



## Recommendation

# Recommendations for the Operation of Endoscopy Centers in the setting of the COVID-19 pandemic – World Endoscopy Organization guidance document

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Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) is the etiologic agent causing the disease Corona Virus Disease 19 (COVID-19), resulting in a worldwide pandemic. Non-emergent endoscopy services have been disrupted as incidence and hospitalizations were rising. It is anticipated that the peak incidence may be leveling off in many parts of the world, but there is a concern for resurgence of the virus activity. Thus, it is important for endoscopy units to have plans in place during peak times of the epidemic and when resuming endoscopic services as the pandemic wanes. The global endoscopy community is faced with the challenge of providing care during

this time. The WEO-COVID guidance task force has provided this resource document based on the current evidence and consensus opinion. These World Endoscopy Organization (WEO) recommendations are meant to guide endoscopists worldwide, should be interpreted in light of specific clinical conditions and resource availability and may not apply in all situations. This guidance document does not supersede the need to check for all local regulations and legislations.

**Key words:** best practices, clinical practice guideline, corona virus, COVID-19, endoscopy, PPE and pandemic, SARS-CoV 2

## INTRODUCTION

IN DECEMBER 2019 the World Health Organization (WHO) first reported a cluster of cases caused by a novel strain of corona virus, Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). Over six million people in more than 200 countries have been affected and 371,000 deaths reported to date in what is now considered a global pandemic by the WHO.<sup>1</sup>

Although the most common manifestation of SARS-CoV-2 is a respiratory illness, the manifestations of the disease have varied from a completely asymptomatic presentation to respiratory failure, septic shock, organ and coagulation

dysfunction with case fatality rates ranging from <1% to 16.4%.<sup>2</sup> Human–human transmission of SARS-CoV-2 mainly occurs through large droplets and contact and less so by aerosols and fomites.<sup>3–5</sup> The virus can be transmitted at least to a distance of one meter by aerosols, although the maximum distance is unclear.<sup>6,7</sup> Endoscopists are at risk of aerosol infection due to the proximity to patient and the potential aerosol generation during the procedures, although, recent data suggest that the risk is low.<sup>8–10</sup> In the setting of rapid spread and high fatality rate, all non-emergent procedures including endoscopy were delayed throughout the world. This was to minimize the spread of the disease and decrease resource utilization. Due to stringent social distancing norms and quarantines, most countries seem to have passed their peak of infections (Phase 6 of the six phases of the pandemic as defined by WHO) or there has been “flattening of the curve”.<sup>1,11</sup> Though, many parts of the world are seeing a decreased disease activity level (compared to peak), current models suggest possible resurgence

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of the disease due to relaxation of social distancing norms.<sup>12,13</sup> Delays in endoscopic procedures result in backlogs and potential for delay in diagnosis and harm to patients.<sup>10,11</sup> Delaying colorectal cancer screening and variceal screening in those with cirrhosis for 6 months could result in delayed diagnosis, increased health care costs and mortality.<sup>12,14</sup>

The task force understands that the disease severity might be different in various parts of the world and the resources might be variable. This document deals with (i) the practice of safe endoscopy (peak/resurgence of the disease/phases 4–6) and (ii) recommendations during the post peak phase.<sup>15</sup>

## PEAK PHASE/RESURGENCE PHASE

**D**URING THE PEAK phase, most units stopped performing routine elective endoscopy. In triaging the care of patients needing endoscopy, it is important to consider the indication and the urgent need for the procedure. Routine procedures (no harm if not done in 4 weeks) should be avoided and urgent ones are to be done (delay harmful to the patient). The principal concept being benefits > harm.

Prior to performing endoscopy, attempts should be made to identify patients at increased risk for or currently infected with the Corona Virus Disease 19 (COVID-19) virus. All patients should be screened by questionnaire for symptoms or exposures. Positive answers should prompt viral testing or delay or cancellation of non-urgent procedures or

consider performing/transfer to a COVID-19 dedicated facility. If viral testing is readily available, it is recommended that all patients undergo rapid nucleic acid based Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)/antigen testing.<sup>16</sup> Ideally, these tests should be performed within 72 h of the procedure.<sup>17</sup> Highly sensitive point of care tests should be used when available and reliable. Barriers to routine pre-procedure testing include availability, cost, and turn-around times. Laboratory tests with long turn-around times may require patients to self-quarantine until the results are available. Serological tests are not useful for identifying patients with active infections. Patients with prior COVID-19 should have viral testing to ensure clearance.<sup>18</sup> It is a reasonable assumption that reactivation, re-infection and viral shedding despite seroconversion are possible.<sup>12</sup>

