Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed

Interim guidance

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World Health Organization

Background

This is the third edition of WHO's interim guidance on infection prevention and control (IPC) strategies during health care when coronavirus disease (COVID-19) is suspected or confirmed. The first edition was adapted from WHO's interim guidance on *Infection prevention and control during health care for probable or confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection*,[1] and on *Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care*.[2] The rationale for this updated edition has been to expand the scope and structure of earlier guidance, bringing together other interim recommendations as well as considerations and advice from subject matter experts.

The main differences and additions compared to the previous versions[a] include the following:

- all sub-sections in the section "Principles of IPC strategies associated with health care for suspected or confirmed cases of COVID-19" were expanded to include clarifications and additional recommendations;
- new guidance and practical advice for management of visitors especially in areas with COVID-19 community transmission;
- inclusion of a sub-section on ventilation in the section "Environmental and engineering controls";
- new guidance on IPC considerations for surgical procedures for patients with suspected or confirmed COVID-19, as well as those patients whose COVID-19 status in unknow;
- considerations for dead body management in health care facilities;
- practical advice and available tools to assess health care facility IPC readiness and to monitor and evaluate IPC measures for COVID-19.

Guidance and considerations included in this document are based on published WHO scientific briefs, guidelines and guidance documents, including the WHO Guidelines on infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care[2], scientific briefs on modes of COVID-19 transmission and discontinuation of isolation, and other WHO COVID-19 interim guidance documents on clinical management, dead body management, and laboratory biosafety available at the WHO Country and Technical Guidance–Coronavirus Disease (COVID-19)[b]. In addition, this IPC guidance has been developed by consulting the WHO ad-hoc COVID-19 IPC Guidance Development Group (COVID-19 IPC GDG) that meets at least once a week, and an ad-hoc engineer expert group that provided input for the section on ventilation.

WHO will continue to update this guidance as new information becomes available.

This guidance is intended for health workers, including health care managers and IPC teams at the facility level, but it is also relevant for the national and district/provincial levels.

Principles of IPC strategies associated with health care for suspected or confirmed cases of COVID-19

To mount an optimal response to the COVID-19 outbreak using the strategies and practices recommended in this document, a facility level IPC programme with a dedicated and trained team or at least an IPC focal point should be in place and supported by the national and facility senior management.[3] In countries where IPC is limited or inexistent, it is critical to start by ensuring that at least basic IPC standards are in place at the national and health-care facility level to provide minimum protection to patients, health workers and visitors. These are known as the *minimum requirements* for IPC that have been developed by WHO in 2019[4] based on a broad consensus among international experts and institutions to facilitate the implementation of the WHO recommendations on the core components for IPC programmes.[3] Achieving the IPC minimum requirements as well as more robust and comprehensive IPC programmes according to the WHO core components across the whole health system in all countries is essential to sustain efforts to control the COVID-19 pandemic, other emerging infectious diseases health care-associated infections and antimicrobial resistance.

[a] Previous versions of this interim guidance were published on 25 January and on 19 March 2020 at https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance-publications

[b] WHO Country & Technical Guidance COVID-19: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance-publications

The five IPC strategies required to prevent or limit transmission of COVID-19 in health care facilities include the following:

Screening[c] and triage[d] for early recognition of patients with suspected COVID-19, and rapid implementation of source control measures

It is critical to screen all persons at the first point of contact with the health-care facility as well as inpatients with suspected COVID-19 to allow for early recognition, followed by their immediate isolation/separation.

Screening and triage

To facilitate screening and triage, health-care facilities should:

- display information at the entrance of the facility directing patients with signs and symptoms of COVID-19 to report to the designated area for screening;
- establish entrances for patients with signs and symptoms of COVID-19;
- train staff on the signs and symptoms of COVID-19 and the most recent case definitions;[e]
- encourage health workers to be alert to potential COVID-19 infection in all patients;
- establish well-equipped screening and triage stations, where screening questionnaires are used according to the most recent WHO case definitions, [c] and where staff have access to adequate supplies of personal protective equipment (PPE), based on WHO's rational use of PPE guidance;[5]
- ensure that screening personnel maintain a distance of at least 1 metre from patients, ideally with a separation created by a glass/plastic screen. If that is not possible, mask and eye protection should be worn;[5]
- use a screening algorithm to promptly identify and direct patients with suspected COVID-19 to an isolation room or dedicated COVID-19 waiting area; all suspected COVID-19 patients should wear masks for source control purposes and be positioned at least 1 metre apart from each other in a designated, well-ventilated, waiting area;
- ensure that a process is in place to reduce the amount of time suspected COVID-19 patients wait to be screened;
- after screening and isolation, triage patients using standardized and validated triage tools (e.g. WHO/ICRC/MSF/IFRC Integrated Interagency Triage Tool) to identify those in need of immediate care and those that can safely wait. Refer to WHO's clinical management of COVID-19 interim guidance.[6]
- suspected COVID-19 patients with symptoms of respiratory distress and severe underlying conditions should be prioritized for medical evaluation.

