

Global guidance for surgical care during the COVID-19 pandemic

COVIDSurg Collaborative*

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Background: Surgeons urgently need guidance on how to deliver surgical services safely and effectively during the COVID-19 pandemic. The aim was to identify the key domains that should be considered when developing pandemic preparedness plans for surgical services.

Methods: A scoping search was conducted to identify published articles relating to management of surgical patients during pandemics. Key informant interviews were conducted with surgeons and anaesthetists with direct experience of working during infectious disease outbreaks, in order to identify key challenges and solutions to delivering effective surgical services during the COVID-19 pandemic.

Results: Thirteen articles were identified from the scoping search, and surgeons and anaesthetists representing 11 territories were interviewed. To mount an effective response to COVID-19, a pandemic response plan for surgical services should be developed in advance. Key domains that should be included are: provision of staff training (such as patient transfers, donning and doffing personal protection equipment, recognizing and managing COVID-19 infection); support for the overall hospital response to COVID-19 (reduction in non-urgent activities such as clinics, endoscopy, non-urgent elective surgery); establishment of a team-based approach for running emergency services; and recognition and management of COVID-19 infection in patients treated as an emergency and those who have had surgery. A backlog of procedures after the end of the COVID-19 pandemic is inevitable, and hospitals should plan how to address this effectively to ensure that patients having elective treatment have the best possible outcomes.

Conclusion: Hospitals should prepare detailed context-specific pandemic preparedness plans addressing the identified domains. Specific guidance should be updated continuously to reflect emerging evidence during the COVID-19 pandemic.

*Members of the COVIDSurg Collaborative are co-authors of this article and are listed in *Appendix S1* (supporting information)

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Introduction

Guidance is urgently needed on how to deliver surgical services safely and effectively in the face of pressures placed by the COVID-19 pandemic^{1–3}. Surgical services need to balance supporting the whole hospital response and minimizing the risk of nosocomial spread of COVID-19 against continuing care for acute surgical conditions and managing urgent elective surgery. This article aimed to support surgical and anaesthetic teams and health service leaders by identifying key domains that should be covered in pandemic preparedness plans.

Methods

Scoping search

A scoping search was undertaken to identify published articles relating to management of surgical patients during pandemics (COVID-19, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), Ebola virus disease). MEDLINE, PubMed, Embase and the Cochrane Library databases were searched from inception to 15 March 2020. The search terms used were 'outbreaks', 'pandemic', 'coronavirus', 'COVID-19', 'MERS' or 'SARS' and 'surgery' or 'surgical', individually or in combination.

Articles in any language were included. Any study design was eligible, but conference abstracts were excluded.

Key informant interviews

Social media was used to identify and contact surgeons and anaesthetists with direct experience of managing patients with confirmed or suspected COVID-19 infection. In addition, surgeons with experience of working through previous epidemics, including Ebola virus disease, were identified. Key informant interviews were conducted by telephone and were supplemented by written case studies. Participants identified local hospital guidelines put in place during the COVID-19 pandemic. Thematic analysis was completed to identify key challenges and solutions to delivering effective surgical services during the COVID-19 pandemic.

Two experienced patient research advocates were involved in planning this article and identified key patient priorities.

Results

Scoping search

A total of 13 articles (12 from China, 1 from Singapore) were identified that reported on the delivery of surgical services during the COVID-19 outbreak^{4–16}. Further articles were identified relating to SARS (6)^{17–22}, MERS (2)^{23,24}, and Ebola virus disease (5)^{25–29} which reported management of surgical patients during those pandemics.

Key informant interviews

Key informants with direct experience of delivering surgical services during the COVID-19 pandemic were identified from China, Hong Kong, Italy, Singapore, Spain, South Korea, the UK and the USA. In addition, surgeons were identified from the Democratic Republic of Congo, Nigeria and Sierra Leone who had experience of Ebola virus disease epidemics. In total, interviews with 13 key informants were conducted, and these were supplemented by input from the wider guidance development group, which had representation from 20 territories (*Fig. 1*). Key themes that emerged are outlined below.