In general, all endoscopic procedures carry some risk of generating aerosols. Upper endoscopic procedures are thought to carry the highest risk. Although SARS-CoV-2 has been isolated from stool, fecal oral transmission of the virus has not been confirmed. Nonetheless, colonoscopy and sigmoidoscopy do carry some risk of aerosol generation.<sup>18</sup> It is recommended to have an algorithm to help triage and make decisions especially in the case of rising COVID-19 infections or peak prevalence (Table 1).<sup>19</sup> There have been various algorithms proposed based on the experience from areas where the disease prevalence was high and risk stratification was based on either laboratory-based RT-PCR testing or clinical, epidemiological or procedure related risk

**Table 1** Prioritization of endoscopic procedures during peak pandemic prevalence

Procedures to be done	Informed decision	Procedures to be delayed
Upper and lower GI bleeding - Symptomatic	HGD/CiS -esophagus/stomach	Screening and surveillance colonoscopy (asymptomatic)
Dysphagia – Foreign body/malignancy	Large colon polyps with dysplasia-delay may result in inoperability	Screening, surveillance (postbleed) of esophageal varices
Cholangitis or suspected cholangitis	Enteral nutrition	EGD for non-alarm symptoms
Symptomatic pancreaticobiliary disease – drainage procedures	Closure of fistula/leakage	pH and motility procedures
Palliative procedure for luminal obstruction	Dysphagia/dyspepsia without alarm symptoms	EUS for evaluation of low/intermediate risk cyst surveillance
Patients with a time-sensitive diagnosis – endoscopy effects treatment change - malignant/premalignant/IBD	Stable GI bleed/anemia	Bariatric procedures
	Non-urgent evaluation of radiological abnormalities/tissue acquisition	Screening or surveillance for Barrett's esophagus
		Gastric cancer screening (no symptoms)

CiS, carcinoma in situ; EUS, Endoscopic Ultrasound; GI, Gastrointestinal; HGD, High grade dysplasia; IBD, Inflammatory Bowel Disease. Adapted from: [https://webfiles.gi.org/links/media/Joint\\_GI\\_Society\\_Guidance\\_on\\_Endoscopic\\_Procedure\\_During\\_COVID19\\_FINAL\\_impending\\_3312020.pdf](https://webfiles.gi.org/links/media/Joint_GI_Society_Guidance_on_Endoscopic_Procedure_During_COVID19_FINAL_impending_3312020.pdf) and [https://www.esge.com/assets/downloads/pdfs/general/ESGE\\_ESGENA\\_Position\\_Statement\\_gastrointestinal\\_endoscopy\\_COVID\\_19\\_pandemic.pdf](https://www.esge.com/assets/downloads/pdfs/general/ESGE_ESGENA_Position_Statement_gastrointestinal_endoscopy_COVID_19_pandemic.pdf).

factors.<sup>12,20–27</sup> Ultimately the decision to perform or delay a case should be individualized.

## ENDOSCOPY FOR INFECTED OR HIGH-RISK INDIVIDUALS

IT IS PREFERABLE these procedures are done in hospital-based endoscopy unit preferably in a negative pressure room where available. Portable High Efficiency Particulate Air (HEPA) filters could be used. Endoscopists and staff should protect themselves with full PPE including respirator mask, water proof disposable gown, gloves (double recommended), protective hairnet, eyewear and shoe cover, using proper donning and doffing techniques.<sup>28</sup> When general endotracheal anesthesia is used only the anesthesiologist/anesthesia staff and a nurse with full Personal Protective Equipment (PPE) be present in the room at the time of intubation and extubation. Post-procedure the endoscopist should remove the PPE and ideally outside the room with the help of a second person. PPE should be removed, hand hygiene performed prior to moving to the work area to complete the operative procedure notes. Post-procedure, the room should remain empty for 6–12 air cycle exchanges and then undergo terminal cleaning (all surfaces, including walls to be wiped down with standard hospital grade disinfectant). The current recommendation is for six air exchanges for endoscopy and 12 for bronchoscopy. Increased air exchanges to 12/min may reduce the time in between procedures to 30 min.<sup>29</sup> It is helpful to post the donning and doffing instructions in the endoscopy room.<sup>20,28,30,31</sup> Some novel barrier shields are in development.<sup>32–34</sup>

