in OR.
    b. They must be free of clinical duties and the role involves coordination of the whole service from the ED through to OR scheduling and liaison with other specialties and managers.
    c. The daily trauma conference should include an update on logistics; identifying problems and those tasked to deal with them.
5. All staff should shower before resuming their regular duties after being in an OR of a suspected/confirmed COVID-19 patient[30].

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 45 publications that addressed the topic. Publication dates ranged from March 6 to June 1, 2020 (search conducted May 25, 2020).



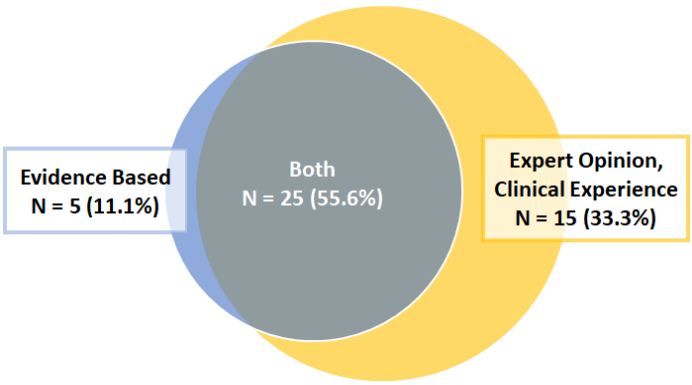
Recommendations were from 13 countries (United Kingdom, N=7; USA, Canada, N=5; Singapore, China, N=4; India, Spain, N=2; Chile, Portugal, Brazil, Italy, Turkey, Malaysia, Germany, N=1; multiple countries, N=9).



EVIDENCE BASE

Of the 45 publications, 12 (26.7%) were developed by surgical or orthopaedic societies/associations, 31 (68.9%) were developed by academic health care institutions/hospitals, and 2 (4.4%) were developed by national/local public health entities. In 10 publications, the authors within the working groups were not reported. Thirty-five publications (77.8%) provided contributor lists, which consisted of 313 clinicals experts or researchers in total.

Of the 45 publications, 15 (33.3%) were developed based on expert opinion and/or clinical experience, 5 (11.1%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 25 (55.6%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE[4] approach:

Peri-operative care

Standard	Rating
Establishing transparency	Good
Management of conflicts of interest of recommendation developers	Good
Recommendation development group composition	Good
Recommendation development (evidence-based)	Good
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Good
External review	Not reported
Updating	Good
Implementing issues	Not reported

