

# Best Practices for Surgeons

**COVID-19 Evidence-Based Scoping Review  
A Unifying Report of Global Recommendations**

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## PART 1: BEST PRACTICES OBJECTIVES AND METHODOLOGY

### THE PROBLEM

In the midst of the rapidly unfolding COVID-19 pandemic<sup>1</sup>, public initiatives and solutions need to be quickly identified and implemented on a large scale. There is an urgent need for protocols to guide clinical decision-making in settings focused on keeping the burden of novel coronavirus illness within the capacities of health-systems around the world<sup>2</sup>. However, the haste to disseminate information may threaten the overall quality of these recommendations, and limit confidence in their potential impact. Ideally, surgeons would be able to make clinical decisions based on the best available evidence, local resource availability and patient priorities, all of which may be quite dynamic as the coronavirus pandemic evolves (Figure 1).



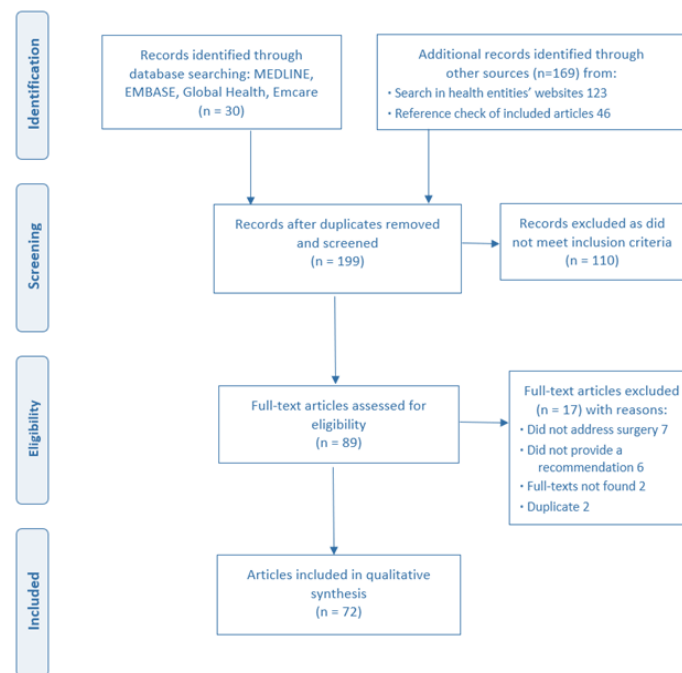
Figure 1. Impact of the COVID-19 pandemic on evidence-based decision making.

### THE APPROACH

To help navigate this challenge, we set out to examine current recommendations relevant to orthopaedic management during the COVID-19 pandemic. Through critical-review, we aimed to put forth evidence-based principles to guide musculoskeletal (MSK) care decision making in the face of acute resource scarcity and substantial opportunity costs as health-systems confront the coronavirus pandemic. We conducted a systematic mapping review of the published information and developed peer-reviewed recommendations intended to help the surgical community dealing with COVID-19 patients in key areas of orthopaedic management.

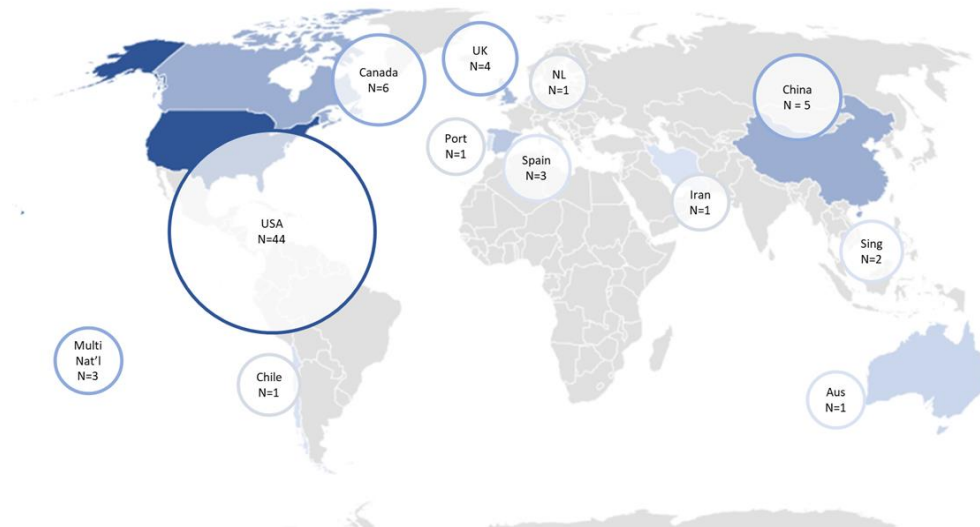
## THE SEARCH

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 72 eligible publications that reported on recommendations for orthopaedic surgeons during the COVID-19 pandemic (Figure 1). Publication dates ranged from February 29 to April 11, 2020 (search conducted April 11, 2020). Sixty-nine publications were from 11 countries (USA, N=44; Canada, N=6; China, N=5; United Kingdom, N=4; Spain, N=3; Singapore, N=2; Australia, Iran, The Netherlands, Chile, Portugal, N=1, Figure 3). Three publications were collaborations from multiple countries. The publication lag (from date of first COVID-19 case recorded in the region<sup>3</sup> to date of recommendation publication) varied from 35 days (The Netherlands) to 87 days (China). We found reference to earlier departmental protocols in China, however, these were not available online.

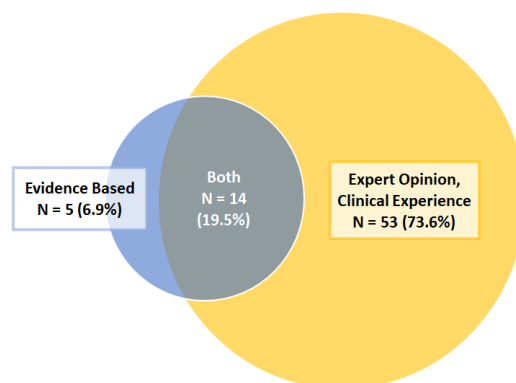


**Figure 3.** Country of origin for included guidelines and protocols

## THE EVIDENCE BASE

Of the 72 publications, 16 (22.2%) were developed by surgical or orthopaedic societies/associations, 19 (26.4%) were developed by academic health care institutions/hospitals, and 37 (51.4%) were developed by international/national/local public health entities. In 21 publications, the authors within the working groups were not reported. Forty-four publications (61.1%) provided contributor lists, which consisted of 141 clinicals experts or researchers in total.

Of the 72 publications, nearly three-quarters (N=53, 73.6%) were developed based on expert opinion and/or clinical experience, 5 (6.9%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 14 (19.5%) were developed based on a combination of both evidence-based methods and expert opinion (Figure 4)

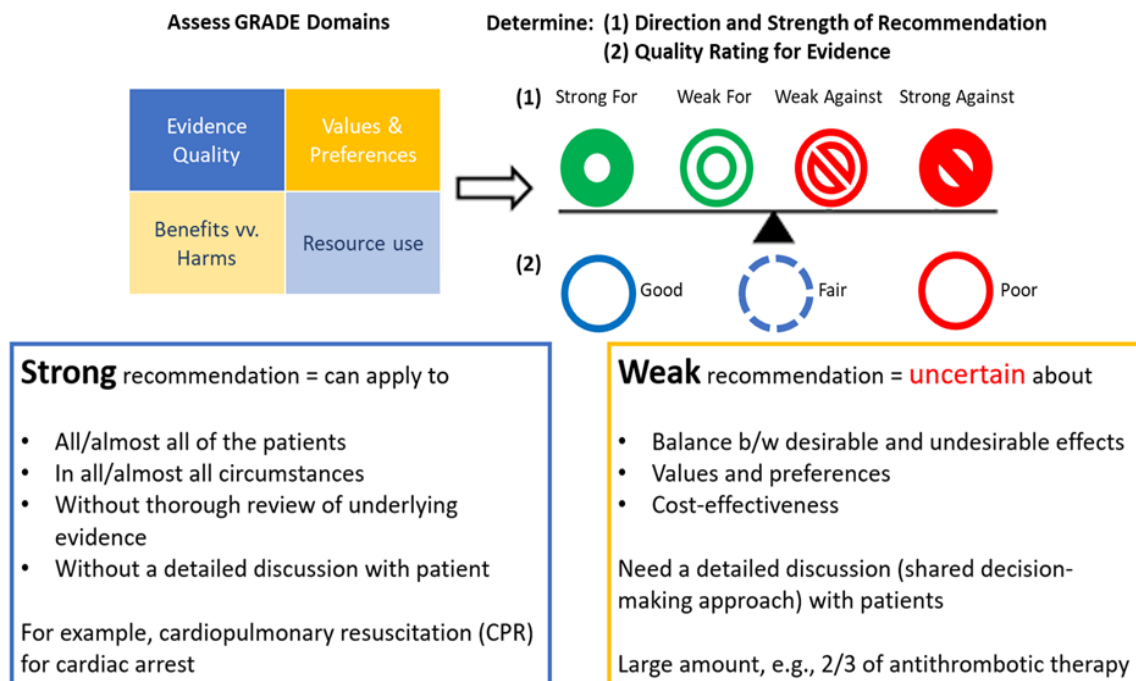


**Figure 4.** Method of recommendation development for included guidelines and protocols



## THE TOOLS

We assessed the strength and quality of each recommendation using the GRADE (Grading of Recommendations, Assessment, Development and Evaluation)<sup>4</sup> 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	Fair
Recommendation development (evidence-based)	Fair
Establishing evidence foundations and rating strength for each recommendation	Fair
Articulation of recommendations	Fair
External review	Not reported
Updating	Good
Implementing issues	Not reported