Isolation or designated waiting area

- Health-care facilities without enough single isolation rooms in emergency departments should designate a separate, well-ventilated area where patients with suspected COVID-19 can wait. This area should have benches, stalls or chairs placed at least 1 metre apart;
- the isolation or designated area should have dedicated toilets, hand hygiene stations, and trash bins with lid for disposal of paper tissues used for respiratory hygiene or after hand washing;
- display graphic information for patients to show them how to perform hand and respiratory hygiene.

To prevent transmission of COVID-19 in health-care facilities it is necessary to promptly detect inpatients with suspected COVID-19, who were missed by screening and triage efforts or became infected within the facility. This can be quite challenging given the high numbers of acute respiratory infections and the atypical clinical presentations of COVID-19.[7]

Health-care facilities should:

- encourage health workers to look out for potential COVID-19 cases, especially when inpatients show signs and symptoms of COVID-19 and there is no other clear explanation for these symptoms;
- encourage rapid testing and reporting of patients with suspected COVID-19 who have been identified after hospitalization;
- establish reminder systems to clinicians to consider COVID-19, based on signs and symptoms especially in areas with community transmission.

Applying standard precautions for all patients

Standard precautions aim to reduce the risk of transmission of bloodborne and other pathogens from both recognized and unrecognized sources. They represent the basic level of infection control precautions that should be used at all times in the care of all patients. Standard precautions include, but are not limited to, hand and respiratory hygiene, the use of appropriate PPE according to risk assessment,[5] environmental cleaning, and safe waste management.

Hand hygiene

Hand hygiene is one the most effective measures to prevent the spread of COVID-19 and other pathogens. For optimal hand hygiene performance, health workers should apply the following principles:[8,9]

- perform hand hygiene according to the WHO's My 5 Moments for Hand Hygiene approach in the following

[c] Screening: refers to prompt identification of patients with signs and symptoms of COVID-19

[d] Triage: prioritization of care according to severity using validated tools (e.g., WHO/ICRC/MSF/IFRC Integrated Interagency Triage Tool)

[e] WHO global surveillance for COVID-19: https://www.who.int/publications/i/item/global-surveillance-for-covid-19-caused-by-human-infection-with-covid-19-virus-interim-guidance

five situations: before touching a patient, before any clean or aseptic procedure is performed, after exposure to body fluid, after touching a patient, and after touching a patient's surroundings;
- hand hygiene includes either cleansing hands with an alcohol-based hand rub (ABHR) containing at least 70% alcohol, or with soap, water and disposable towels;
- alcohol-based hand rub products are preferred if hands are not visibly soiled;
- wash hands with soap and water when they are visibly soiled;
- use the appropriate technique and duration for performing hand washing or hand rubbing.

Respiratory hygiene

Ensure that the following respiratory hygiene measures are used:

- display graphic information on the need to cover nose and mouth with a tissue or bent elbow when coughing or sneezing;
- perform hand hygiene after contact with respiratory secretions or objects that may be potentially contaminated with respiratory secretions;
- give patients with suspected COVID-19 a medical mask to wear.

Use of PPE

The rational and correct use of PPE reduces exposure to pathogens. The effectiveness of PPE strongly depends on:
- staff training on putting on and removing PPE;[10]
- prompt access to sufficient supplies;[5]
- appropriate hand hygiene;[8,9]
- health worker compliance;[11]
- regular monitoring and feedback by IPC personnel.[2,3,8,11]

Environmental cleaning

It is important to ensure that cleaning and disinfection procedures are followed consistently and correctly. All surfaces in health-care facilities should be routinely cleaned and disinfected, especially high-touch surfaces, and whenever visibly soiled or if contaminated by body fluids.[12] In settings where suspected or confirmed COVID-19 patients are admitted, frequency depends on type of patient areas and surfaces. Detailed guidance on environmental cleaning and disinfection in the context of COVID-19 is available from WHO.[13]

In summary, to clean environmental, non-porous, surfaces effectively:

1) clean surfaces thoroughly with water and detergent;
2) apply a disinfectant solution. For COVID-19, either 0.1% (1000ppm) sodium hypochlorite or 70-90% ethanol are effective. However, if there are large spills of blood or body fluids, a concentration of 0.5% (5000ppm) sodium hypochlorite should be used;[13]
3) contact time of a minimum of 1 minute is recommended for ethanol, chlorine-based products and hydrogen peroxide ≥0.5%;[14]
4) after appropriate contact time, disinfectant residue may be rinsed off with clean water if required.[12]