Preparing plans

Pandemic preparation should be undertaken as part of routine hospital planning, before the emergence of a pandemic. A named surgeon or anaesthetist should take

responsibility for developing the plan in collaboration with infection control experts, and updating it as national and international guidelines are published. All surgical and anaesthetic specialties should be included in the plan.

Once a potential pandemic threat has been identified, staff should be trained rapidly to implement the plan. At this point, surgical services should be represented on the hospital's central incident command team, to facilitate communication between surgical teams and hospital management.

Referrals and outpatient clinics

Outpatient clinic activity should be decreased dramatically to reduce the risk of cross-infection, particularly of frail, elderly patients or those with co-morbidities who are at increased risk of adverse outcomes with COVID-19 infection. New clinic referrals should be triaged, with as many as possible offered telephone consultations. Patients with suspected malignancies can be triaged straight to diagnostic tests, which can be booked for an appropriate time, based on local capacity. Routine referrals that require in-person examination should be postponed. Checklists should be designed to allow staff to follow up hospital inpatients through online or telephone consultations.

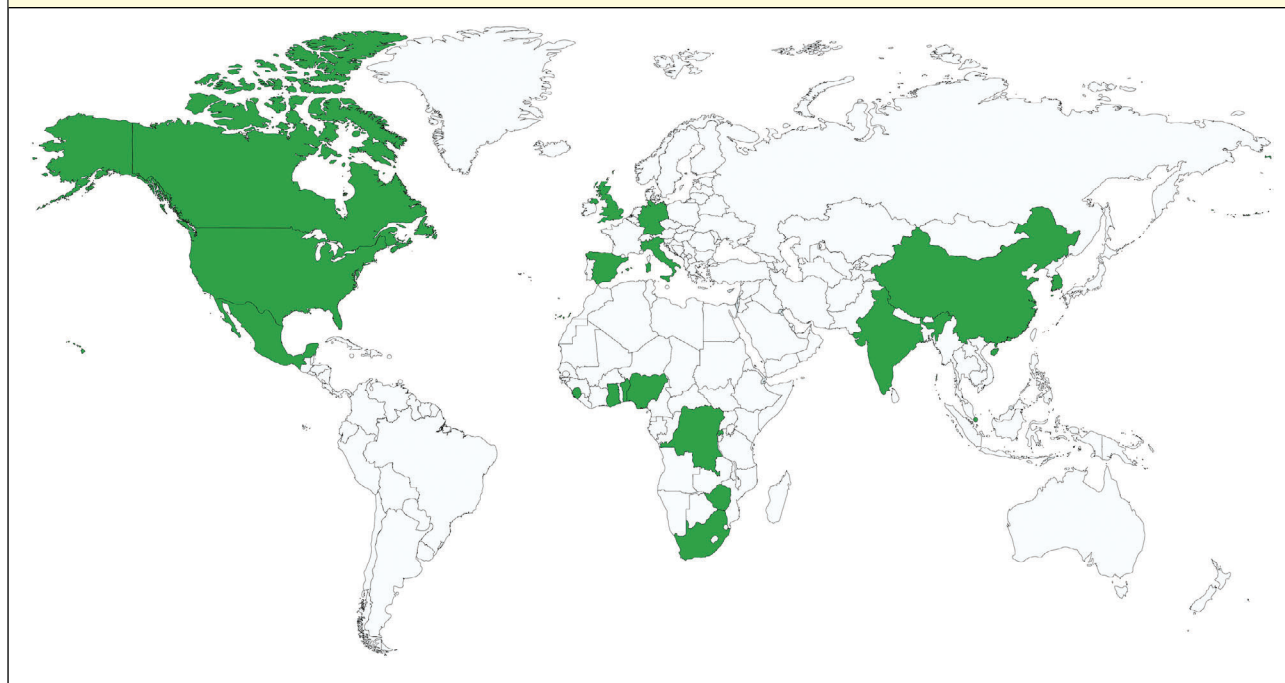
Patients should be advised not to attend outpatient clinic if they develop respiratory symptoms or fever, or are diagnosed with COVID-19 infection. Surgical teams should be trained to identify and respond to possible COVID-19 infection during face-to-face and telephone consultations.