## ENDOSCOPY FOR LOW-RISK OR ASYMPTOMATIC PATIENTS

FOR ASYMPTOMATIC AND low-risk patients (e.g. no history of exposure or travel to high-risk area, negative pre-procedure viral testing) standard PPE including surgical mask, eye protection, gown and gloves is recommended. The decision to use a respirator mask should be based on local availability of respirators and SARS-CoV2 prevalence recognizing that asymptomatic patients may shed virus. (Table 2).

## OTHER CONSIDERATIONS DURING THE PEAK/ RESURGENCE PHASE

ONLY ESSENTIAL PERSONNEL should be present in the endoscopy room. Minimize the number of horizontal surfaces in the room. The endoscopy assistant should

change gloves to touch or reach any equipment to minimize contamination. Trainee involvement may be restricted. Reuse of the N95 respirator mask is considered reasonable in view of the local shortages and various methods are available to preserve them. Please check the local resources for the optimal method of preserving and reusing the masks.<sup>35</sup> Options include using the same mask for a week at a time and storing the mask in a paper bag or container until the end of the week or until it is soiled and is either discarded or sent for cleaning. Similar strategies have been used for face shields. Other barrier equipment including impervious gowns, hair nets, shoe covers, and nitrile gloves seem to be available. Where N95 or equivalent respirator masks are not available a surgical mask may be used. Data regarding efficacy as compared to N95 respirator are conflicting.<sup>16,36,37</sup> Combining with a face shield and eye protection maximizes protection. There are other respirator masks available but not all of them are equally efficacious, and many including the N95 require fit testing to ensure an adequate seal. Consider checking the National Institute of Occupational Safety and Health website for updated recommendations.<sup>38</sup> Other respirator options are listed.

**Table 2** Recommended PPE for the unit staff

Admission area	Procedure room	Pre- and post-procedure area
Surgical mask	Surgical mask if low prevalence or tested negative for COVID19	Surgical mask
Nitrile gloves	Fit tested respirator (N95, FFP2/FFP3, CAPR, PAPR) if no test and prevalence is >1% or uncertain Nitrile gloves – double glove is recommended	Nitrile gloves  If direct contact with a patient, consider respirator if COVID-19 positive or uncertain Eye protection if patient masking is not secure
	Impervious gowns/ laundered gowns Face Shield/Eye protection Head covering Shoe covers (optional) No makeup/jewelry/ facial hair especially if respirator masks are to be used	

CAPR, controlled air purifying respirator; COVID-19, Corona Virus Disease 19; FFP, filtering face piece; PAPR, powered air purifying respirator.

PPE guidance for staff working in different areas of the unit can be tailored based on exposure risk.

## GUIDANCE FOR SAFE ENDOSCOPY SERVICES POST PEAK/RESURGENCE OF COVID-19 INFECTION

### General guidance

**B**EFORE OPENING ONE should check with the local regulations and authorities regarding the opening of endoscopy services. Any regional/local guidance supersedes any guidance provided here since local conditions may vary. WEO recommends that you notify your local/regional health authorities regarding resumption of services as applicable. Ideally, resume endoscopy after a period of at least 2 weeks where there is no surge in the number of reported cases in the local area/region. Performance of endoscopy is dependent on adequate facilities, personnel, and PPE. For ease of description and planning the guidance is divided into facility, personnel, PPE, patient flow and follow up, equipment and financial issues. Based on the experience in areas where endoscopy services were resumed, initially only urgent procedures were done, with most centers gradually performing endoscopy for patients with symptoms or follow up of a finding on imaging prior to resuming elective procedures such as surveillance endoscopy and/or screening procedures.