Medical devices and equipment, laundry, food service utensils and medical waste should be managed in accordance with safe routine procedures.[12-16]

Waste management

Health-care waste produced during the care of patients with suspected or confirmed COVID-19 is considered to be infectious and should be collected safely in clearly marked lined containers and sharp safe boxes.[16] To safely manage health-care waste, facilities should:

- assign responsibility and adequate human and material resources to segregate and dispose of waste;
- treat waste preferably on-site, and then safely dispose of it. If waste is moved off-site, it is critical to understand where and how it will be treated and disposed;
- use appropriate PPE (boots, long-sleeved gown, heavy-duty gloves, mask, and goggles or a face shield) while managing infectious waste and perform hand hygiene after taking off the PPE;[5,8,10]
- prepare for increases in the volume of infectious waste during the COVID 19 outbreak, especially through the use of PPE.[16]

Implementing additional precautions

According to current evidence, SARS-CoV-2, the virus that causes COVID-19, is primarily transmitted between people through respiratory droplets and contact routes.[17-22] Droplet transmission occurs when a person is in close contact (within 1 m) of someone with respiratory symptoms (e.g. coughing or sneezing) and is therefore at risk of having his/her mucosae (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets. Transmission may also occur through fomites in the immediate environment around the infected person.[23] Therefore, transmission of the COVID-19 virus may occur by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person (e.g. stethoscope or thermometer).

Airborne transmission is different from droplet transmission as it refers to the presence of microbes within droplet nuclei. Droplet nuclei are generally considered to be particles <5μm in diameter that can remain in the air for longer periods of time and can be transmitted to others over distances greater than 1 metre. Airborne transmission of the COVID-19 virus is possible under circumstances and settings where aerosol generating procedures (AGPs) are performed, as demonstrated by other coronaviruses and as discussed in section 3.3 of this document.[2, 24] Although the COVID-19 virus has been detected by RT-PCR in air samples gathered in the rooms of COVID-19 patients who did not undergo

AGPs, none of these studies have been able to culture the virus from these air particles, a step that is critical to determining the infectiousness of viral particles.[25-27]

Isolation and cohorting of patients with suspected or confirmed COVID-19

To isolate patients with suspected or confirmed COVID-19 in single rooms or, if unavailable, cohorting them in the same room, the following principles should be used:

- designate a team of health workers, where possible, for care of patients with suspected or confirmed COVID-19 to reduce the risk of transmission;
- restrict the number of health workers in contact with each COVID-19 patient;
- patients should be placed in well ventilated single rooms if feasible;[2, 28]
- when single rooms are not available or the bed occupancy rate is anticipated to be at 100% or more, suspected, probable or confirmed COVID-19 patients should be grouped together (cohorted) in adequately ventilated areas with beds placed at least 1 metre apart (e.g. suspected with suspected);
- avoid moving and transporting patients out of their room or area unless medically necessary. Use designated portable X-ray equipment and/or other designated diagnostic equipment.[29] If transport is required, use predetermined transport routes to minimize exposure for staff, other patients and visitors, and give the patient a medical mask to wear if tolerated;
- ensure that health workers who are transporting patients perform hand hygiene and wear appropriate PPE as described in the WHO's rational use of PPE guidance;[5]
- equipment should be either single-use and disposable or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared between patients, clean and disinfect it each time it is used by another patient (e.g. by using ethyl alcohol 70%);[13]
- maintain a record of all staff entering the patient's room.

Contact and droplet precautions

In addition to using standard precautions, all individuals, including health workers and caregivers, should use contact and droplet precautions before entering the room where suspected or confirmed COVID-19 patients are admitted. The following principles should be used:

- perform hand hygiene before putting on and after removing PPE;
- use appropriate PPE: medical mask, eye protection (googles) or facial protection (face shield) to avoid contamination of mucous membranes, clean, non-sterile, long-sleeved gown, and medical gloves;[5,30]
- in areas with COVID-19 community transmission, health workers and caregivers working in clinical areas should continuously wear a medical mask during all routine activities throughout the entire shift;[31]
- it is not necessary for health workers and caregivers to wear boots, coverall and apron during routine care;
- extended use of medical mask, gown and eye protection can be applied during the care of COVID-19 patients given PPE shortages, as described in the WHO's rational use of PPE.[5] For a COVID-19 patient who is infected with a multi-drug resistant organism (e.g. *Clostridioides difficile*), a new set of gown and gloves are needed after caring for such patients;[5]
- health workers should refrain from touching their eyes, nose or mouth with potentially contaminated gloved or bare hands;
- notify the area receiving the patient of any necessary precautions as early as possible before the patient's arrival;
- frequently clean and disinfect surfaces with which the patient is in contact.[13]