Elective surgery

Reducing elective activity, including day-case surgery, has three key benefits. First, it releases general ward and ICU beds, increasing capacity for patients infected with COVID-19. Recovery areas in the operating theatre suite may be converted for use as additional ICUs. Second, it releases surgeons and theatre teams to perform drills and support wider emergency care. Anaesthetists and acute care surgeons trained in acute intensive care may be required to support critical care delivery, with general surgeons backfilling emergency roles. Third, it reduces the risk of cross-infection of elective patients and hospital visitors with COVID-19 by infected patients and staff, preventing subsequent spread of infection from the hospital to the community.

As an early measure, most elective surgery should be postponed, especially procedures likely to require critical care support. Clinical urgency should be balanced against resource availability; some time-sensitive procedures may

Fig. 1 Territories represented by participants in the guidance development group



need to be prioritized. Competition for limited operating capacity may arise among different specialties, so protocols should be established to prioritize patients based on clinical need. If operating resources are severely limited, dual consultant operating and reduction in training procedures should be considered to decrease operating times. Patients should be counselled about the potential risks of both postponing and going ahead with surgery.

A backlog of procedures after the end of the COVID-19 pandemic is inevitable, and hospitals should plan how to address this effectively to ensure that elective patients have the best possible outcomes.

Cancer care

Surgical cancer care poses unique dilemmas, because delayed diagnosis and definitive treatment could worsen oncological outcomes and will cause distress for patients and their families. Patients at high risk of COVID-19 complications, such as the frail and elderly, can be offered neoadjuvant treatments while definitive surgical management is delayed. The duration of pandemic-related disruption is unpredictable so, although postponing cancer care increases immediate hospital capacity, treatment delays may be prolonged.

Radiological and endoscopic investigations for patients triaged by telephone with prioritized high-risk symptoms

should continue for as long as possible³⁰, and elective cancer surgery should be offered to as many patients as possible. The delivery of these services should be reviewed regularly, based on overall hospital capacity.

Emergency surgical care

Surgeons across all specialties need to be prepared to encounter COVID-19 in three key areas. First, some patients admitted to hospital for treatment of COVID-19 infection will develop additional problems that require surgical intervention. This may be particularly prevalent in patients treated in ICU who are at risk of complications, such as perforated hollow viscus, mesenteric ischaemia or acute limb ischaemia. The risk of perioperative mortality in patients infected with COVID-19 who are already receiving ventilatory support is likely to be high. Care decisions should be informed by formal risk stratification and multidisciplinary discussion, including senior surgeons and the ICU and infectious disease teams. Non-operative treatment options should be considered carefully³¹, particularly if resources are limited and survival after major surgery is unlikely.

Second, patients admitted with acute surgical pathologies, some of whom require surgery, may have concurrent COVID-19 infection. COVID-19 may present with gastrointestinal symptoms (such as diarrhoea) or fever, which

itself is a common acute surgical presentation. Surgeons should be trained to recognize and respond to possible COVID-19 infection.

Third, after surgery patients may develop respiratory symptoms or fever of unknown origin, indicating possible nosocomial COVID-19 infection. Teams should be trained to isolate patients with suspected infection early, and to ensure that individuals at risk of exposure are tested rapidly.

Emergency surgery

The logistics of transferring patients from general or critical care wards to operating theatres should be planned to minimize the risk of cross-infection of other patients and staff, particularly when using elevators. Protocols should be established to ensure that patients are not moved between different areas until their destination has been confirmed as being ready, to prevent contamination of holding areas. A dedicated COVID-19 operating theatre should be designated, ideally a negative pressure theatre that is close to the theatre complex entrance to allow clear routes for movement of patients, without passing through non-infected areas.