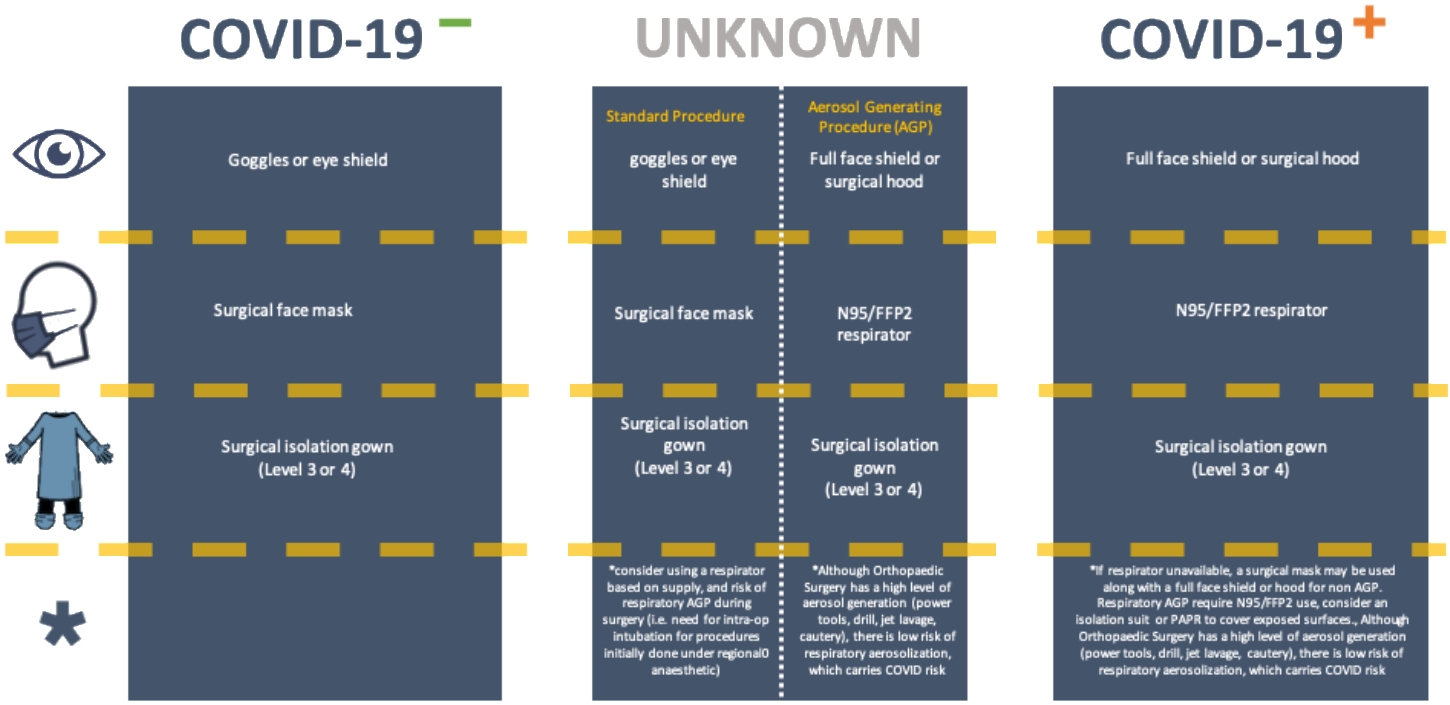
PART 8: FIGURES AND TABLES

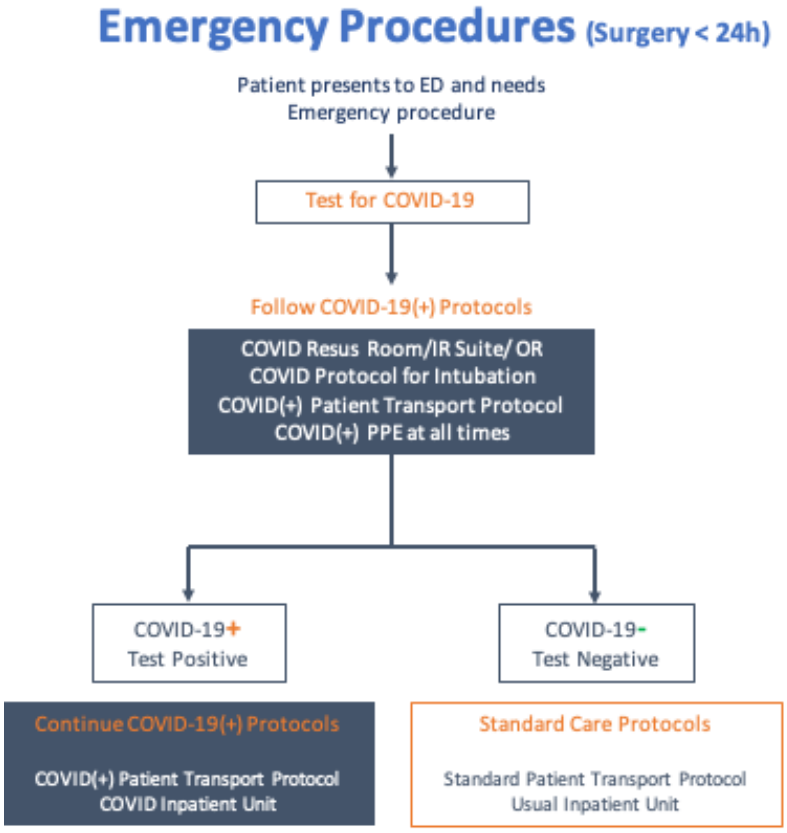
Table 2: Suggested urgency for common orthopaedic procedures[21,41,46, 91,114,126,130,131,133, 136]