Airborne precautions

Some AGPs have been associated with an increased risk of transmission of coronaviruses (SARS-CoV-1, SARS-CoV-2 and MERS-CoV).[24,32, 33] The current WHO list of these AGPs is: tracheal intubation, non-invasive ventilation (e.g. BiPAP, CPAP), tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy, sputum induction induced by using nebulized hypertonic saline, and autopsy procedures. It remains unclear whether aerosols generated by nebulizer therapy or high-flow oxygen delivery are infectious, as data on this is still limited.[6]

Health workers performing AGPs or in settings where AGPs are performed among suspected or confirmed COVID-19 patients (e.g. intensive care units or semi-intensive care units) should:

- perform procedures in an adequately ventilated room – refer to the environmental and engineering control section in this guidance;[2]
- use appropriate PPE: wear a particulate respirator at least as protective as a US National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Union (EU) standard FFP2, or equivalent.[2,31,34] Although initial fit testing is needed prior to the use of a particulate respirator, many countries and health-care facilities do not have a respiratory fit testing programme. Therefore, it is critical that when health workers put on a disposable particulate respirator, they should always perform the required seal check to ensure there is no leakage.[34] Note that if the wearer has a beard or other thick facial hair this may prevent a proper respirator fit. Other PPE items include eye protection (i.e. goggles or a face shield), long-sleeved gown and gloves. If gowns are not fluid resistant, health workers performing AGPs should use a waterproof apron if the procedure is expected to produce a large volume of fluid that might penetrate the gown;[2, 5]
- in the intensive care units, where AGPs are frequently performed, the health worker may choose

to wear a particulate respirator throughout his or her shift, in areas of community transmission;[31]
- keep the number of persons present in the room or unit to the absolute minimum required for the patient's care and support.

Implementing administrative controls

Administrative controls[2] and policies for the prevention and control of transmission of COVID-19 within the health-care facility include, but may not be limited to: establishing sustainable IPC infrastructures and activities; educating patients' caregivers; developing policies for early recognition of patients with suspected COVID-19; ensuring access to laboratory testing for COVID-19 detection; preventing overcrowding, especially in the emergency department; providing dedicated waiting areas for symptomatic patients; planning for (e.g. repurposing of other wards) and isolating COVID-19 patients; ensuring adequate supplies of PPE; and ensuring adherence to IPC policies and procedures in all aspects of health care.

Administrative measures related to health workers

These measures include**:**

- provision of adequate training for health workers;
- ensuring an adequate patient-to-staff ratio;
- establishing an active syndromic surveillance of health workers at the facility entrance when they arrive at work;
- ensuring that health workers and the public understand the importance of seeking medical care promptly;
- monitoring health workers' compliance with standard precautions and providing mechanisms for improvement as needed.

Administrative measures to manage visitors

Ideally all health-care facilities in areas with COVID-19 community transmission should implement policies to restrict visitor access. This measure aims not only to protect visitors from getting infected, but also to reduce visitors' potential to introduce the COVID-19 virus into the health-care facilities.

Health-care facilities should:

- identify alternatives for direct interaction between patients, family members, other visitors and clinical staff, including making remote communications available (e.g. telephone, internet connection);
- restrict entry to visitors who are essential such as the parents of paediatric patients and caregivers;
- encourage family members to assign a single caregiver to the patient. These caregivers should not be people who are at high risk for severe COVID-19, such as older people or people with underlying medical conditions;
- designate an entrance that visitors who are caregivers can use to access the health-care facility;
- maintain a record of all visitors allowed in the facility;
- educate caregiver visitors on hand hygiene, respiratory etiquette, physical distancing and other standard precautions, and how to recognise the signs and symptoms of COVID-19;
- train and supervise caregiver visitors of patients with suspected or confirmed COVID-19 patients on the use of required PPE (i.e. droplet and contact precaution); [5]
- caregiver visitors in areas with community transmission, including those caring for patients without suspected or confirmed COVID-19, should wear a medical mask in clinical areas to prevent transmission; [31]
- restrict movement of the visitor within the health-care facility;
- conduct active screening of all caregiver visitors before entering the facility in areas with widespread community transmission;
- prohibit visitors' presence during AGPs;
- reduce traffic to the health-care facility: consider relocating outpatient pharmacy or other services to a location outside of the main health-care facility.