## THE TRADE-OFFS - BENEFITS AND HARMS

We suggest against the continuance of elective procedures while health systems are in the preparatory phase and in the midst of confronting the pandemic. While some systems have chosen to continue with regular or limited elective procedures<sup>5</sup>, we feel that this may pose substantial harm, and compromise a health system's response to a large-scale disaster such as COVID-19. In the lead up to dealing with the full burden of the pandemic, each system will need to work towards preservation of key items such as personal protective equipment (PPE)<sup>6,24</sup>, inpatient beds and critical care resources. The diversion away from elective procedures can assist in resource reallocation to needed areas during the pandemic, and limit patient traffic from potential asymptomatic carriers which may act as a source of unknown transmission in clinical settings. If elective procedures are to continue, have a pre-planned scale down linked to worsening pandemic severity in your region. Singapore provides an example, as their health system was guided by the Disease Outbreak Response System Condition' (DORSCON) scale, which consists of 4 different levels (Green, Yellow, Orange and Red)<sup>5</sup>. 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 elective 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 could be rapidly scaled down to urgent or emergent trauma or tumor cases only. While various health systems will differ in their ability to continue with elective orthopaedic services, to limit harm to health-care capacity during the pandemic, rapid cessation of non-urgent/emergent procedures should be strongly considered, and is supported by most guidelines<sup>10,18,22,23,27,32-34,41,43,44,46,48-77</sup>.

Further to this, when considering the management of urgent or emergent orthopaedic issues, it is imperative to only perform surgical interventions with documented superior treatment effects over non-operative management. 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 the COVID-19 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. Patients face a similar threat, and often have additional comorbidities placing them at increased mortality risk from severe acute respiratory syndrome-2 (SARS-2). Therefore, operative treatment must be expected to result in outcome benefits important enough to the patient to justify the substantial (and potentially fatal) risk of coronavirus exposure, in addition to the harms associated with compromising hospital capacity during the pandemic.

To facilitate distancing measures and ensure uninterrupted orthopaedic care, we support the establishment of rotating orthopaedic teams during the pandemic. Each team should consist of several surgeons and health-care team members available to provide urgent or emergent orthopaedic care for 1 to 2 weeks, ideally allowing for a 14 day isolation period between clinical rotations<sup>36,45</sup>. This will be dependent on the number of teams and availability of members for each team. As the severity of the pandemic escalates, 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 as it may occur, 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 (ie. how to optimize a rotating team).
- Identification of the ideal screening process for asymptomatic surgical patients.
- Determination of duration of aerosolization following intubation/extubation of a patient.
- Examination of the aerosolization or blood-borne transmission of COVID-19, and if/when it may be a concern during orthopaedic procedures (e.g: using cautery, reamers, saws, drills, etc).
- To determine optimal treatment strategies for urgent and emergent orthopaedic issues.
- To determine a process and set priorities for the reintroduction of scheduled elective surgery following the pandemic.

## PART 2: BEST PRACTICES OVERARCHING RECOMMENDATIONS

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

- Ensure patient and staff safety.
- Keep up-to-date regarding evolving clinical guidelines, as well as your institution capacity issues relative to regional pandemic severity.
- Prevent unnecessary use of PPE and prepare contingency plans for supply shortages.
- Only schedule urgent or emergent surgical cases.
- Only perform interventions with expected superior treatment effects over non-operative management relative to priority outcomes.
- 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

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#### 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]
- Individuals and institutions should follow general hygiene and distancing measures to limit spread of the disease\*. [Strong recommendation for, fair quality]
- Be prepared for supply shortages and develop contingency plans and policies to preserve personal protective equipment (PPE). [Weak 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]
- Surgeons may be asked to redeploy into unfamiliar (non-orthopaedic) roles. Prepare for this scenario 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\*. [Weak 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<sup>24</sup>. Frequently check and follow national and institutional guidelines<sup>21,41</sup>.
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<sup>16</sup>.
3. Stay situationally aware regarding patient load and other indicators of institutional capacity and resource needs during the pandemic<sup>16</sup>.
4. Hospitals need to be prepared to transfer patients between institutions and share resources in order to optimize the care of regional populations<sup>23</sup>.

### *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<sup>16</sup>.
2. Limit/restrict patient visitors in clinical settings, and screen all patients and personnel entering clinics and hospitals.
3. When possible, separate known or suspected COVID-19 patients from other patients (i.e. designating COVID-19 Specific Clinic areas, Wards, and ORs)<sup>17,18</sup>.
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<sup>6,16,21,23</sup>.
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<sup>45</sup>. However, they are still not as effective as the N95/FFP2 respirators at blocking contaminants and better prevent the transmission of COVID-19 in high-risk exposure settings<sup>45</sup>.
6. Develop protocols for preserving supplies of PPE<sup>6</sup>, and be prepared for potential PPE and other supply shortages<sup>18</sup>. Develop contingency plans for supply chain issues<sup>26</sup>.
  - a. Given the concern for continued availability of PPE, considerations and recommendations on the reuse of N95 respirators should be in place<sup>45</sup>. There are significant ongoing efforts to identify safe and effective ways to disinfect N95 respirators to allow their reuse, including ultraviolet light and heat reprocessing.
7. Be alert to the fact that viral contamination of surfaces is a known means of transmission within, and outside of clinical settings 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)<sup>7</sup>.

- 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<sup>6</sup>.
  - c. Keep hand sanitizer and/or disposable gloves for use of ATM, vending machines, gasoline pumps, and handling of items at time of purchase<sup>6</sup>.
- 8. While at home<sup>6</sup>:
  - 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).
- 9. Physically isolate – stay home. Avoid any activity that brings you in contact with others to stay healthy<sup>41</sup>. 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*

1. Individuals should work out of one institution, if possible, to avoid potential spread between hospitals<sup>41</sup>.
2. Allow providers not on service and non-clinical staff to work from home. Support schedules and team culture to optimize wellness and maintain resilience<sup>39</sup>.
3. Clinical team leadership should be effective and clear<sup>33</sup>. Experienced surgeons should take the lead in decision-making.
4. Hold daily strategy meetings with an OR coordinator, nursing representative, and consultants from anesthesia as well as from each relevant surgical specialty<sup>21</sup>. 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<sup>21</sup>. Resource allocation and patient prioritization should be agreed upon together.
5. Surgeons should try to avoid long-term overwork and fatigue, which could compromise immunity against COVID-19<sup>33</sup>.
6. Establish isolated, rotating orthopaedic teams, consisting of surgeons and other health care members of the team as able<sup>5</sup>. These teams are responsible for clinical duties as needed; ideally rotating every 2 weeks to facilitate recommended isolation periods<sup>36,45</sup>.
  - 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<sup>5</sup>.
  - b. To minimize cross-contamination teams should not come into contact with each other, and should alternate on a weekly or bi-weekly basis<sup>5,45</sup>.
  - c. Trainees (residents and fellows) should also follow a team structure, as able<sup>45</sup>.



7. Healthcare institutions and systems may make housing accommodations available for healthcare workers who cannot/prefer not to go home following patient care activities.
8. If the workforce is reduced due to spread of illness, 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)<sup>14</sup>. If able, create several teams that are completely insulated from each other<sup>24</sup>.
9. Clinicians may need to work in unfamiliar environments or outside of their specialty/subspecialty areas<sup>26</sup>. They will need to be supported and deployed judiciously.
10. Due to the pressure on emergency departments (EDs), non-respiratory emergencies may be triaged to an alternate pathway which may need support from surgeons (ie. Non-COVID ED, emergency fracture clinic)<sup>14</sup>.