Ortho Sub-specialty	< 24h (Emergent)	< 48-72hs (Urgent)	< 2 weeks (Expedited semi-urgent)	< 3-months (semi-urgent)	>3-months (non-urgent)
TRAUMA	- Open fractures - Young adult femoral neck fractures - Pelvic ring fractures with bleeding/HD instability - Fractures with vascular injury - Fractures with neurologic compromise - Compartment syndrome - Irreducible joint dislocations - Necrotizing fasciitis - Closed fractures with impending soft tissue compromise - External fixation for complex fractures	- Elderly femoral neck/ intertrochanteric fractures - Talar neck fractures - Femoral shaft fractures - Distal femur fractures - Tibia shaft fractures	- Operative Clavicle fractures - Operative scapula fractures - Operative humerus fractures - Operative radius/ulna fractures - Operative tibial plateau fractures - Operative ankle fractures - Pelvis and acetabulum fractures - Closure/flap coverage of open fractures - Repairable osteochondral fractures	- Non-union/ malunion impacted ability to weight bear/mobilize - rapidly progressive AVN	- Non-union/ malunion reconstruction - Symptomatic hardware removal
SPINE	- Dislocated cervical facets - Spinal cord injury - Epidural abscess - Epidural hematoma -steomyelitis with instability/ sepsis	- Cauda Equina - unstable cervical/ thoracic/ Lumbar fractures - repair CSF leak	- Operative but stable cervical/ thoracic/ lumbar fractures - infections refractory to medical management with potential neuro compromise or instability - Radiculopathy with functional weakness - Instrument failure	- Operative lumbar disc hernia with radiculopathy - Operative cervical radiculopathy - Cervical myelopathy - Stenosis with functional deficits	- Spondylolis- thesis - Cervical/Lumbar spinal stenosis but function
ONCOLOGY	- Operative spine tumor with cord compression	- Impending pathologic fractures	- Sarcomas in treatment windows - Operative benign aggressive tumors		
SHOULDER/ ELBOW					- Shoulder arthroplasty - Elbow arthroplasty - Arthroscopy