Implementing environmental and engineering controls

Environmental and engineering controls are an integral part of IPC and include standards for adequate ventilation according to specific areas in health-care facilities, adapted structural design, spatial separation, as well as adequate environmental cleaning.

Ventilation rates within defined spaces in health-care facilities are generally addressed by national regulations. In health-care facilities, large quantities of fresh and clean outdoor air are required both for the benefit of their occupants and the control of contaminants and odours by dilution and removal. There are three basic criteria for the ventilation: [35]

- *ventilation rate:* the amount and quality of outdoor air provided into the space;
- *airflow direction:* the overall airflow direction in a building and between spaces should be from clean-to-less clean zones; and
- *air distribution or airflow pattern:* the supply of air that should be delivered to each part of the space to improve dilution and removal of airborne pollutants generated in the space.

There are three methods that may be used to ventilate spaces within health-care facilities: natural, mechanical and hybrid (mixed-mode) ventilation.

Environmental and engineering controls play a key role in aiming to reduce the concentration of infectious respiratory aerosols (i.e. droplet nuclei) in the air and the contamination of surfaces and inanimate objects.[36] Such controls are particularly important in the context of SARS-CoV-2, a novel virus with a high public health impact, which spreads primarily via respiratory droplets that may aerosolize under certain conditions such as AGPs.

In this context, patient areas require that specific ventilation requirements are met. Any decision on whether to use natural, hybrid (mixed-mode) or mechanical ventilation should take into account climate, including prevalent wind direction, floor plan, need, availability of resources, and the cost of the ventilation system. Each ventilation system has its advantages and disadvantages, as described in WHO's manual on severe acute respiratory treatment centres.[35]

When AGPs are not performed, adequate ventilation is considered to be 60 litres/second per patient (L/s/patient) for naturally-ventilated areas or 6 air changes per hour (ACH) (equivalent to 40 L/s/patient for a 4x2x3 m^3 room) for mechanically-ventilated areas. [28,35]

For areas where AGPs are performed, adequate ventilation rates are indicated below. In this particular context, specific ventilation requirements should be met in patient's areas. Ideally, AGPs should be performed in rooms equipped with negative pressure ventilation systems, according to airborne precautions.[2] However, when many severe patients requiring medical interventions that may generate aerosol are admitted or isolation room capacity is limited, especially in low-resource settings, this may not be feasible.

Naturally ventilated areas

Health-care facilities using natural ventilation systems should ensure that contaminated air exhaust directly outdoor, away from air-intake vents, clinical areas, and people. Because natural ventilation provides fluctuating airflows, higher ventilation rate values than for mechanical ventilation are recommended. The recommended average natural ventilation rate is 160 L/s/patient.[28] The application of natural ventilation depends on favourable climate conditions. When natural ventilation alone cannot satisfy the recommended ventilation requirements, alternative ventilation systems, such as a hybrid (mixed-mode) should be considered. [35]

Mechanically ventilated areas

In health-care facilities where a mechanical ventilation system is available, negative pressure should be created to control the direction of airflow. The ventilation rate should be 6-12 ACH (e.g. equivalent to 40-80 L/s/patient for a 4x2x3 m^3 room), ideally 12 ACH for new constructions, with a recommended negative pressure differential of ≥2.5Pa (0.01-inch water gauge) to ensure that air flows from the corridor into the patient room.[37,38] Airflow direction can be assessed by measuring the pressure difference between the rooms with a differential pressure gauge. If measuring the pressure difference is not feasible, the airflow direction from a clean to a less-clean area can be assessed using cold smoke (smoke test puffer).[39]

For health-care facilities without adequate natural or mechanical ventilation, the following approaches can be considered in consultation with an environmental engineer:[35, 38]

- Installation of exhaust fans: care is needed because the fans need to be installed so that the air is released directly outdoors. The number and technical specification of exhaust fans will depend on the size of the room and the desired ventilation rate. Positioning the exhaust fan should be done so that it is not close to the ventilation air intake. A reliable electricity supply is required for the exhaust fan. If problems associated with increased or decreased temperature occur, spot cooling or heating systems and ceiling fans may be added.

- Installation of whirlybirds (e.g. whirligigs, wind turbines): these devices do not require an electrical supply and provide a roof-exhaust system increasing the airflow in a building.

- Installation of high-efficiency particulate air (HEPA) filters: when appropriately selected, deployed and maintained, single-space air cleaners with HEPA filters (either ceiling mounted or portable) can be effective in reducing/lowering concentrations of infectious aerosols in a single space.[40-42] However, the evidence on the effectiveness of HEPA filters in preventing health-care transmission of coronaviruses is currently limited. The effectiveness of portable HEPA filters will depend on the airflow capacity of the unit, the configuration of the room including furniture and persons in the room, the position of the HEPA filter unit relative to the layout of the room, and the location of the supply registers or grilles. To be effective, recirculation of all or nearly all of the room air through the HEPA filter should be achieved, and the unit should be designed to achieve the equivalent of ≥12 ACH.[37]. Health-care facilities that choose to use HEPA filters should follow the manufacturer's instructions, including on recommended cleaning and maintenance procedures for HEPA filters, otherwise portable HEPA filters can lead to a false sense of security as their performance decreases due to filter loading.