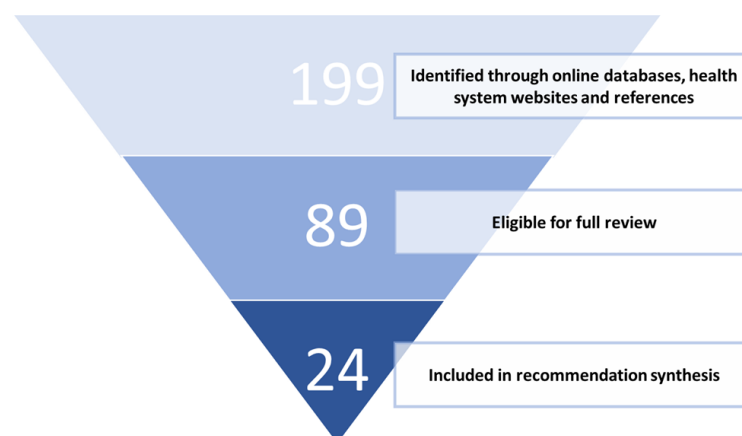
### *Implementation of technology*

1. During the pandemic, tele-health should be used where possible to limit exposure risk. Different aspects of care may utilize this strategy<sup>37,45</sup>:
  - a. Virtual visits with smartphones or computers may be used for perioperative visits and follow-up<sup>20,21,24</sup>.
  - b. Virtual consults from specialists may be required by on-call clinicians/surgeons<sup>14</sup>.
  - c. Necessary in-person rounds, conferences, courses, panels, and meetings should transition to online/virtual platforms (including fracture rounds and departmental meetings)<sup>21,24, 36, 41,45</sup>.
2. Practices are encouraged to utilize alternatives to face-to-face visits<sup>10,15</sup>. This is particularly useful for vulnerable or quarantined patients, who can be monitored remotely. Digital tools can be used as an adjunct to telephone calls for<sup>26,34,45</sup>:
  - a. Triage new consults.
  - b. Monitoring postoperative patients<sup>26,34</sup>.
  - c. Providing treatment recommendations for patients with chronic diseases<sup>27,34</sup>.
3. Telerehabilitation initiatives may allow patients to be reviewed in the comfort of their own homes, and be useful beyond the pandemic<sup>5</sup>.
  - 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<sup>5</sup>.
  - 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.

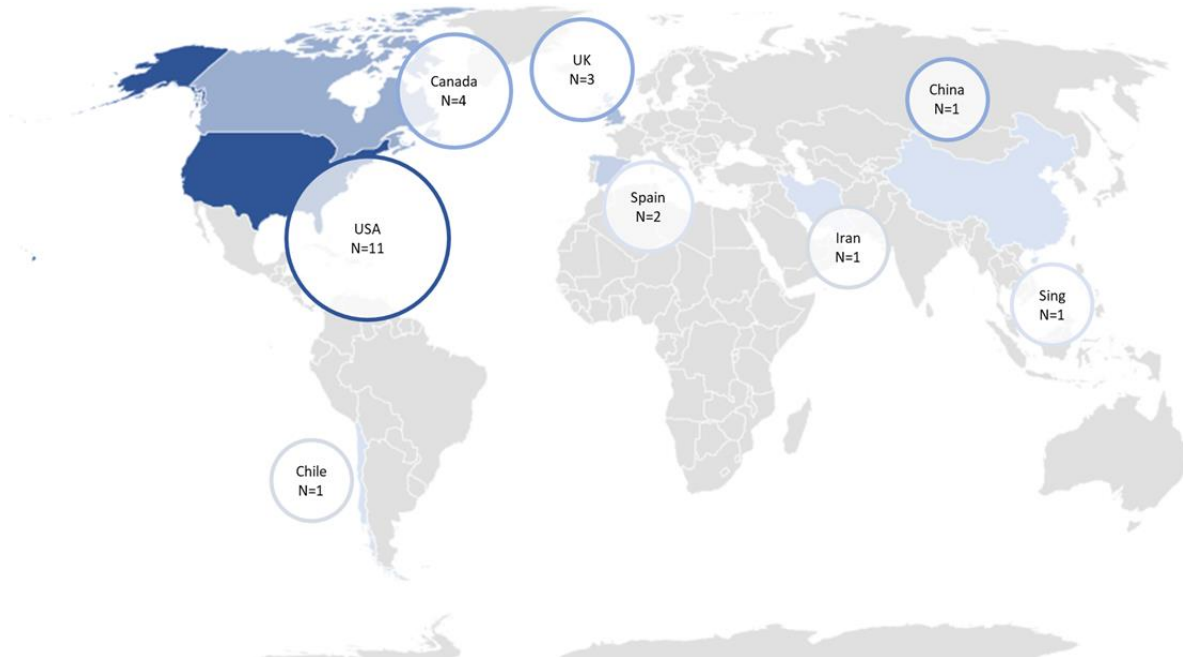
### Impact on surgical trainees

1. Technology should be integrated for training needs<sup>5,40,45</sup>.
2. In-person teaching unrelated to direct patient care may need to be suspended<sup>5</sup>.
3. Cancellation of elective surgical procedures will have repercussions on resident training, requiring adaptive strategies for knowledge and skill acquisition<sup>40,41,42,44</sup>:
  - 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<sup>5</sup>:
  - 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.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 24 publications that addressed the topic.



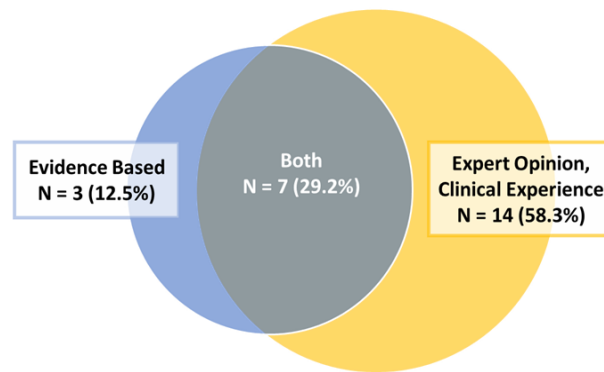
Publication dates ranged from February 29 to April 11, 2020 (search conducted April 11, 2020). Recommendations were from 8 countries (USA, N=11; Canada, N=4; United Kingdom, N=3; Spain, N=2; China, Chile, Iran, Singapore, N=1).



## EVIDENCE BASE

Of the 24 publications, 10 (41.7%) were developed by surgical or orthopaedic societies/associations, 11 (45.8%) were developed by academic health care institutions/hospitals, and 3 (12.5%) were developed by national/local public health entities. In 12 publications, the authors within the working groups were not reported. Twelve publications (58.3%) provided contributor lists, which consisted of 66 clinical experts or researchers in total.

Of the 24 publications, more than half (N=14, 58.3%) were developed based on expert opinion and/or clinical experience, 3 (12.5%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 7 (29.2%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE<sup>4</sup> approach:  
General considerations

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

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## PART 4: BEST PRACTICES

### OUTPATIENT CARE

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#### 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.
- Orthopaedic surgeons can help to diminish emergency department (ED) workloads by arranging outpatient settings to be available for patients presenting to the ED with orthopaedic issues (i.e. trauma/fracture clinics)\*. [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\*. [Weak recommendation for, fair quality]
- Discuss benefits and harms of treatment options with patients. Preferred options may differ from “standard treatment” during non-pandemic times due to limited resource availability and dynamic patient and system priorities. Non-operative treatment and removable splint use may be preferred where possible\*. [Weak recommendation for, fair quality]
- Optimize follow-up requirements by reviewing recommended schedules based on injury, with the aim of reducing unnecessary appointments. [Strong recommendation for, fair quality]
- Screen all patients attending outpatient clinics for risk factors and COVID-19 related symptoms (i.e. fever). [Strong recommendation for, fair quality]
- 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 more frequent or longer clinics with fewer patients (i.e. spreading out patients over time and/or distance). If social 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<sup>45</sup>. Avoid booking consults that will not require surgery within 90 days<sup>10</sup>.
2. Patients should receive definitive decision-making from consultant surgeons at their initial visit. Patients should not be scheduled for surgery without consulting surgeon input<sup>21,26</sup>.
3. Emergency Departments (EDs) are likely to come under intense and sustained pressure. Orthopaedic surgeons can reduce ED workload to allow emergency clinicians to focus on COVID-19 patients<sup>21,26</sup>:
  - a. Arrange an 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.
  - b. Timing of the clinic will depend on local resources and requirements. It would ideally be able to offload/support ED daily during pandemic surges.
  - c. If possible, arrange for availability of a mini C-arm in the clinic to facilitate access to imaging for diagnostics and minor procedures.
4. As regular, non-trauma/fracture orthopaedic clinics will likely be suspended, sub-specialty consultants may need access to orthopaedic trauma clinics for urgent consultations (i.e. patients with infected prosthesis, cauda equina, tumors)<sup>26</sup>.
5. Impact on radiology services should be minimized<sup>21,36,41</sup>. Limit repeat imaging and use of multiple imaging modalities. 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<sup>26</sup>.
6. Decision making should be guided by evidence surrounding the risks and benefits of orthopaedic management during shifting patient and provider values related to limited resources and additional risks posed by pandemic severity. This may result in treatment recommendations that differ from standard orthopaedic management outside of a pandemic environment<sup>35,41</sup>.
7. When possible, use non-operative treatment<sup>35,41</sup> and removable splints to minimize exposure risk, 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.