### Facilities

Prior to reopening, assess the endoscopy unit including the pre-procedure and post-procedure areas to maximize safety for patients and staff. This includes appropriate ventilation, negative pressure capabilities, the possibility of using portable HEPA filter equipment, air change rate settings, and adequate spacing or barrier separation of patients in the pre- and post-procedure recovery areas. If pre-procedure COVID-19 testing is to be offered, identify a testing site remote from the endoscopy unit so as to prevent potentially infected patients from entering your facility. We recommend assessing the lobby area rearranging or taping off seats and adding appropriate signage to maintain physical distancing (2 m). Consider installation of additional barriers at reception (e.g., Plexiglas). Notify your vendors (supply chain), referring providers and other ancillary services. Ensure that your affiliated or local hospital has adequate capacity to admit your patients should the need for hospitalization arise. For endoscopy units that were completely shut down, it is advisable to contact your scope manufacturer regarding scope cleaning. All procedural areas should undergo terminal cleaning before reopening. For larger units it might be reasonable to delegate teams to look into various aspects of

operations such as scheduling, screening, room turnover, sedation/anesthesia, infection control and supplies. Team members might include an endoscopist, the nurse manager, anesthesia provider and administrative staff each with a delegated responsibility and perform a periodic team meeting to ensure safe operation of the unit and to ensure patient and staff safety. Check lists are helpful (Table 3).

### Personnel

We advise contacting the staff to ensure their availability and that there is adequate staffing while planning return to operations. Ideally, staff should be assigned to one team consisting of one endoscopist with a procedure nurse/assistant per day so that in case of exposure alternate staff are available. This also helps with the flow and minimizes PPE use. During the procedure minimize staff changes to conserve PPE. Staff should be rotated in such a way that there are an adequate number of staff should there be any illness or exposure. Consider using one or two teams for the intra-procedural area for a few days or weekly and rotate them with the pre/post-procedural area staff. All staff should be checked daily for temperature, symptoms, and exposure. Staff rest areas should also be maintained in such a way that there is social distancing. All staff should wear a mask on entry to the unit until they exit except when eating, drinking beverages or when they are in their private offices. Staggered breaks are advised to minimize crowding in the rest areas.

Trainee participation during the peak phase was restricted to minimize exposure and conserve PPE. Balance educational needs with the clinical needs of the patient and the operational issues. Similar restrictions apply for observers and industry representatives.

### PPE

Ensure that adequate PPEs are available and based on the size, number of procedures and personnel. Respirators may

**Table 3** Proposed preprocedural check list

Symptom questionnaire	Negative 72 h prior and day of examination
Preoperative antigen testing	Negative when possible
Check-in/recovery	Secluded area
Attendant policy	Limit at most to one screened attendant
Mask policy	Must for patient and attendant
If symptom questionnaire/ test positive	Triage and follow up appropriately

require fit testing, and this should be done for each team member in advance of opening. It is advisable to have at least 2 weeks supply of supplies and PPE in place. PPE requirements can be estimated based on the prior usage patterns.<sup>39,40</sup>

## Patient flow

### Pre- procedure considerations

It is advisable that the patient is contacted and administered the symptom questionnaire in advance of their appointment. Electronic formats may be used. Questionnaire may be adapted to the local language. It is advisable to have a visitor policy and a policy for communication of results and when applicable attendants (not more than one) come with a mask. Any attendant may also be prescreened by the questionnaire and temperature check. Maintaining social distance is important. Other useful strategies include curbside drop off and pick up of patients and staggered arrivals. If the patient either tests positive or has a positive questionnaire in the absence of SARS-CoV-2 testing capability, one should consider delaying the procedure until the patient is asymptomatic or has a negative test. If the procedure is time sensitive, then consider performing it with the utmost precaution using full PPE including respirators preferably in a hospital or a negative pressure room.

The preprocedural check-in area should be minimally occupied. Avoid any unnecessary furniture or decorations to minimize cleaning requirements. Rearrange furniture to maintain 2 m distance between each patient/visitor. Staff should be advised to wear gloves or use 70% alcohol-based sanitizer between each contact. Any electronic equipment used should be cleaned after every use and the use of disposable pens is encouraged. Avoid reading materials, uncovered food or unbottled beverages. Ensure hand sanitizers or hand wash areas are available.