Any modifications to health-care ventilation need to be made carefully, taking into consideration the cost, design, maintenance and potential impact on the airflow in other parts of the health-care facility (see above). Poorly designed or maintained ventilation systems can increase the risk of health-care-associated infections transmitted by airborne pathogens due to incorrect airflow and poor maintenance of the system. Rigorous standards for installation and maintenance of ventilation systems are essential to ensure that they are effective and contribute to a safe environment within the health-care facility as a whole.

It is not known how long the air inside an examination room remains potentially infectious. This may depend on a number of factors including the size of the room, the number of air changes per hour, how long the patient has been in the room, and whether an AGP was performed there. These factors need to be considered when decisions in the health-care facility are made on when someone who is not wearing PPE can enter the vacated room. General guidance on how long it takes for aerosols to be removed by different ventilation conditions is available at https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html#tableb1

Ultraviolet germicidal irradiation (UVGI)
UVGI has been proposed as a supplemental air-cleaning measure, however, currently there is limited evidence of its effectiveness in preventing respiratory pathogen transmission in health-care facilities.[2] In addition, there are concerns about potential adverse effects because UVGI may be absorbed by the outer surfaces of the eyes and skin, leading to keratoconjunctivitis and dermatosis.[43,44]

Spatial separation and physical barriers
Spatial separation of at least 1 metre should be maintained between patients at all times. Both spatial separation and adequate ventilation can help to reduce the spread of many pathogens in the health-care facility.[30,45] Use of physical barriers such as glass or plastic windows can also reduce health workers' exposure to the COVID-19 virus. This approach can be implemented in the areas of health-care facilities where patients first present, such as screening and triage areas, registration desk at the emergency department, or at the pharmacy window where medication is collected.

Environmental cleaning and disinfection
Environmental cleaning and disinfection is a critical element among environmental controls. As described above, healthcare facilities should ensure that cleaning and disinfection procedures are followed consistently and correctly and performed frequently.[12] Cleaning environmental surfaces with water and detergent, and applying commonly used hospital disinfectants (such as sodium hypochlorite) is an effective and sufficient procedure.[13] Manage laundry, food service utensils and medical waste in accordance with safe routine procedures.[16]

Duration of contact and droplet precautions for patients with COVID-19

Standard precautions should be applied at all times. Contact and droplet precautions should only be discontinued in consultation with clinicians and should take into consideration resolution of clinical signs and symptoms, or the number of days since a positive test was carried out with an upper respiratory specimen by molecular assay. For symptomatic patients, these additional precautions can be discontinued 10 days after symptoms onset AND at least three consecutive days with neither fever nor respiratory symptoms. For asymptomatic patients, isolation can end 10 days after the initial positive RT-PCR test result.[6] Although some patients have been tested positive for COVID-19 based on molecular assays several days after resolution of symptoms, it is still unknown whether these patients continue to shed the virus, since only RNA viral fragments have been detected.[46] See WHO's Scientific Brief on criteria for releasing COVID-19 patients from isolation.

Collecting and handling laboratory specimens from patients with suspected COVID-19

All specimens collected for laboratory investigations should be regarded as potentially infectious. Health workers who collect, handle or transport any clinical specimens should adhere to the following measures and biosafety practices to minimize the possibility of exposure to pathogens.[47]

- ensure that health workers who collect specimens, including nasopharyngeal and oropharyngeal swabs, use appropriate PPE (i.e. eye protection, a medical mask, a long-sleeved gown and gloves). If the specimen is collected with an AGP (e.g. sputum induction), personnel conducting the procedure should wear a particulate respirator at least as protective as a NIOSH-certified N95, an EU standard FFP2, or equivalent;
- ensure that all personnel who transport specimens are trained in safe handling practices and spill decontamination procedures;[12,13]
- place specimens for transport in leak-proof specimen bags (i.e. secondary containers) that have a separate sealable pocket for the specimen (i.e. a plastic biohazard specimen bag), with the patient's label on the specimen container (i.e. the primary container), and a clearly written laboratory request form;
- ensure that laboratories in health-care facilities adhere to appropriate biosafety practices and transport requirements based on WHO's interim guidance *Laboratory biosafety guidance related to coronavirus disease* (COVID-19);[47]
- deliver all specimens by hand whenever possible. Do not use pneumatic-tube systems to transport specimens;
- document clearly patient's full name, date of birth and clinical diagnosis of the suspected case of COVID-19 on the laboratory request form. Notify the relevant laboratory as soon as possible that the specimen is being transported.