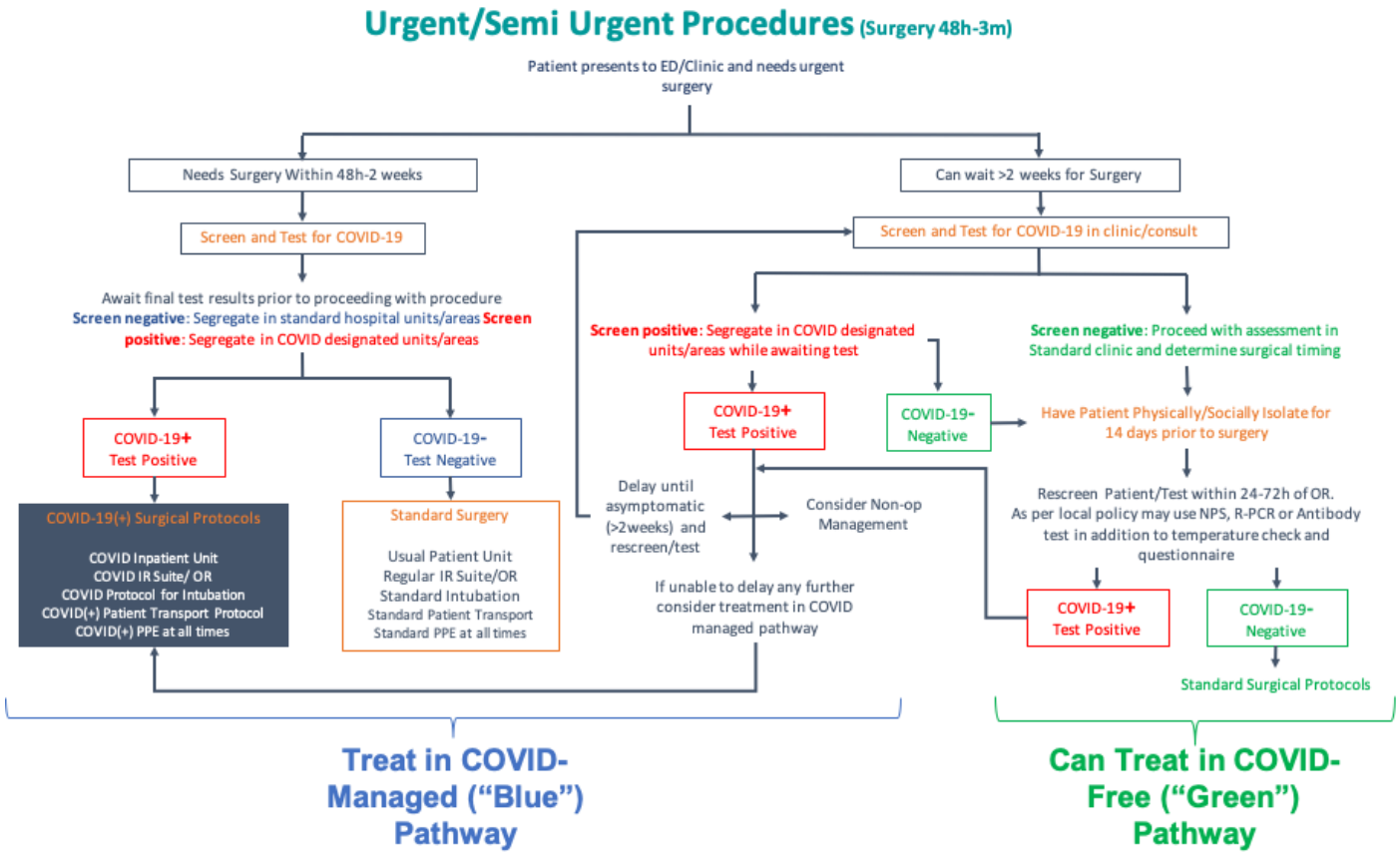
HAND & WRIST	- Acute Carpal tunnel syndrome - Pyogenic flexor tenosynovitis - Digit replants - Irreducible joint dislocation		- Operative hand/ wrist fractures (including scaphoid) - Tendons and ligament injuries	- Ulnar nerve compression - Progressive Carpal tunnel	- Trigger finger - Chronic Carpal Tunnel - Dupuytren's release - Scaphoid non-union - Arthroplasty /fusion - Scapholunate dissociation - TFCC Tears
ADULT RECON	- Acute arthroplasty infection (septic patient) - Irreducible joint dislocation	- Periprosthetic fractures	- Sub-acute arthroplasty infection - catastrophic implant failure	- Loosening or failure of knee arthroplasty - Loosening or failure of hip arthroplasty - arthroplasty for acute/rapidly progressive AVN	- Knee arthroplasty - Hip arthroplasty - Proximal tibial/ distal femur osteotomies
FOOT & ANKLE		- uncontrolled diabetic foot infections/gangrene	- Operative foot fractures - major tendon ruptures (ie. Tib ant, EHL)		- Ankle arthroplasty/ fusion - Foot fusions - Deformity correction - Ligamentous injuries with ongoing instability - Ankle arthroscopy
SPORTS	- External fixation of knee dislocation		- Operative major tendon tears - Acute loose body removal - Locked knee from displaced meniscal tears - Ligament avulsion repairs - Operative Complete AC dislocation	- Multi-lig recon - Rotator cuff repair in young patient/laborers, or large tear with pseudoparalysis	- ACL Recon - Cartilage repair/regen - Chronic rotator cuff repair - Labral repair - Tendonitis - Hip impingement procedures - Recurrent shoulder instab. needing stabilization - Patellofemoral stabilization
PEDIATRICS	-Open fractures -Hip fractures/ dislocations -Supra Condylar humeral fractures with vascular compromise -Slipped Capital Femoral Epiphysis -Tibia fractures with vascular compromise	- femur and tibial shaft fractures	- Most operative pediatric fractures - Ligament avulsion repairs	- ACL recon - scoliosis correction (immature curve >90deg)	- deformity correction (including most scoliosis surgery)
MISC	-Septic arthritis	- Infected/septic bursitis - uncontrolled osteomyelitis			