The COVID-19 theatre should be adequately stocked with the equipment required for specific procedures. Runners should be available outside of theatre to pass equipment through a non-infected area. Local protocols should be agreed for personal protective equipment (PPE) in the operating theatre, including scrubbing, donning and doffing techniques, and allocation of dedicated changing areas. Online video resources are available to support training^{32,33}. To preserve limited stock of PPE, procedures should be risk-assessed based on patient and procedure factors.

Postoperative complications

Surgeons should be prepared to manage a range of complications in patients with COVID-19 infection. Patients who develop fever of unknown origin or respiratory symptoms should be isolated, and chest CT performed or COVID-19 laboratory testing considered. To prevent cross-infection, such patients should be cared for by COVID-19-specific surgical teams if possible, rather than teams who are also seeing uninfected patients.

When planning patients' discharge from hospital, surgeons should consider their psychosocial needs. If there is a possibility that patients are still infectious, they should be given clear advice on how to avoid transmitting COVID-19 to members of their household.

Team structures

The risk of surgical team members cross-infecting patients and other staff is high. Team structures are variable across the world, so local teams need to make decisions on how to care for patients during the pandemic. Staff sickness is likely in surgical teams and should be planned for, with surgeons preparing as teams rather than individually. Potential approaches include doubling or cross-covering rotas in anticipation of high levels of staff absence owing to sickness and self-isolation, reducing doctor-to-patient ratios in some parts of the hospital, and augmenting surgical teams with retired surgeons, clinical academics or final-year medical students.

Consideration needs to be given to keeping the surgical workforce safe and able to complete their duties. Social distancing should be maintained by cancelling face-to-face meetings, and promoting teleconferencing, including that for multidisciplinary team meetings. Support should be identified for staff who have childcare needs, for example when schools are closed, or other caring responsibilities. Consideration should be given to which staff members are at high risk of COVID-19 complications (such as pregnant surgeons, older surgeons, those with co-morbidities) and whether their duties should be altered to reduce the risk of infection.

Discussion

To mount an effective response to the COVID-19 pandemic, hospitals should prepare detailed context-specific pandemic preparedness plans for surgical services, addressing the key domains identified here (*Table 1*). Specific guidance should be updated continuously to reflect emerging evidence as the COVID-19 pandemic progresses. In communities that have not experienced infectious disease outbreaks, planning should build on the lessons learnt in regions that have already had large-scale COVID-19 (*Table 2*) and Ebola virus disease (*Table 3*) epidemics.

Currently, most recommendations are based on expert opinion only and there are many areas of uncertainty (*Table 4*). To inform COVID-19 surgical plans and address patients' concerns effectively (*Table 5*), there is an urgent need for high-quality multicentre research. Key areas for future research include determining the impact of COVID-19 infection on postoperative outcomes, identifying risk stratification strategies, and determining whether prophylaxis using repurposed drugs (for example hydroxychloroquine) reduces rates of hospital-acquired COVID-19 infection. There is also a need to determine

Table 1 Key domains	
Domain	Recommendations
Prepare a pandemic response plan for surgical services	All hospitals should prepare context-specific pandemic plans that can be implemented as soon as COVID-19 cases are identified locally. Plans should include all surgical specialties and both elective and emergency services
Ensure staff are trained to deliver surgery safely during pandemic	Practise drills with experienced infection control teams, including: patient transfers between different areas of the hospital; donning and doffing personal protection equipment; recognizing and managing COVID-19 infection
Support hospital response to COVID-19	Reduce non-urgent activities, including outpatient clinics, endoscopy and non-cancer elective operations. Plan how to continue delivering urgent elective surgery safely, for example for patients with cancer
Agree a team-based approach for running emergency services	Anticipate increased pressure on emergency surgical services during the pandemic, with staff absence owing to illness or quarantine. Establish team structures that minimize cross-contamination and risk of nosocomial infection
Recognize and manage COVID-19 infection	Have a high index of suspicion for COVID-19 infection in both emergency surgical admissions and patients who develop postoperative respiratory complications. Ensure there are arrangements in place for patients with suspected COVID-19 to be isolated and tested