Considerations for surgical procedures

Any decision on whether to operate on a patient should not be based on the patient's COVID-19 status but on need (e.g. trauma or emergency), the risks and benefits of surgery (e.g. life-threating outcomes or patient harm if surgery is delayed), and patient clinical conditions. Recent data point to a high proportion of post-operative pulmonary complications associated with increased mortality in patients with COVID-19.[48] In the context of the COVID-19 pandemic, every surgical procedure may entail risk for both health workers and patients.[49] As part of their routine clinical practice, health workers should apply standard precautions and assess potential risks of exposure to infectious material. These precautions should include engineering controls that reduce exposure to infectious material, administrative controls, and PPE use.[2,5]

The following should be considered before performing a surgical procedure:

General considerations
- consider whether non-surgical interventions or treatments could be an alternative;
- postpone elective surgery in areas with community transmission to minimize the risk to the patient and medical staff, and also to increase capacity in terms of patient beds, beds in intensive care units, and ventilators during the outbreak;

- if the surgical procedure cannot be postponed (e.g. urgent), a careful risk assessment should be done to screen patients for COVID-19 symptoms, signs and exposure history;[50]
- patients with sign and symptoms of COVID-19 should be tested for the virus using molecular assay on upper respiratory specimens, such as nasopharyngeal or oropharyngeal swab, if available.[47] However, urgent surgery should not be delayed if this test is not available and IPC precautions should be informed by a careful COVID-19 risk assessment; [49]
- depending on the local testing capacity and intensity of transmission in the area, some healthcare facilities may consider testing of surgical patients for COVID-19 before the surgical procedure, regardless of risk assessment for COVID-19. However, there are several limitations with this practice:
    - delays in the results may impact time-critical surgical procedure and increase morbidity and mortality;
    - negative results during the incubation period, and patients may become infectious later;[51]
    - false-negative test results depending on the test method used;
    - false reassurance, if test is negative leading to less stringent adherence to IPC measures;
    - a positive molecular assay test, which may remain positive for 6–8 weeks due to viral RNA fragments, can lead to delays in necessary surgeries.
- if the urgency of the surgical procedure does not allow sufficient time for testing or if testing is unavailable, patients with signs of COVID-19 should undergo chest-X-ray, chest computerized tomography (CT) or chest ultrasound, if available, as an early diagnostic tool and as a baseline to monitor patient;[29,52]
- avoid AGPs if possible;
- if time permits, pre-operative risk stratification tools such as POTTER and NELA may be helpful to guide prognosis.[53]

Surgical procedures in suspected or confirmed COVID-19 patients

- When surgical procedures in COVID-19 patients cannot be postponed, surgical staff in the operating room should use contact and droplet precautions that include sterile medical mask, eye protection (i.e. face shield or goggles), gloves and gown (apron may be required if gowns are not fluid resistant and surgical staff will perform a procedure that is expected to generate high volume of fluid);
- A particulate respirator (i.e. N95, FFP2 or equivalent) should be used instead of a medical mask, if there is potential for an anticipated or unanticipated AGP (see list of AGPs in section 3.3 above) or if the procedure involves anatomic regions where viral loads of the virus may be higher (e.g. nose, oropharynx, respiratory tract).[54,55] Because the risk of AGPs during surgical procedures may be difficult to anticipate, health workers may use particulate respirators when performing surgical procedures on suspected or confirmed COVID-19 patients, if available. Respirators with exhalation valves should not be used during surgical procedures as unfiltered exhaled breath will compromise the sterile field;
- COVID-19 patients should wear a medical mask while being transported to the operating room, if tolerated;
- transport staff should use contact and droplet precautions when transporting suspected or confirmed COVID-19 patients to the operating room;
- ideally, a negative pressure room should be used for anaesthesia and intubation, if available (see ventilation section for negative pressure room requirements), and health workers should wear a particulate respirator in addition to eye protection, gown and gloves. However, if a negative pressure room is not available, intubation should occur in the operating room where the surgical procedure will be performed, and a particulate respirator should be worn by health workers in the room; [54]
- one or more operating rooms for surgical procedures of COVID-19 patients could be identified. These rooms should ideally be in the far corner of the surgery floor to avoid areas with a high flux of staff, and can also be used for surgical procedures of other patients, if it cannot be dedicated to COVID-19 patients, after terminal cleaning;[49,52]
- surgical staff in the room should be limited to essential personnel;
- operating rooms that were built to applicable design code should already have a high ventilation rate (15-20 ACH) and their doors should always remain closed during procedures;[37,38]
- terminal cleaning should be performed after each surgical procedure, in accordance with cleaning and disinfection recommendations for COVID-19;[12, 13]
- all surgical instruments should undergo standard transport, cleaning and sterilization procedures. Medical masks, eye protection, gloves and gowns should be worn by personnel responsible for cleaning these instruments prior to sterilization.[5,52]