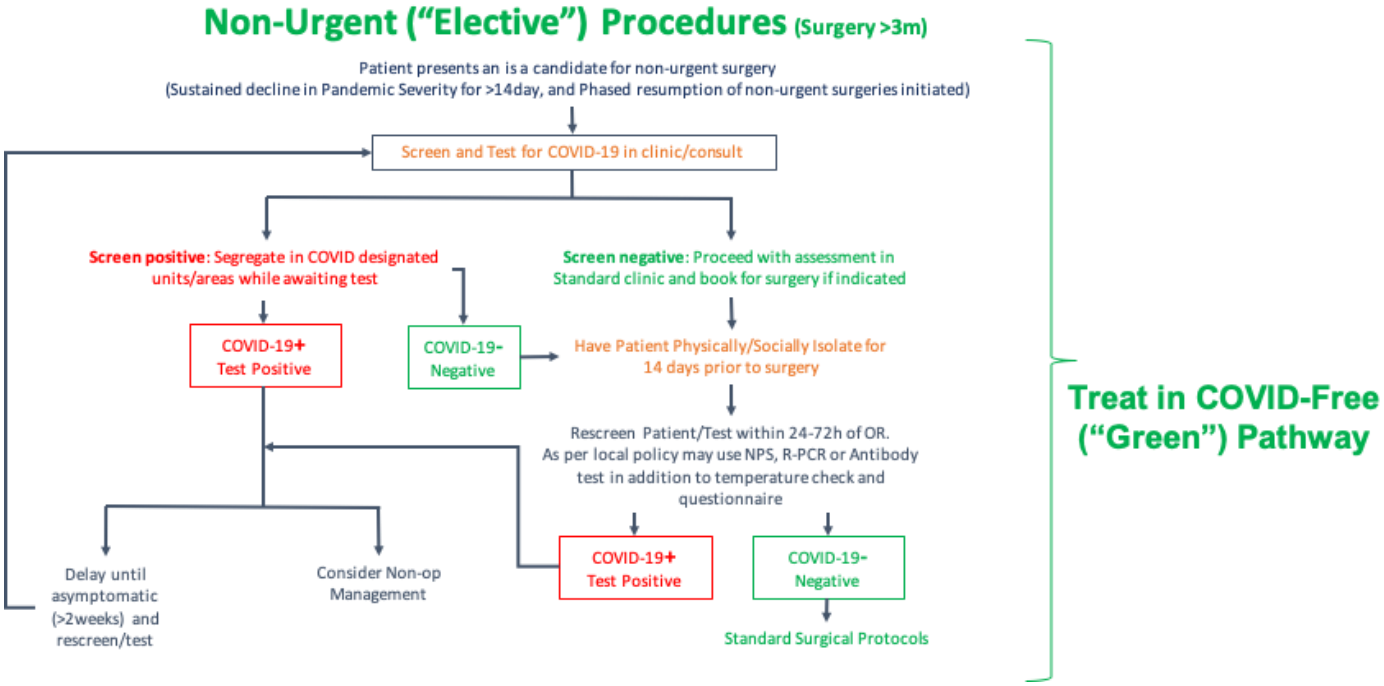
PPE for Surgical Procedures

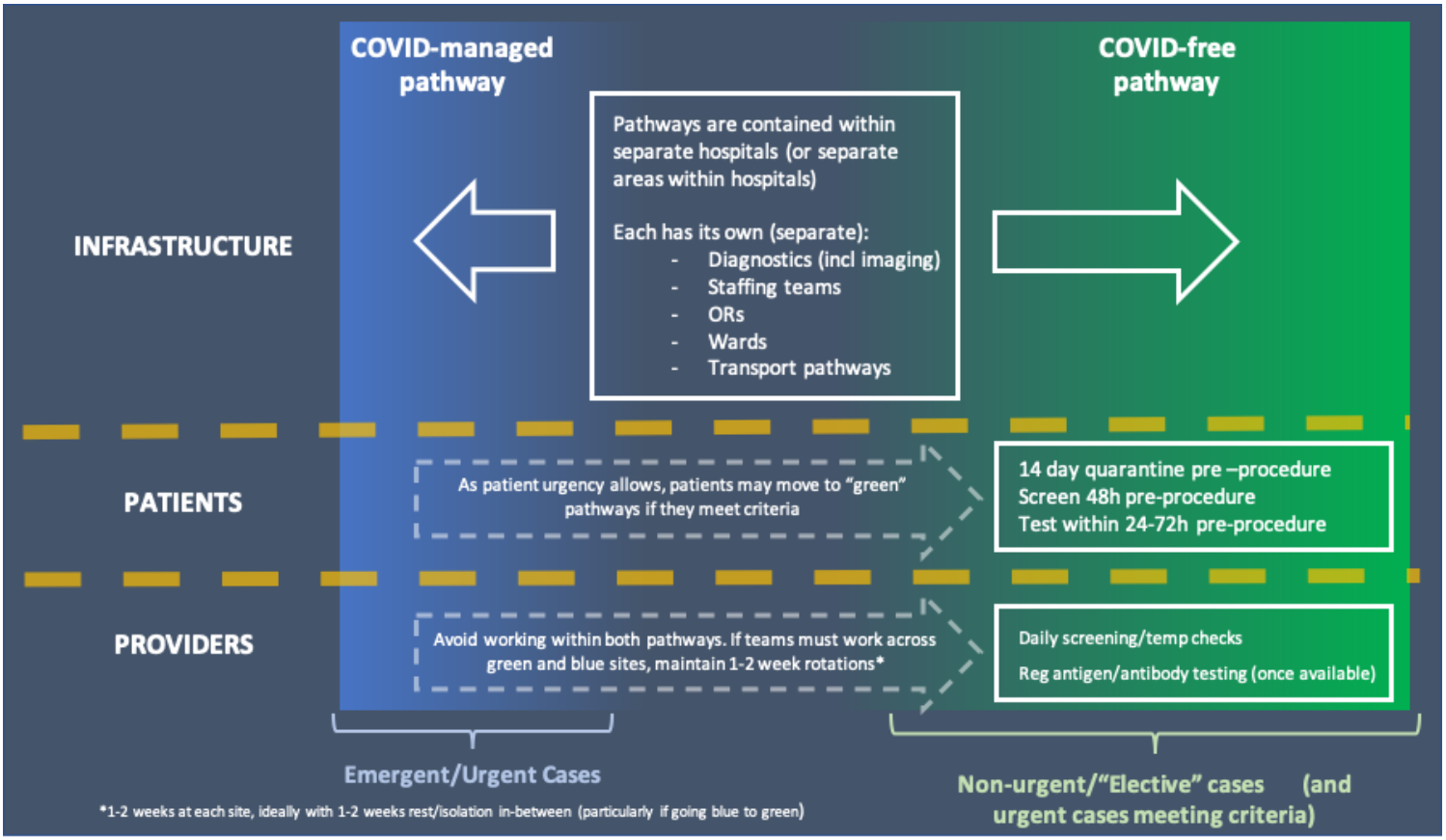




Treat in COVID-Managed ("Blue") Pathway


Urgent/Semi Urgent Procedures (Surgery 48h-3m)
Patient presents to ED/Clinic and needs urgent surgery
Needs Surgery Within 48h-2 weeks
Can wait >2 weeks for Surgery
Screen and Test for COVID-19
Screen and Test for COVID-19 in clinic/consult
Await final test results prior to proceeding with procedure
Screen negative: Segregate in standard hospital units/areas Screen positive: Segregate in COVID designated units/areas
Screen positive: Segregate in COVID designated units/areas while awaiting test
Screen negative: Proceed with assessment in Standard clinic and determine surgical timing
COVID-19+ Test Positive
COVID-19- Test Negative
COVID-19+ Test Positive
COVID-19- Negative
Have Patient Physically/Socially Isolate for 14 days prior to surgery
COVID-19(+) Surgical Protocols
COVID Inpatient Unit
COVID IR Suite/ OR
COVID Protocol for Intubation
COVID(+) Patient Transport Protocol
COVID(+) PPE at all times
Standard Surgery
Usual Patient Unit
Regular IR Suite/OR
Standard Intubation
Standard Patient Transport
Standard PPE at all times
Delay until asymptomatic (>2weeks) and rescreen/test
Consider Non-op Management
If unable to delay any further consider treatment in COVID managed pathway
Rescreen Patient/Test within 24-72h of OR. As per local policy may use NPS, R-PCR or Antibody test in addition to temperature check and questionnaire