Table 2 Solutions from around the world in dealing with COVID-19
In Lombardy in Italy, severe trauma was centralized to specific hospitals, increasing capacity in other hospitals for admission of patients with suspected COVID-19
In Madrid, instant messaging groups linking different hospitals aided rapid identification of regional critical bed availability, facilitating rapid patient transfers
In South Korea, elective surgery continued throughout the COVID-19 outbreak. Patients were screened for respiratory symptoms and tested for COVID-19 infection before admission to minimize cross-infection risk
In Singapore, 'hot teams' were established to manage acute surgical admissions, while 'cold teams' continued elective work. Contact between hot and cold teams was minimized to reduce cross-infection risk
In Hong Kong, public hospitals implemented early measures to reduce nosocomial spread of infection, including prohibiting visitors, and requiring everyone to wear masks on hospital premises
In Ghana, dedicated theatres and holding bay facilities were established in isolated infectious disease facilities
In the UK, the National Health Service entered into partnerships with independent sector providers to support both the treatment of patients with COVID-19 and also to deliver urgent operations and cancer care

Table 3 Lessons from Ebola virus disease epidemics
Although the focus will be on treating the epidemic, patients will continue to need emergency procedures, including caesarean sections; ensure that hospital leaders are aware of the need to plan how surgical services will operate during the epidemic
Strictly adhere to policies for wearing PPE; a colleague should observe gowning and degowning to ensure it is properly completed
Prepare for colleagues to become sick; hospitals should plan for how to continue delivering surgical services with reduced number of staff
Working through an epidemic with high patient caseload and high mortality rates is psychologically challenging; hospitals should plan how they can support staff both psychologically in the short term and long term
Governments should ensure that healthcare workers are covered by insurance schemes so that, in the event of their acquiring infection, their dependents are protected financially

PPE, personal protective equipment.

Table 4 Uncertainties for patients and surgeons
What is the risk of acquiring COVID-19 infection following elective surgery? Should patients be specifically consented for postoperative COVID-19 pneumonia?
Should the use of non-operative management be increased for acute surgical conditions (e.g. antibiotic therapy for appendicitis)?
Should elective cancer surgery continue in hospitals affected by COVID-19?
Should surgeons stay on hospital premises during the pandemic to avoid the risk of infecting their families?

Table 5 Questions patients might have

Does the hospital have sufficient resources to safely complete my surgery?
What is my risk of being infected with COVID-19 after my surgery?
Would COVID-19 infection at the time of surgery increase my risk of dying or suffering a serious complication after surgery?
Will my family be able to visit me in hospital?
If my surgery is cancelled, when is it likely to be rescheduled?
If my surgery is cancelled, what should I do if my condition gets worse?
If cancelling my surgery means that I am unable to work, what help can I get?
What happens if I am unable to get the medications I need from the pharmacy?

whether COVID-19 is present in abdominal fluids (such as peritoneal fluid, bile and urine) or aerosols created during gas insufflation, in order to inform recommendations around the benefits and risks of open and laparoscopic surgery during the COVID-19 pandemic.