### *Follow-up consultations*

1. Consider cancelling or postponing long-term follow-ups until the crisis has passed<sup>24</sup>.
2. To prioritize bookings, review and classify follow-ups as those that can be delayed versus those that cannot<sup>27,37</sup>.
3. Identify patients with injuries or follow-ups that do not require in-person visits, and provide remote alternatives (tele-health)<sup>26,27,37,45</sup>.
4. Limit in-person postoperative visits to the following<sup>45</sup>:
  - 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 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. Follow-up imaging should be performed when there is likely to be a significant change in management<sup>21, 45</sup>. There is no role for imaging to check for fracture union in most injuries if the patient is otherwise asymptomatic.

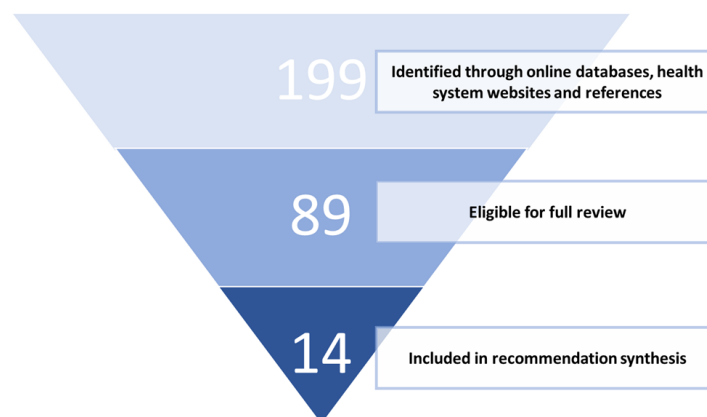
### *Personal protective equipment (PPE) and patients screening*

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<sup>5,45,46</sup>:
  - 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.
2. When reviewing patients suspected of or diagnosed with COVID-19, all providers must wear full PPE (droplet precautions)<sup>5,13,28</sup>. Strict compliance with hand hygiene is crucial<sup>45</sup>.
  - a. Droplet precautions include: Face shield or goggles, N95/FF2 respirator (or medical facemask if respirator unavailable), isolation gown, clean non-sterile gloves.
3. If possible, arrange facilities to provide segregated, safely-spaced waiting areas, assessment cubicles and treatment rooms. Plan for a space to store, don and remove personal PPE.

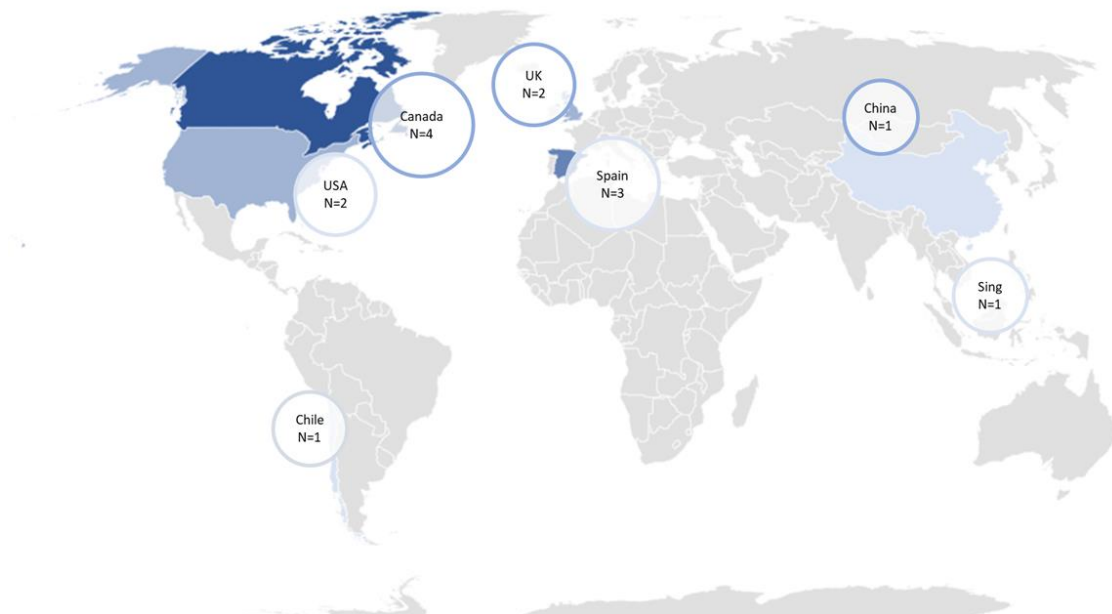
### Outpatient facilities

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<sup>26</sup>.
2. Use removable casts or splints when able to reduce follow-up requirements<sup>21,26</sup>.
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<sup>26</sup>.
4. In-person rehabilitation services will likely be very limited. Adaptive measures include providing written instructions or access to online/tele-rehab resources<sup>21</sup>.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 14 publications that addressed the topic.



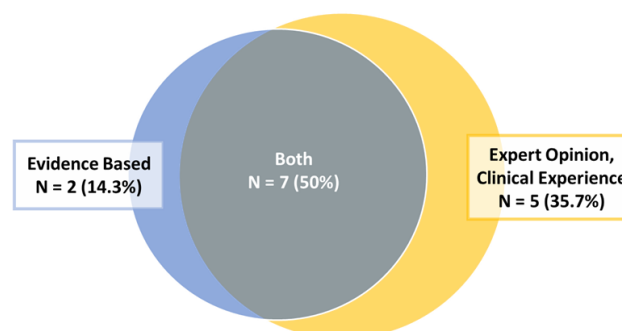
Publication dates ranged from March 16 to April 11, 2020 (search conducted April 11, 2020). Recommendations were from 7 countries (Canada, N=4; United Kingdom, USA, N=2; Spain, N=3; China, Chile, Singapore, N=1).



## EVIDENCE BASE

Of the 14 publications, 5 (35.7%) were developed by surgical or orthopaedic societies/associations, 6 (42.9%) were developed by academic health care institutions/hospitals, and 3 (21.4%) were developed by national/local public health entities. In 7 publications, the authors within the working groups were not reported. Seven publications (50%) provided contributor lists, which consisted of 40 clinical experts or researchers in total.

Of the 14 publications, about one-third (N=5, 35.7%) were developed based on expert opinion and/or clinical experience, 2 (14.3%) were developed using evidence-based methods including systematic review, surveys and observational studies, and half (N=7, 50%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE<sup>4</sup> 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

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## PART 5: BEST PRACTICES

### ELECTIVE SURGICAL PROCEDURES

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#### Key Findings

- Non-urgent elective surgeries should be postponed to reduce resource burden and preserve health system capacity. [Strong recommendation for, fair quality]
- Decisions regarding semi-urgent elective 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]
- There is controversy regarding which orthopaedic surgical procedures are designated as elective [Weak recommendation for, fair quality] .
  - A rational, data-driven process is needed to assess and communicate which elective procedures should be allowed to be performed.
  - To limit orthopaedic surgical procedures and manage health-care resources throughout and following the pandemic, detailed criteria are needed to define which patients are deemed necessary candidates for acute surgical treatment for elective procedures.
- The decision to proceed with semi-urgent surgery should take into account patient and injury/disease characteristics, expected benefits and potential harms of surgery, regional pandemic severity and institutional resources. [Weak recommendation for, fair quality]
- COVID-19 screening measures in asymptomatic surgical patients remains controversial. Limited test availability and diagnostic properties (sensitivity/specificity) should be weighed against the key information gained by clinical providers. [Weak recommendation for, fair quality]
  - Adequate pre-operative screening/testing for COVID-19 may require a SARS-CoV-2 PCR of a deep nasopharyngeal swab in conjunction with a low-dose chest CT (without iv contrast).
- Access to outpatient rehabilitation services may be useful in temporizing demand for elective procedures, and decreasing in-patient length of stay for any post-operative semi-urgent elective patients. [Weak recommendation for, fair quality]
  - Online/ tele-rehabilitation platforms facilitate remote access while distancing measures are in place