COVID-19+ Test Positive
COVID-19- Negative
Standard Surgical Protocols
Treat in COVID-Managed ("Blue") Pathway
Can Treat in COVID-Free ("Green") Pathway


Non-Urgent ("Elective") Procedures (Surgery >3m)
Patient presents an is a candidate for non-urgent surgery
(Sustained decline in Pandemic Severity for >14day, and Phased resumption of non-urgent surgeries initiated)
Screen and Test for COVID-19 in clinic/consult
Screen positive: Segregate in COVID designated units/areas while awaiting test
Screen negative: Proceed with assessment in Standard clinic and book for surgery if indicated
COVID-19+ Test Positive
COVID-19- Negative
Have Patient Physically/Socially Isolate for 14 days prior to surgery
Rescreen Patient/Test within 24-72h of OR.
As per local policy may use NPS, R-PCR or Antibody test in addition to temperature check and questionnaire
Delay until asymptomatic (>2weeks) and rescreen/test
Consider Non-op Management
COVID-19+ Test Positive
COVID-19- Negative
Standard Surgical Protocols
Treat in COVID-Free ("Green") Pathway


COVID-managed pathway
COVID-free pathway
Pathways are contained within separate hospitals (or separate areas within hospitals)
Each has its own (separate):
- Diagnostics (incl imaging)
- Staffing teams
- ORs
- Wards
- Transport pathways
INFRASTRUCTURE
PATIENTS
As patient urgency allows, patients may move to "green" pathways if they meet criteria
14 day quarantine pre –procedure
Screen 48h pre-procedure
Test within 24-72h pre-procedure