Surgical procedures in patients whose COVID-19 status is unknown

- In areas with community transmission, transport staff should wear a medical mask when transporting patients to the operating room.[31] Some countries and health-care facilities in areas of community transmission may also consider the use of medical masks by patients who are not intubated and can tolerate their use while being transported to the operating room;[52]
- contact and droplet precaution should be applied by surgical staff. In health-care facilities located in areas with community transmission that do not have COVID-19 test capacity or where testing

could not be done due to the urgency of the procedure, a particulate respirator can be worn instead of a medical mask if there is potential for anticipated or unanticipated AGPs (see list of AGPs in section 3.3 above) or if the procedure involves anatomic regions where viral loads of the COVID-19 virus may be high (e.g. nose, oropharynx, respiratory tract); [55]

- terminal cleaning of operating room should be performed using standard hospital cleaning practices.[12,13]

Recommendation for outpatient care

The basic principles of IPC and standard precautions should be applied in all health-care facilities, including outpatient settings and primary care.[56] For COVID-19, the following measures should be adopted:

- consider alternatives to face-to-face outpatient visits using telemedicine (e.g. telephone consultations or cell phone videoconference) to provide clinical support without direct contact with the patient; [57]
- screening, early recognition and isolation of patients with suspected COVID-19;
- emphasis on hand hygiene, respiratory hygiene and medical masks to be used by patients with respiratory symptoms;
- appropriate use of contact and droplet precautions when performing clinical exam on patients with suspected COVID-19;
- prioritization of care of symptomatic patients;
- when symptomatic patients are required to wait, ensure they have a separate waiting area where patients can sit at least 1-meter apart and provide them with masks;
- educate patients and families about the early recognition of symptoms, basic precautions to be used and which health-care facility they should refer to if any family member shows signs of COVID-19.

Dead body management

Health workers should do a preliminary evaluation and risk assessment before undertaking any activity related to the management of suspected or confirmed COVID-19 fatality and follow WHO's IPC guidance for safe management of dead bodies in the context of COVID-19.[58] Health workers should:

- perform hand hygiene before and after handling the body;
- use appropriate PPE based on the level of interaction with the body and risk assessment (e.g. use of eye protection and medical masks in addition to gloves and fluid-resistant gown or apron, if there is a risk of body fluids splashes while handling the body);[5]
- ensure that any body fluids leaking from orifices are contained and cover body in cloth to transfer to mortuary area;
- do not engage in any other activity during body handling or preparation;
- disinfect any non-disposable equipment used during handling of the body as per WHO guidance on cleaning and disinfection in the context of COVID-19;[13]
- correctly remove and dispose of PPE when finished (See PPE video on https://openwho.org/courses/IPC-PPE-EN).
- Body bags are not necessary for COVID-19, although they may be used for other reasons such as excessive body fluid leakage or absence of refrigerated morgue, especially in countries with a warm climate. If more than 24 hours has passed since the person died, or if burial/cremation is not foreseen within the next 24–48 hours, a second body bag may be used.

Monitoring and evaluation of IPC practices

A set of process, output and outcome key performance indicators (KPIs) are recommended in the Strategic Preparedness and Response Plan Monitoring and Evaluation Framework.[59]

Correct implementation of IPC measures will minimize the spread of the COVID-19 virus in health-care facilities. Several tools have been developed for health-care facilities and public health stakeholders to assess the extent to which health-care facilities are ready to identify and safely manage patients with COVID-19, but also to monitor and evaluate implementation of IPC measures. Health-care facilities should consider using these tools to identify IPC gaps and to monitor progress in addressing them. WHO is developing a facility-readiness tool that will be available on the WHO technical guidance on COVID-19 website. Other general tools and more in-depth IPC assessment tools are available, including:

- hospital readiness checklist for COVID-19 from WHO's Regional Office for Europe and from the Pan American Health Organization
- CDC facility readiness assessment for COVID-19
- CDC checklist and monitoring tool for triage of suspected COVID-19 cases

A WHO surveillance protocol for data collection among health workers infected with the COVID-19 virus and a case-control study to assess risk factors for COVID-19 among health workers are also available.[60, 61]

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WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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