*\*Details in full report.*

*General recommendations:*

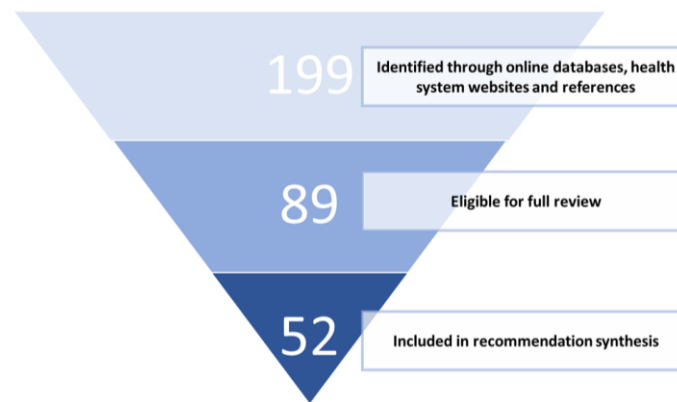
1. As pandemic severity escalates, non-urgent, elective surgery may need to be postponed for several key reasons: <sup>10,18,22,23,27,32-34,41,43,44,46,48-77</sup>
  - a. Reduction of unnecessary patient traffic in the hospital. This decreases the introduction and spread of COVID-19 among patients and 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 health care staff. This aids in the ability to confront COVID-19 and maintain surgical access for essential time-sensitive procedures (i.e. trauma and cancer surgery)<sup>10,32</sup>.
2. For semi-urgent elective cases, a process should exist at each institution, by which a committee of perioperative peers or departmental heads provides guidance for proceeding with semi-urgent elective procedures.
3. The committee should be structured with representation from surgery, anaesthesia and nursing<sup>19,22</sup>.
  - a. Decisions should be made on a daily basis, no later than the day before surgery<sup>22</sup>.
  - 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, elective cases<sup>19</sup>:
    - 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 direction provided specific to orthopaedic surgery. Elective procedures have been broadly defined as any non-trauma or non-oncology related procedure. Limited included references designate the following orthopedic specific procedures as elective/non-urgent<sup>17,44,48-78</sup>:
  - a. Arthroplasty (hip/knee/shoulder/elbow/ankle) for chronic degenerative conditions.
  - b. Elective spine surgery (i.e., laminectomy, fusion) for degenerative neck and back conditions.
  - c. Closed fractures >4 weeks old that do not lead to loss of function or permanent disability if left untreated.

- d. Procedures for chronic neurologic compression syndromes (i.e. carpal tunnel).
  - e. Sports procedures to address chronic joint pain.
  - f. Shoulder and elbow procedures for chronic pain with retained function (including chronic cuff disease).
  - g. Oncologic procedures for benign soft tissue masses or bone tumors that can wait.
  - h. Foot and ankle procedures other than fracture or achilles tendon ruptures.
  - i. 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<sup>19,44</sup>.
    - 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 (i.e. carpal tunnel procedures, Tier-1a) operations, 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 elective 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 are deemed necessary candidates for acute surgical treatment for elective procedures<sup>46</sup>.
  7. Proceed with caution for any procedures during the pandemic, especially in the elderly:
    - 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<sup>47</sup>.
  8. Depending on the local pandemic severity, if outbreaks are contained, elective day surgical cases (requiring <23 hours of hospital stay) may be allowed to continue, as they were in Singapore. This may include arthroscopies (shoulders, knees, and ankles) and simple day procedures (e.g., soft-tissue surgical procedures and implant removals)<sup>5</sup>. 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.

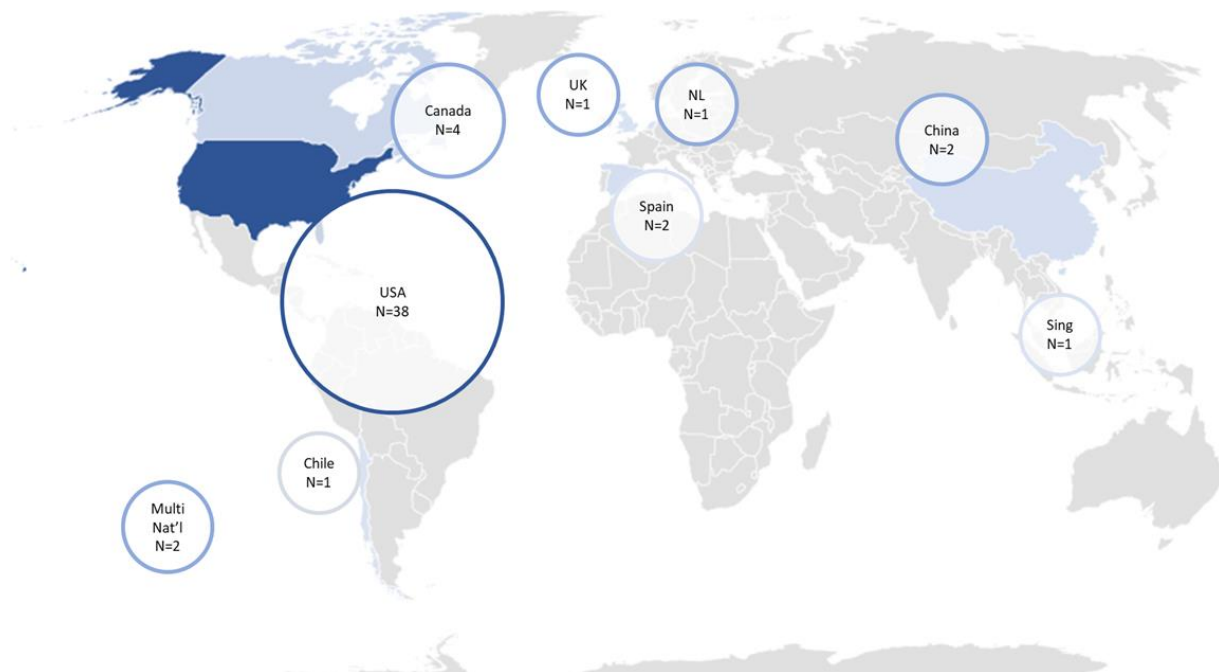
- b. Patients are discharged expediently and are at low risk for nosocomial COVID-19 infections, particularly if day-surgical cases are done at a separate facility from inpatient units.
  - c. Pandemic severity is within the health system response capacity, and vital resource supplies are secure.
- 9. As pandemic severity escalates, (i.e. rapidly spreading, uncontained outbreaks) a staged closure of all elective (including semi-urgent) should occur. A 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](#)<sup>17</sup>.
- 10. For procedures done, equipment decontamination should be ensured after each use<sup>25</sup>.
  - 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.
- 11. In orthopaedic surgery, certain semi-urgent procedures are being performed in ASCs. These facilities should follow protective guidelines for staff during procedures<sup>46</sup>:
  - a. Ensure that all who are present during intubation and extubation have access to appropriate PPE, including N95 masks.
  - b. Ensure that terminal cleaning of all ORs and equipment is performed between cases.
- 12. Perioperative COVID-19 screening in asymptomatic surgery patients is controversial, but being increasingly performed<sup>28,29,45</sup>. 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 <sup>29</sup>.
  - 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<sup>29</sup>.
- 13. The Dutch Surgical Association recommends that all adult patients requiring a surgical procedure under general anesthesia undergo pre-operative 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)<sup>29</sup>.
- 14. Access to outpatient rehabilitation services and infrastructure may be useful in temporizing demand for elective procedures, and decreasing in-patient length of stay for any postoperative semi-urgent elective patients<sup>26</sup>.
  - a. Online/ tele-rehabilitation platforms facilitate remote access while distancing measures are in place.

15. When patients present to the clinic with fractures that truly require operative fixation to avoid significant morbidity due to a delay of greater than 30 days, surgeons should be aware of their local resources (if any) to perform surgery outside from the hospital (Ambulatory Surgery Centers [ASC]). Several cities in the US are already using this strategy<sup>45</sup>.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 52 publications that addressed the topic.



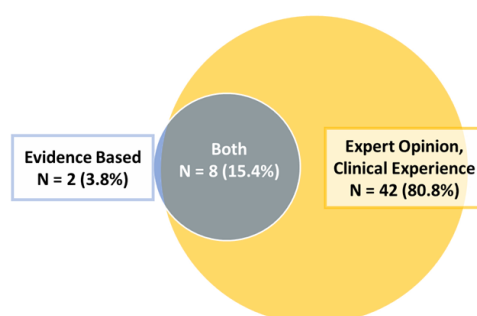
Publication dates ranged from February 29 to April 11, 2020 (search conducted April 11, 2020). Recommendations were from 8 countries (USA, N=38; Canada, N=4; Spain, China, N=2; Australia, United Kingdom, The Netherlands, Singapore, N=1; multiple countries, N=2).



## EVIDENCE BASE

Of the 52 publications, 11 (21.2%) were developed by surgical or orthopaedic societies/associations, 6 (11.5%) were developed by academic health care institutions/hospitals, and 35 (67.3%) were developed by international/national/local public health entities. In 18 publications, the authors within the working groups were not reported. Thirty-four publications (65.4%) provided contributor lists, which consisted of 55 clinicals experts or researchers in total.