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References

- 1 Brindle M, Gawande A. Managing COVID-19 in surgical systems. *Ann Surg* 2020; <https://doi.org/10.1097/SLA.0000000000003923> [Epub ahead of print].
- 2 Pellino G, Spinelli A. How COVID-19 outbreak is impacting colorectal cancer patients in Italy: a long shadow beyond infection. *Dis Colon Rectum* 2020; <https://doi.org/10.1097/DCR.0000000000001685> [Epub ahead of print].
- 3 Spinelli A, Pellino G. COVID-19 pandemic: perspectives on an unfolding crisis. *Br J Surg* 2020; <https://doi.org/10.1002/bjs.11627> [Epub ahead of print].
- 4 Chen YH, Peng JS. [Treatment strategy for gastrointestinal tumor under the outbreak of novel coronavirus pneumonia in China.] *Zhonghua Wei Chang Wai Ke Za Zhi* 2020; **23**: I–IV.
- 5 Hu XH, Niu WB, Zhang JF, Li BK, Yu B, Zhang ZY *et al*. [Thinking of treatment strategies for colorectal cancer patients in tumor hospitals under the background of coronavirus pneumonia.] *Zhonghua Wei Chang Wai Ke Za Zhi* 2020; **23**: E002.
- 6 Lai THT, Tang EWH, Chau SKY, Fung KSC, Li KKW. Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong. *Graefes Arch Clin Exp Ophthalmol* 2020; <https://doi.org/10.1007/s00417-020-04641-8> [Epub ahead of print].
- 7 Li X, Liu M, Zhao Q, Liu R, Zhang H, Dong M *et al*. [Preliminary recommendations for lung surgery during 2019 novel coronavirus disease (COVID-19) epidemic period.] *Zhongguo Fei Ai Za Zhi* 2020; **23**: 133–135.
- 8 Li Y, Qin JJ, Wang Z, Yu Y, Wen YY, Chen XK *et al*. [Surgical treatment for esophageal cancer during the outbreak of COVID-19.] *Zhonghua Zhong Liu Za Zhi*. 2020; **42**: E003.
- 9 Luo Y, Zhong M. [Standardized diagnosis and treatment of colorectal cancer during the outbreak of novel coronavirus pneumonia in Renji hospital.] *Zhonghua Wei Chang Wai Ke Za Zhi* 2020; **23**: E003.
- 10 Ma FH, Hu HT, Tian YT. [Surgical treatment strategy for digestive system malignancies during the outbreak of novel coronavirus pneumonia.] *Zhonghua Zhong Liu Za Zhi* 2020; **42**: E001.
- 11 Si Y, Sun XF, Zhong M, Yue JN, Fu WG. [Countermeasures and treatment for aortic acute syndrome with novel coronavirus pneumonia.] *Zhonghua Wai Ke Za Zhi* 2020; **58**: E002.
- 12 Tao KX, Zhang BX, Zhang P, Zhu P, Wang GB, Chen XP; General Surgery Branch of Hubei Medical Association, General Surgery Branch of Wuhan Medical Association. [Recommendations for general surgery clinical practice in novel coronavirus pneumonia situation.] *Zhonghua Wai Ke Za Zhi* 2020; **58**: 170–177.
- 13 Ti LK, Ang LS, Foong TW, Ng BSW. What we do when a COVID-19 patient needs an operation: operating room preparation and guidance. *Can J Anaesth* 2020; <https://doi.org/10.1007/s12630-020-01617-4> [Epub ahead of print].
- 14 Wen X, Li Y. Anesthesia procedure of emergency operation for patients with suspected or confirmed COVID-19. *Surg Infect (Larchmt)* 2020; **21**: 299.
- 15 Xu K, Lai XQ, Liu Z. [Suggestions for prevention of 2019 novel coronavirus infection in otolaryngology head and neck surgery medical staff.] *Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi* 2020; **55**: E001.