### Intra-procedural considerations

Ensure all personnel in the room have adequate PPEs based on the availability and the patient's risk for possible COVID-19. Proper donning and doffing of the PPE is important to minimize risk of infection.<sup>28</sup> The patient should remain masked for all procedures to the extent possible, removing at the time of upper endoscopy or if there is a need to access the airway. Various barriers between the endoscopist and the patient are being developed and use of these would depend again on local resources. Minimize staff only to the critical personnel needed in the room. Patients should be adequately recovered in the endoscopy room to ensure secure patient masking prior to moving to the recovery area. Nebulizer

therapy if needed, should be done in the procedure room and wait until coughing (if any) subsides prior to transfer. Patient should be transported with a facial mask.

### Post-procedural considerations

All staff should follow the proper protocol for doffing the PPE. Once PPE is removed and hand hygiene is performed the endoscopist should wear a regular mask before returning to the work area to complete the procedure note and discharge instructions.<sup>28</sup> Based on the unit policy the post-procedure findings and instructions may be conveyed to the patient/visitor or family in person or by a telephone/video visit. Each provider should be provided only one workstation, telephone, and equipment. Use of surgical scrubs in the work area when feasible might limit infection.

### Endoscopy unit and cleaning

The endoscopy unit floor should be mopped regularly at least two–three times a day. All procedure rooms should be cleaned after each procedure. All horizontal surfaces should be cleaned. Consider terminal cleaning after each high-risk patient procedure or at least once a day at the end of each day. Consider cleaning all door handles/knobs or frequently touched surfaces. All toilets should be cleaned regularly.

### Scope reprocessing

At this time there are no special scope reprocessing requirements other than manufacturer recommended standard high-level disinfection. Scope reprocessing personnel should wear standard PPE.

### Patient follow up

Appropriate follow up is suggested. Consider surveying patients 1–2 weeks post-procedure for symptoms of SARS-CoV-2 over the phone and advising that the patient and family should notify the unit immediately if the patient develops any symptoms or tests positive for SARS-CoV-2 to help with contact tracing and infection control. It helps to maintain the list of procedures delayed/deferred and review periodically to facilitate and assess patient's symptoms and need for procedure sooner. An elective procedure does not mean the procedure is optional.

## CONCLUSIONS

THE COVID-19 PANDEMIC has had major impacts on the practice of endoscopy. During the exponential



growth phase leading to a peak in cases and medical resource usage, most endoscopy practices were markedly curtailed. In order to practice safely during the surge, careful triage of patients such that only the most urgent and emergent procedures are done is important to preserve needed supplies, PPE and limit infectious exposures. Meticulous infection control practices particularly with regard to PPE are necessary to protect staff from infection and spreading that infection to others including patients. As the surge passes, endoscopy units should reopen in order to provide needed treatment to patients. Safe reopening requires a different but related set of principles with a focus on safety and infection control given the continued community spread of COVID-19. Even with mitigation and community infection control measures, future recurrences and surges are possible, and units need to be ready to respond with reinstitution of strict triage etc. This WEO consensus document provides guidance to endoscopists and endoscopy units to continue to provide needed care to patients both during a pandemic surge and the subsequent recovery.

These recommendations are meant to guide endoscopists may not apply in all situations, and do not supersede local advisories and institutional guidelines.

## CONFLICT OF INTERESTS

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## FUNDING INFORMATION

NONE.