Of the 52 publications, 42 (80.8%) were developed based on expert opinion and/or clinical experience, 2 (3.8%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 8 (15.4%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE<sup>4</sup> approach:  
Elective consult and 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



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## PART 6: BEST PRACTICES

### URGENT AND/OR EMERGENT SURGERY

#### Key Findings

- Urgent and emergent surgery should be prioritized. [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 haemorrhage.
  - Open fractures.
  - Compartment syndrome.
  - Exsanguinating injuries
- 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]
- 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 stay. [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.
2. A Surgical Review Committee composed of surgery, anesthesiology, and nursing personnel should be in place to decide on prioritization of cases<sup>22</sup>.
3. Classification for different prioritization of surgical cases is advised. All bookings must be given a rationale, which is reviewed by the Surgical Committee<sup>22</sup>.
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<sup>22</sup>.
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<sup>21</sup>.
6. For semi-urgent procedures, schedule patients for same-day admissions where possible<sup>5</sup>.
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<sup>5,12</sup>.

### Orthopaedic Surgery

1. Emergent surgery is warranted for life and limb threatening injuries<sup>21,41</sup>:
  - a. Polytrauma patients or pelvic/acetabular fractures with major haemorrhage.
  - b. Open fractures.
  - c. Compartment syndrome.
  - d. Exsanguinating injuries
  - e. Spinal injuries with acute neurologic compromise (i.e. cauda equina).

- f. 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 or 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<sup>45</sup>.
  - a. A potential way to further classify procedures is by separating them into 2 categories :
    - i. Those that need to be performed within 2 weeks, and
    - ii. Those that need to be performed within 4 weeks.
3. In addition to the above urgent procedures, some feel that surgical treatment should be considered necessary for the following<sup>46</sup>:
  - 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. Specifically, surgical necessity should be considered for 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>)<sup>46</sup>:
    - 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<sup>35,41</sup>.
5. Hip and femoral fractures remain a surgical priority. It is reasonable to offer hemiarthroplasty rather than total hip replacement if suitable surgeons are not available, in order to facilitate early surgery<sup>21</sup>. In very frail patients with multiple comorbidities at high-risk of COVID-19 related mortality consider palliative care.

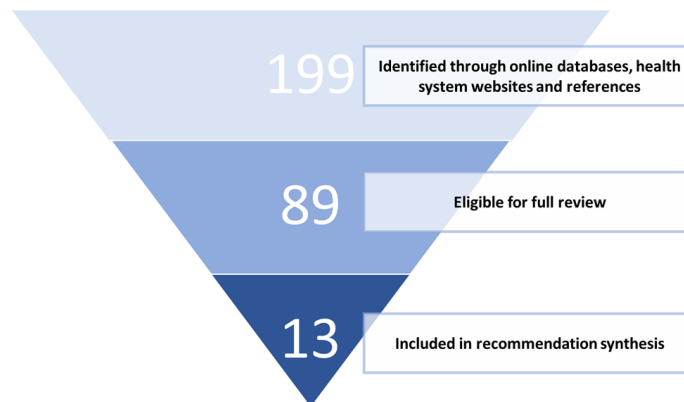


6. Aim to make surgically treated patients with fragility fractures of the pelvis, acetabulum or lower limb immediately fully weight bearing to allow rehabilitation and reduce inpatient stays/coronavirus exposure<sup>21</sup>.
7. Patients with complex fractures should have surgery planned to minimize 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.
8. It may be necessary to explore different surgical solutions when facing specific circumstances<sup>21</sup>:
  - 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.
  - 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 more scarce, surgeons may be required to postpone treatments beyond what we would consider usual<sup>44</sup>.
9. Consider day-case treatment when feasible<sup>26</sup>:
  - 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).
10. 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.
11. Wrist fractures may be treated with removable casts or splints to reduce follow-ups<sup>35</sup>.
12. Consider non-operative management and bracing of patients with spinal fractures without progressive neurologic symptoms.
13. 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.
14. Ligamentous injuries of the knee may be managed with bracing in preference to early ligament reconstruction.
15. 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.

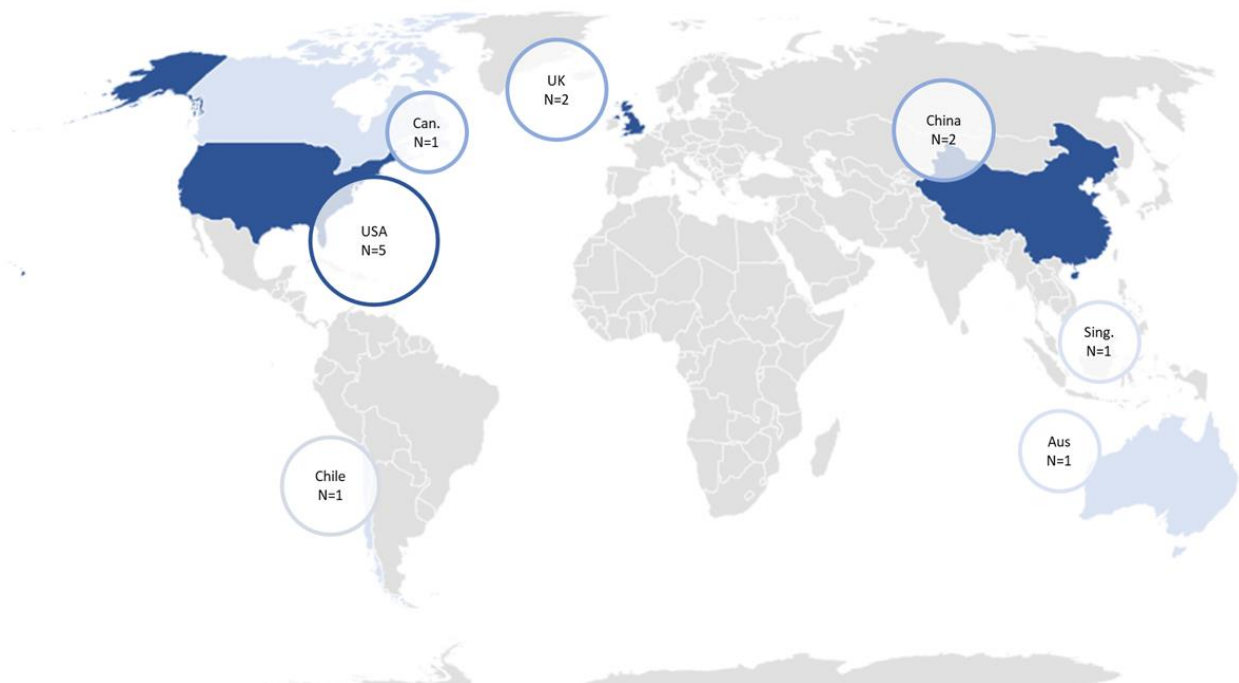


16. Abscesses in patients without systemic sepsis may be incised and drained under local anaesthetic in the ED, minor procedure area or fracture clinic.
17. Specific to Hand injuries<sup>21</sup>:
  - a. If possible, arrange additional outpatient or minor operations space to perform manipulations and 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.
18. Specific to Pediatric injuries<sup>21,36</sup>:
  - a. Consider the possibility of non-accidental injury.
  - 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<sup>21</sup>: 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.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 13 publications that addressed the topic. Publication dates ranged from March 16 to April 11, 2020 (search conducted April 11, 2020).

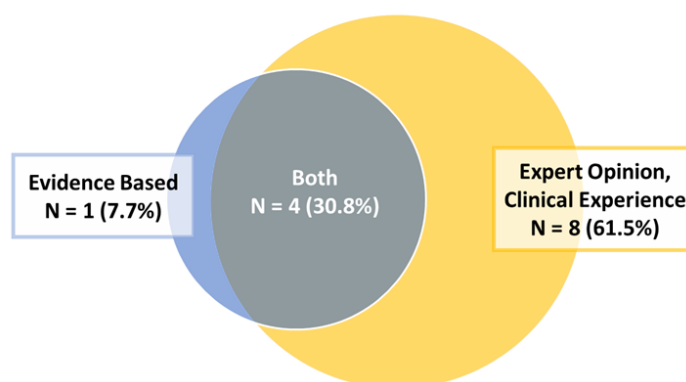


Recommendations were from 7 countries (USA, N=5; United Kingdom, China, N=2; Australia, Canada, Chile, Singapore, N=1).



## EVIDENCE BASE

Of the 13 publications, 6 (46.2%) were developed by surgical or orthopaedic societies/associations, 6 (46.2%) were developed by academic health care institutions/hospitals, and 1 (7.6%) was developed by a national public health entity. In 5 publications, the authors within the working groups were not reported. Eight publications (61.5%) provided contributor lists, which consisted of 50 clinicals experts or researchers in total.



Of the 13 publications, 8 (61.5%) were developed based on expert opinion and/or clinical experience, 1 (7.7%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 4 (30.8 %) were developed based on a combination of both evidence-based methods and expert opinion.