PROVIDERS
Avoid working within both pathways. If teams must work across green and blue sites, maintain 1-2 week rotations*
Daily screening/temp checks
Reg antigen/antibody testing (once available)
Emergent/Urgent Cases
Non-urgent/"Elective" cases (and urgent cases meeting criteria)
*1-2 weeks at each site, ideally with 1-2 weeks rest/isolation in-between (particularly if going blue to green)

PART 9: BEST PRACTICES
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Disclaimer & Conflict of Interest
All authors declare no conflicts of interest in the development of these Best Practices.

PART 10: BEST PRACTICES
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APPENDIX

VERSION HISTORY

Version, date	Publications (N)	Countries, contributors	Type of developers, associations/institutions /public health entities, N (%)	Type of development methods, expert opinion/evidence-based/both, N (%)
1.0 Apr 11	72	11 countries 141 authors	16 (22%) / 19 (27%) / 37 (51%)	53 (74%) / 5 (7%) / 14 (19%)
2.0 Apr 22	83	14 countries 189 authors	19 (23%) / 24 (29%) / 40 (48%)	59 (71%) / 5 (6%) / 19 (23%)
3.0 May 27	150	18 countries 625 authors	43 (29%) / 64 (42%) / 43 (29%)	94 (63%) / 17 (11%) / 39 (26%)

SEARCH STRATEGY

The search strategy used is detailed below:

1	Pneumonia, Viral/ or Coronavirus Infections/ or covid.mp. or Betacoronavirus/
2	Practice Guideline/ or Guideline/
3	healthcare recommendation.mp.
4	surg*.mp. or General Surgery/
5	2 or 3
6	1 and 4 and 5
7	remove duplicates from 6