- 16 Yu GY, Lou Z, Zhang W. [Several suggestion of operation for colorectal cancer under the outbreak of corona virus disease 19 in China.] *Zhonghua Wei Chang Wai Ke Za Zhi* 2020; **23**: 9–11.
- 17 Bradford IM. Tales from the frontline: the colorectal battle against SARS. *Colorectal Dis* 2004; **6**: 121–123.
- 18 Chee VW, Khoo ML, Lee SF, Lai YC, Chin NM. Infection control measures for operative procedures in severe acute respiratory syndrome-related patients. *Anesthesiology* 2004; **100**: 1394–1398.
- 19 Tan FL, Loo WL, Tan SG, Wong CY, Tan YM. Severe acute respiratory syndrome in surgical patients: a diagnostic dilemma. *ANZ J Surg* 2005; **75**: 21–26.
- 20 Tan TK. How severe acute respiratory syndrome (SARS) affected the Department of Anaesthesia at Singapore General Hospital. *Anaesth Intensive Care* 2004; **32**: 394–400.
- 21 Tien HC, Chughtai T, Joglekar A, Cooper AB, Brenneman F. Elective and emergency surgery in patients with severe acute respiratory syndrome (SARS). *Can J Surg* 2005; **48**: 71–74.
- 22 Vlantis AC, Tsang RK, Wong DK, Woo JK, van Hasselt CA. The impact of severe acute respiratory syndrome on otorhinolaryngological services at the Prince of Wales Hospital in Hong Kong. *Laryngoscope* 2004; **114**: 171–174.
- 23 Nazer RI. Outbreak of Middle East respiratory syndrome–coronavirus causes high fatality after cardiac operations. *Ann Thorac Surg* 2017; **104**: e127–e129.
- 24 Park J, Yoo SY, Ko JH, Lee SM, Chung YJ, Lee JH *et al*. Infection prevention measures for surgical procedures during a Middle East respiratory syndrome outbreak in a tertiary care hospital in South Korea. *Sci Rep* 2020; **10**: 325.
- 25 Badia JM, Rubio-Pérez I, Arias Diaz J, Guirao Garriga X, Serrablo A, Jover Navalón JM. Surgical protocol for confirmed or suspected cases of Ebola and other highly transmissible diseases. *Cir Esp* 2016; **94**: 11–15.
- 26 Brolin Ribacke KJ, van Duinen AJ, Nordenstedt H, Höijer J, Molnes R, Froseth TW *et al*. The impact of the West Africa Ebola outbreak on obstetric health care in Sierra Leone. *PLoS One* 2016; **11**: e0150080.
- 27 Drevin G, Molsted Alvesson H, van Duinen A, Bolkan HA, Koroma AP, Von Schreeb J. ‘For this one, let me take the risk’: why surgical staff continued to perform caesarean sections during the 2014–2016 Ebola epidemic in Sierra Leone. *BMJ Glob Health* 2019; **4**: e001361.
- 28 Haddad LB, Horton J, Ribner BS, Jamieson DJ. Ebola infection in pregnancy: a global perspective and lessons learned. *Clin Obstet Gynecol* 2018; **61**: 186–196.
- 29 Reichart PA, Gelderblom HR, Khongkhunthian P, Schmidt-Westhausen A. Ebola virus disease: any risk for oral and maxillo-facial surgery? An overview. *Oral Maxillofac Surg* 2016; **20**: 111–114.
- 30 British Society of Gastroenterology. *Endoscopy Activity and COVID-19: BSG and JAG Guidance – Update 22.03.20*. <https://www.bsg.org.uk/covid-19-advice/endoscopy-activity-and-covid-19-bsg-and-jag-guidance/> [accessed 26 March 2020].
- 31 American College of Surgeons. *COVID-19 Guidelines for Triage of Emergency General Surgery Patients*; 2020. <https://www.facs.org/covid-19/clinical-guidance/elective-case/emergency-surgery> [accessed 26 March 2020].
- 32 Di Saverio S. *Personal Protection During COVID 19 + Surgery*; 2020. <https://www.youtube.com/watch?v=d9vKVF3oPzI> [accessed 26 March 2020].
- 33 Kinross J.. *Sterile PPE Donning and Doffing Video for SURGICAL Aerosol Generating Procedures*; 2020. <https://www.youtube.com/watch?v=1M9IWuLzV28> [accessed 26 March 2020].

Supporting information

Additional supporting information can be found online in the Supporting Information section at the end of the article.