## REFERENCES

- 1 Cornoavirus Resource Center. [Cited 14 Jun 2020.] Available from URL: <https://coronavirus.jhu.edu/data/new-cases>.
- 2 Case fatality data from Johns Hopkins University. [Cited 12 May 2020.] Available from URL: <https://coronavirus.jhu.edu/data/mortality>.
- 3 Chan JF, Yuan S, Kok KH *et al.* A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet* 2020; **395**: 514–23.
- 4 Lewnard JA, Lo NC. Scientific and ethical basis for social-distancing interventions against COVID-19. *Lancet Infect Dis* 2020; **20**: 631–3.
- 5 Feng Y, Marchal T, Sperry T, Yi H. Influence of wind and relative humidity on the social distancing effectiveness to prevent COVID-19 airborne transmission: A numerical study. *J Aerosol Sci.* 2020; **147**: 105585.
- 6 Zhu N, Zhang D, Wang W *et al.* A Novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020; **382**: 727–33.
- 7 Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *Lancet* 2020; **395**: 470–3.
- 8 Johnston ER, Habib-Bein N, Dueker JM *et al.* Risk of bacterial exposure to the endoscopist's face during endoscopy. *Gastrointest Endosc.* 2019; **89**: 818–24.
- 9 Wong TW, Lee CK, Tam W *et al.* Cluster of SARS among medical students exposed to single patient, Hong Kong. *Emerg Infect Dis.* 2004; **10**: 269–76.
- 10 Repici A, Aragona G, Cengia G *et al.* Low risk of covid-19 transmission in GI endoscopy. *Gut* 2020;gutjnl-2020-321341. [Published online ahead of print]. DOI: <https://doi.org/10.1136/gutjnl-2020-321341>.
- 11 Kenyon C. Flattening-the-curve associated with reduced COVID-19 case fatality rates- an ecological analysis of 65 countries. *J Infect* 2020; **81**: e98–9.
- 12 Gupta S, Shahidi N, Gilroy N, Rex DK, Burgess NG, Bourke MJ. A proposal for the return to routine endoscopy during the COVID-19 pandemic. *Gastrointest Endosc* 2020;S0016-5107(20)34249-8. [Published online ahead of print]. <https://doi.org/10.1016/j.gie.2020.04.050>.
- 13 Pita-Fernandez S, Gonzalez-Saez L, Lopez-Calvino B *et al.* Effect of diagnostic delay on survival in patients with colorectal cancer: A retrospective cohort study. *BMC Cancer* 2016; **16**: 664.
- 14 North Italian Endoscopic Club for the S, Treatment of Esophageal V. Prediction of the first variceal hemorrhage in patients with cirrhosis of the liver and esophageal varices. A prospective multicenter study. *N Engl J Med* 1988; **319**: 983–9.
- 15 Pandemic Influenza Preparedness and Response: A WHO Guidance Document. *Gastrointest Endosc.* 2020; S0016-5107(20)34247-4. [Published online ahead of print]. DOI: 10.1016/j.gie.2020.04.048. Available from URL:<https://www.ncbi.nlm.nih.gov/books/NBK143061/>.
- 16 Boskoski I, Gallo C, Wallace MB, Costamagna G. COVID-19 pandemic and personal protective equipment shortage: Protective efficacy comparing masks and scientific methods for respirator reuse. *Gastrointest Endosc* 2020.<https://doi.org/10.1016/j.gie.2020.04.048>.
- 17 WEO Guidelines. [Cited 23 May 2020.] Available from URL: [http://www.worldendo.org/wp-content/uploads/2020/05/WEO\\_Guidance-for-Reopening-Endoscopy-Services-May-2020.pdf](http://www.worldendo.org/wp-content/uploads/2020/05/WEO_Guidance-for-Reopening-Endoscopy-Services-May-2020.pdf).
- 18 Ding S, Liang TJ. Is SARS-CoV-2 also an enteric pathogen with potential fecal-oral transmission: A COVID-19 virological and clinical review. *Gastroenterology* 2020; S0016-5085(20)30571-0. <https://doi.org/10.1053/j.gastro.2020.04.052>. [Published online ahead of print].
- 19 Gralnek IM, Hassan C, Beilenhoff U *et al.* ESGE and ESGENA position statement on gastrointestinal endoscopy and the COVID-19 pandemic. *Endoscopy* 2020; **52**: 483–90.
- 20 Repici A, Maselli R, Colombo M *et al.* Coronavirus (COVID-19) outbreak: What the department of endoscopy should know. *Gastrointest Endosc* 2020; **92**: 192–7.