The Rating of Recommendations using a GRADE<sup>4</sup> approach:  
Urgent/Emergent inpatient and surgical care recommendations

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

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## PART 7: BEST PRACTICES PERI-OPERATIVE CARE

### Key Findings

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

- Develop a dedicated COVID-19 operating room (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, ensure there is clear physical access from specific waiting area to the designated OR is necessary\*.
- 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 when appropriate. 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 AGMP (including N95/FFP2 masks).
  - Controversy exists regarding the time required for the remaining staff to re-enter the OR after intubation/extubation\*.
- 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 OR\*.
- Stagger surgical teams to reduce the number of surgeons simultaneously clinically active in the hospital to decrease exposure risk and preserve staff. Develop redundancy in backup schedules for providers who may become ill or exposed, and require quarantine.

*\*Details in full report.*

### *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 COVID-19 operating space<sup>23,45</sup>. 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<sup>23</sup>:
    - i. Away from high-traffic areas and be completely emptied of all non-essential materials<sup>30</sup>.
    - 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. Instructional posters on appropriate procedures should be prominently displayed<sup>38</sup>. 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<sup>24</sup>. 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<sup>31</sup>.
  - b. Patients should wait in an isolation waiting area, and be transferred from there directly to the dedicated OR<sup>12</sup>.



- c. Ensure clear channels of communication between the anesthesia and infectious disease teams to discuss any COVID-19 transferred to the dedicated OR<sup>12</sup>.
  - 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<sup>45</sup>.
  - e. The dedicated OR and anteroom should be equipped with a negative pressure system, and an appropriate level of negative pressure must be ensured<sup>12,24,30,38,45</sup>. This negative pressure OR should have a minimum of 6 air changes per hour<sup>25</sup>. Air from the OR should be exhausted to the outside or filtered through a high-efficiency particulate air (HEPA) filter before recirculation<sup>25,38</sup>.
  - 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<sup>8,12,30</sup>.
  - 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/FFP2), goggles or face shield, protective isolation gown, boot covers, latex gloves, and powered air-purifying respirator (PAPR) as needed for droplet or aerosol precautions<sup>8,30,38</sup>.
  - h. The surgeons and scrub nurses should wear disposable sterile operating gowns and gloves in addition to the PPE<sup>8</sup>.
  - i. Patients should wear disposable caps and disposable surgical masks<sup>8</sup>.
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. 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<sup>12</sup>.
2. Develop policies and procedures for airway management for potential COVID-19 patients requiring emergent intubation<sup>16</sup>.
3. Aerosolization and droplet transmission of the COVID-19 virus are important hazards for surgical personnel, with increased risk during endotracheal intubation<sup>6,27</sup>. Whenever possible, regional or local anesthesia is preferable.

4. During induction room, a powered, air-purifying respirator (PAPR) should be worn during induction and reversal of anesthesia for all personnel within 2 m of the patient<sup>31</sup>.
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<sup>6,45</sup>.
6. Controversy exists regarding the time required for the remaining staff to re-enter the OR after intubation/extubation<sup>43,45</sup>. 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<sup>45</sup> (most guidelines recommend between 15-20 minutes).
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<sup>28</sup>.
2. In patients without suspected COVID-19, N95/FFP2 masks are not required to be worn by anyone in the room other than the anesthesiologist and the person assisting with intubation, 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.
3. Consideration should be given to surgical approaches that could decrease operating staff exposure and shorten case duration<sup>28</sup>.
4. For all procedures in the OR, donning an additional pair of gloves is recommended, as resources allow<sup>38</sup>.
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).<sup>21,38</sup>
  - a. Although there is potential for aerosolization, blood-borne transmission of COVID-19 has not been shown to occur.
6. Use a smoke evacuator when electrocautery is used<sup>6,11,30,31</sup>. Power settings of electrocautery should be as low as possible. Avoid long dissecting times on the same spot by electrocautery or ultrasonic scalpels to reduce the surgical smoke<sup>11</sup>.
7. When handling surgical instruments<sup>28</sup>:
  - 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<sup>21,28,45</sup>. Consider using transparent film dressings (i.e. tegaderm) to facilitate checking the wounds post-operatively remotely or in person<sup>36</sup>.
- 9. Use easily removable post-operative dressings and splints<sup>45</sup> so remote follow-up may be performed by rehabilitation team<sup>21</sup>.
- 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<sup>21</sup>.

### *After surgical procedures*

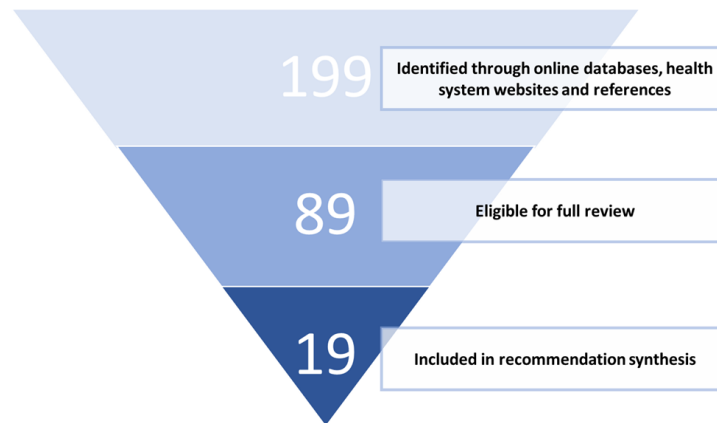
- 1. Patients with COVID-19 should be recovered in the OR with dedicated staff until they can be transferred to an isolation room on the ward or in the intensive care unit (ICU) bypassing the postanesthesia care unit<sup>12</sup>. During transfer, minimize the staff needed and wear different PPE from that worn during the procedure<sup>6</sup>.
- 2. Known or suspected COVID-19 patients must wear a surgical mask or N95/FFP2 mask and be covered with a disposable operating sheet. They should be transferred through dedicated corridors and elevators. The surfaces of passageways and the elevators should be cleaned and covered<sup>12</sup>.
- 3. Procedures for Final Disinfection of the designated OR<sup>8,28</sup>:
  - 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<sup>30</sup>.
  - 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/FFP2 masks will be removed outside the anteroom<sup>30</sup>.

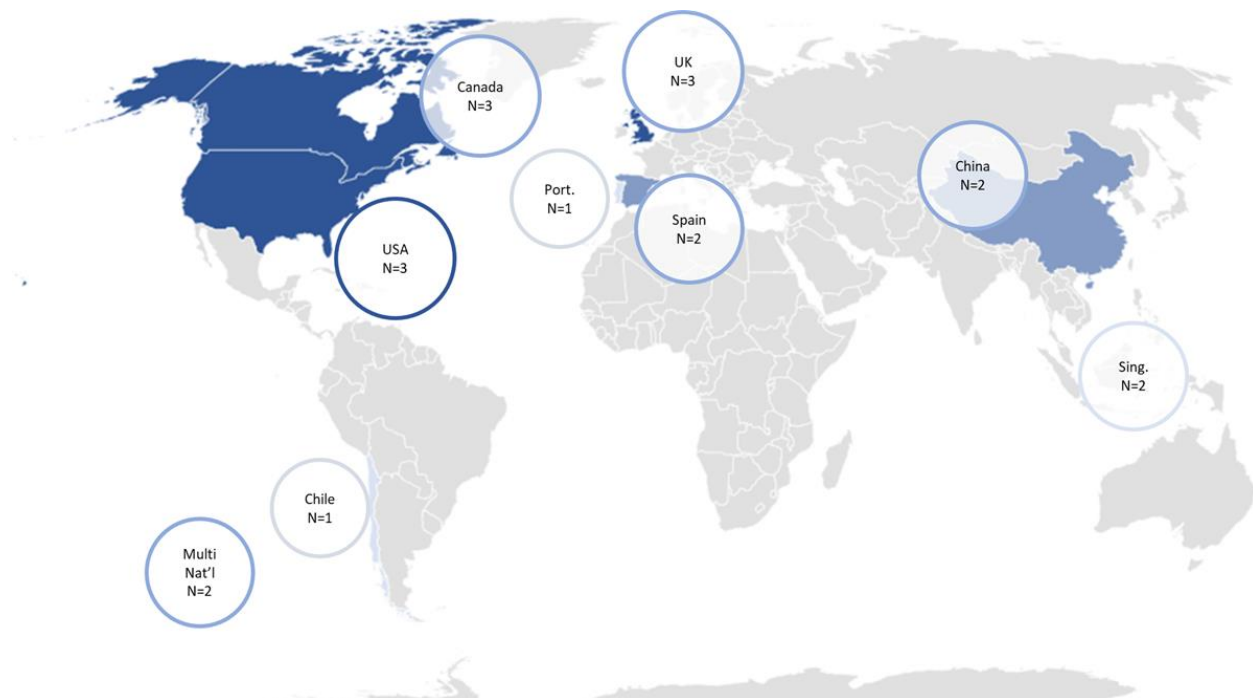
### *Human resources*

- 1. Surgical assists should be kept to an essential minimum<sup>5,30,45</sup> 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<sup>23</sup>.
- 2. Consider to discourage sales representative presence in the OR unless critical for patient care<sup>45</sup>.
- 3. When possible, restructure trauma teams and stagger cohorts to reduce the number of providers in the hospital simultaneously. This measure can decrease exposure risk and preserve staff<sup>6</sup>:
  - a. Develop redundancy in backup schedules for providers who may be ill or exposed.
  - 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”<sup>26</sup>.
  - 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<sup>30</sup>.

The documentation was based on a systematic search of MEDLINE, EMBASE, Global Health and Emcare and major health entities. We identified 19 publications that addressed the topic. Publication dates ranged from March 6 to April 10, 2020 (search conducted April 11, 2020).



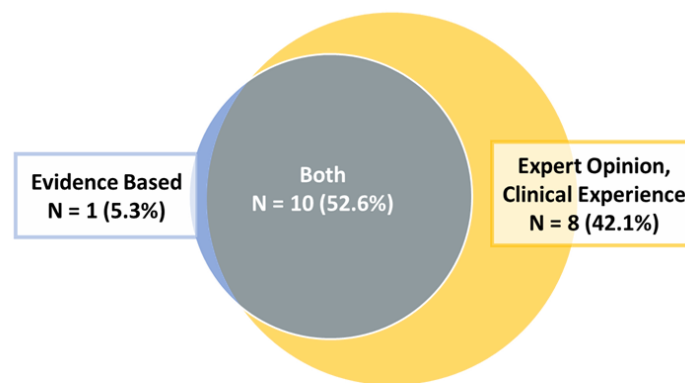
Recommendations were from 8 countries (United Kingdom, Canada, USA, N=3; China, Singapore, Spain, N=2; Chile, Portugal, N=1; multiple countries, N=2).



## EVIDENCE BASE

Of the 19 publications, 7 (36.8%) were developed by surgical or orthopaedic societies/associations, 11 (57.9%) were developed by academic health care institutions/hospitals, and 1 (5.3%) was developed by a national public health entity. In 9 publications, the authors within the working groups were not reported. Ten publications (52.6%) provided contributor lists, which consisted of 52 clinicals experts or researchers in total.

Of the 19 publications, almost half (N=8, 42.1%) were developed based on expert opinion and/or clinical experience, 1 (5.3%) were developed using evidence-based methods including systematic review, surveys and observational studies, and 10 (52.6%) were developed based on a combination of both evidence-based methods and expert opinion.



The Rating of Recommendations using a GRADE<sup>4</sup> approach:

Risk mitigation strategies & Recommendations for the peri- and postoperative period

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

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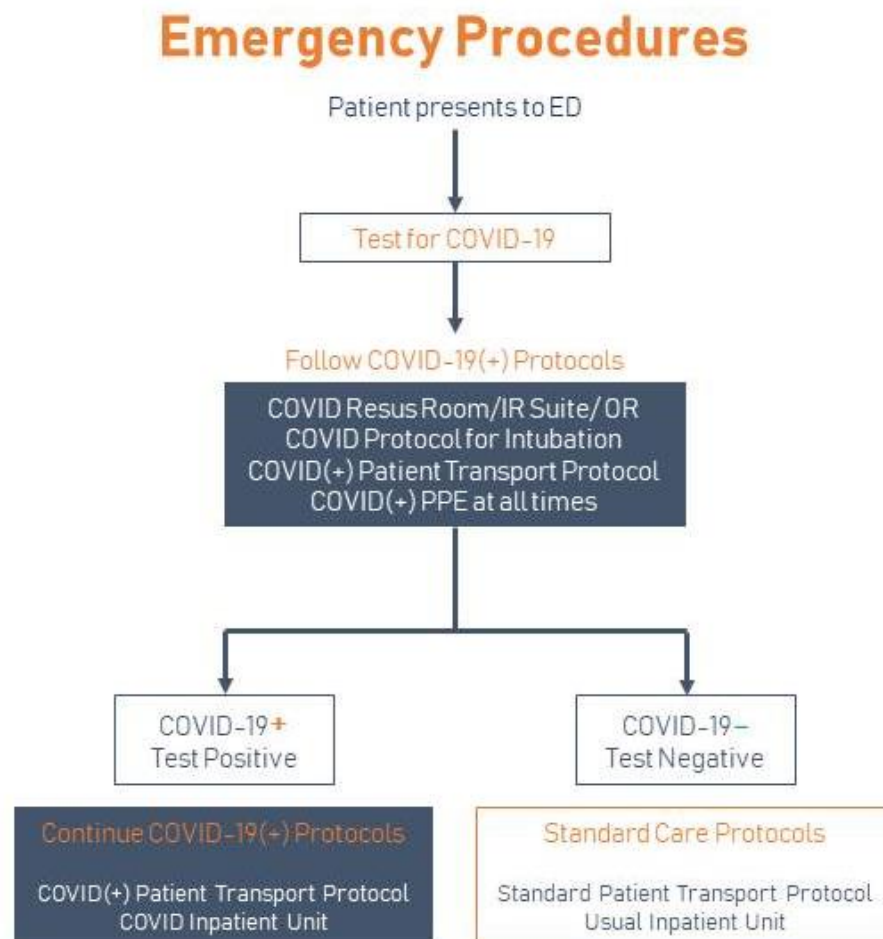


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## PART 8: Additional Resources

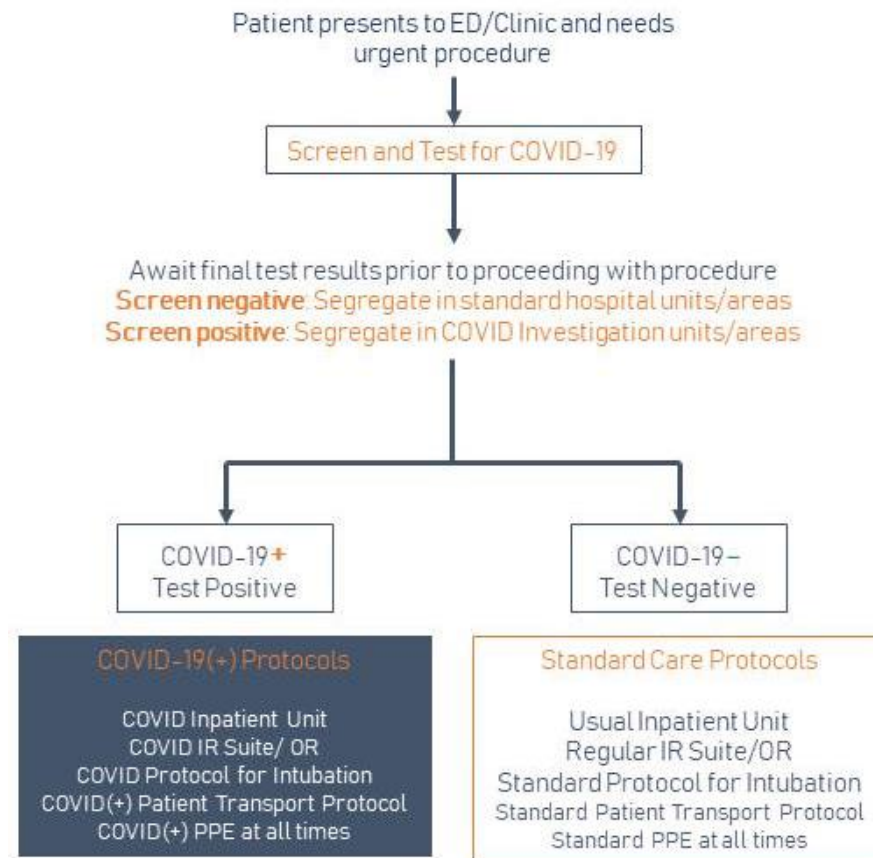
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Protocol for Emergency Procedures:







## Protocol for Urgent Procedures:

## Urgent Procedures



# PPE for Surgical Procedures:

	COVID-19 <sup>-</sup>	UNKNOWN	COVID-19 <sup>+</sup>
	Goggles or eye shield	Standard Procedure goggles or eye shield	Aerosol Generating Procedure (AGP) Full face shield or surgical hood
	Surgical face mask	Surgical face mask	N95 respirator
	Surgical isolation gown (Level 3 or 4)	Surgical isolation gown (Level 3 or 4)	Surgical isolation gown (Level 3 or 4)
			*If N95 respirator unavailable, a surgical mask may be used along with a full face shield or hood for non-AGP

## PART 9: BEST PRACTICES

### KEY CONTRIBUTORS

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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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