- 21 Lui RN, Wong SH, Sanchez-Luna SA *et al.* Overview of guidance for endoscopy during the coronavirus disease 2019 pandemic. *J Gastroenterol Hepatol* 2020; **35**: 749–59.
- 22 Han J, Wang Y, Zhu L *et al.* Preventing the spread of COVID-19 in digestive endoscopy during the resuming period: Meticulous execution of screening procedures. *Gastrointest Endosc* 2020; S0016-5107(20)34133-X. <https://doi.org/10.1016/j.gie.2020.03.3855>. [Published ahead of print].
- 23 Chiu PWY, Ng SC, Inoue H *et al.* Practice of endoscopy during COVID-19 pandemic: Position statements of the Asian Pacific Society for Digestive Endoscopy (APSDE-COVID statements). *Gut* 2020; **69**: 991–6.
- 24 American College of Gastroenterology Guidance on safely reopening of your endoscopy centers.. [Cited 12 May 2020.] Available from URL: <https://webfiles.gi.org/docs/policy/2020resuming-endoscopy-fin-05122020.pdf>.
- 25 ASGE guidance on reopening of endoscopy units, 2020. [Cited 19 May 2020.] Available from URL: [https://www.asge.org/docs/default-source/default-document-library/asge-guidance-for-reopening\\_4-28-2020.pdf](https://www.asge.org/docs/default-source/default-document-library/asge-guidance-for-reopening_4-28-2020.pdf).
- 26 Guidelines D-A. *Joint AGA/DHPA Guidance: Recommendations for Resumption of Elective Endoscopy During the COVID-19 Pandemic*, 2020. DHPA-AGA guidelines. [Cited 27 Apr 2020.] Available from URL: <https://www.dhpassociation.org/2020/04/27/aga-dhpa-resume-endoscopy-covid19/>.
- 27 An P, Huang X, Wan X *et al.* ERCP during the pandemic of COVID-19 in Wuhan. *China. Gastrointest Endosc* 2020; S0016-5107(20)34174-2. <https://doi.org/10.1016/j.gie.2020.04.022>. [Published online ahead of print].
- 28 CDC guidelines for Donning and Doffing of PPE, 2020. [Cited 12 May 2020.] Available from URL: <https://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>.
- 29 CDC airexchange for COVID, 2020. [Cited 23 May 2020.] Available from URL: <https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1>.
- 30 Soetikno R, Teoh AY, Kaltenbach T *et al.* Considerations in performing endoscopy during the COVID-19 pandemic. *Gastrointest Endosc* 2020; **92**: 176–83.
- 31 Ortega R, Gonzalez M, Nozari A, Canelli R. Personal protective equipment and Covid-19. *N Engl J Med* 2020; **382** (26): e105. <https://doi.org/10.1056/NEJMc2014809>. [Epub 2020 May 19].
- 32 Marchese M, Capannolo A, Lombardi L, Di Carlo M, Marinangeli F, Fusco P. Use of a modified ventilation mask to avoid aerosolizing spread of droplets for short endoscopic procedures during coronavirus COVID-19 outbreak. *Gastrointest Endosc* 2020; S0016-5107(20)34131-6. <https://doi.org/10.1016/j.gie.2020.03.3853>. [Published online ahead of print].
- 33 Sagami R, Nishikiori H, Sato T, Murakami K. Endoscopic shield: Barrier enclosure during the endoscopy to prevent aerosol droplets during the COVID-19 pandemic [published online ahead of print, 2020 May 11]. *VideoGIE* 2020; 10.1016/j.vgie.2020.05.002. <https://doi.org/10.1016/j.vgie.2020.05.002>.
- 34 Luis S, Margarita JH, Javier P, Daniela S. New protection barrier for endoscopic procedures in the era of pandemic COVID-19 [published online ahead of print, 2020 May 13]. *VideoGIE* 2020; 10.1016/j.vgie.2020.05.006. <https://doi.org/10.1016/j.vgie.2020.05.006>.
- 35 CDC Recommendations on Decontamination and Reuse of Filtering Facepiece Respirators. [Cited 19 May 2020.] <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html>.
- 36 Radonovich LJ Jr, Simberkoff MS, Bessesen MT *et al.* N95 respirators vs medical masks for preventing influenza among health care personnel: A randomized clinical trial. *JAMA* 2019; **322**: 824–33.
- 37 Loeb M, Dafeo N, Mahony J *et al.* Surgical mask vs N95 respirator for preventing influenza among health care workers: A randomized trial. *JAMA* 2009; **302**: 1865–71.
- 38 NIOSH approved N 95 masks, 2020. NIOSH approved N 95. [Cited 14 Jun 2020.] Available from URL: [https://www.cdc.gov/niosh/npptl/topics/respirators/disp\\_part/n95list1.html](https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/n95list1.html).
- 39 Sinonquel P, Roelandt P, Demedts I *et al.* COVID-19 and gastrointestinal endoscopy: What should be taken into account? [published online ahead of print, 2020 Apr 26]. *Dig Endosc* 2020; 10.1111/den.13706. <https://doi.org/10.1111/den.13706>.
- 40 PPE Burn Calculator, 2020. [Cited 14 Jun 2020.] Available from URL: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/burn-calculator.html>.