Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19)

Interim guidance
27 February 2020

World Health Organization

Coronavirus disease 2019 (COVID-19), caused by the COVID-19 virus, was first detected in Wuhan, China, in December 2019. On 30 January 2020, the WHO Director-General declared that the current outbreak constituted a public health emergency of international concern.

This document summarizes WHO's recommendations for the rational use of personal protective equipment (PPE) in healthcare and community settings, as well as during the handling of cargo; in this context, PPE includes gloves, medical masks, goggles or a face shield, and gowns, as well as for specific procedures, respirators (i.e., N95 or FFP2 standard or equivalent) and aprons. This document is intended for those who are involved in distributing and managing PPE, as well as public health authorities and individuals in healthcare and community settings, and it aims to provide information about when PPE use is most appropriate.

WHO will continue to update these recommendations as new information becomes available.

Preventive measures for COVID-19 disease

Based on the available evidence, the COVID-19 virus is transmitted between people through close contact and droplets, not by airborne transmission. The people most at risk of infection are those who are in close contact with a COVID-19 patient or who care for COVID-19 patients.

Preventive and mitigation measures are key in both healthcare and community settings. The most effective preventive measures in the community include:

- performing hand hygiene frequently with an alcohol-based hand rub if your hands are not visibly dirty or with soap and water if hands are dirty;
- avoiding touching your eyes, nose and mouth;
- practicing respiratory hygiene by coughing or sneezing into a bent elbow or tissue and then immediately disposing of the tissue;
- wearing a medical mask if you have respiratory symptoms and performing hand hygiene after disposing of the mask;
- maintaining social distance (a minimum of 1 m) from individuals with respiratory symptoms.

Additional precautions are required by healthcare workers to protect themselves and prevent transmission in the healthcare setting. Precautions to be implemented by healthcare workers caring for patients with COVID-19 disease include using PPE appropriately; this involves selecting the proper PPE and being trained in how to put on, remove and dispose of it.

PPE is only one effective measure within a package that comprises administrative and environmental and engineering controls, as described in WHO's *Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care* (*1*). These controls are summarized here.

- **Administrative controls** include ensuring the availability of resources for infection prevention and control measures, such as appropriate infrastructure, the development of clear infection prevention and control policies, facilitated access to laboratory testing, appropriate triage and placement of patients, adequate staff-to-patient ratios and training of staff.
- **Environmental and engineering controls** aim at reducing the spread of pathogens and reducing the contamination of surfaces and inanimate objects. They include providing adequate space to allow social distance of at least 1 m to be maintained between patients and between patients and healthcare workers and ensuring the availability of well-ventilated isolation rooms for patients with suspected or confirmed COVID-19 disease.

COVID-19 is a respiratory disease that is different from Ebola virus disease, which is transmitted through infected bodily fluids. Due to these differences in transmission, the PPE requirements for COVID-19 are different from those required for Ebola virus disease. Specifically, coveralls (sometimes called Ebola PPE) are not required when managing COVID-19 patients.

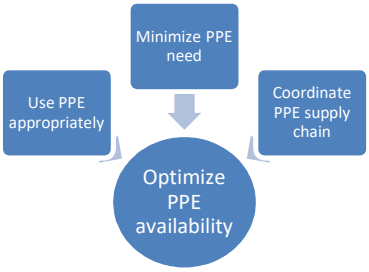
Disruptions in the global supply chain of PPE

The current global stockpile of PPE is insufficient, particularly for medical masks and respirators; the supply of gowns and goggles is soon expected to be insufficient also. Surging global demand − driven not only by the number of COVID-19 cases but also by misinformation, panic buying and stockpiling − will result in further shortages of PPE globally. The capacity to expand PPE production is limited, and the current demand for respirators and masks cannot be met, especially if the widespread, inappropriate use of PPE continues.

Recommendations for optimizing the availability of PPE.

In view of the global PPE shortage, the following strategies can facilitate optimal PPE availability (Fig. 1).

Fig. 1. Strategies to optimize the availability of personal protective equipment (PPE)



(1) Minimize the need for PPE

The following interventions can minimize the need for PPE while protecting healthcare workers and other individuals from exposure to the COVID-19 virus in healthcare settings.

- Consider using telemedicine to evaluate suspected cases of COVID-19 disease (*2*), thus minimizing the need for these individuals to go to healthcare facilities for evaluation.
- Use physical barriers to reduce exposure to the COVID-19 virus, such as glass or plastic windows. This approach can be implemented in areas of the healthcare setting where patients will first present, such as triage areas, the registration desk at the emergency department or at the pharmacy window where medication is collected.
- Restrict healthcare workers from entering the rooms of COVID-19 patients if they are not involved in direct care. Consider bundling activities to minimize the number of times a room is entered (e.g., check vital signs during medication administration or have food delivered by healthcare workers while they are performing other care) and plan which activities will be performed at the bedside.

Ideally, visitors will not be allowed but if this is not possible, restrict the number of visitors to areas where COVID-19 patients are being isolated; restrict the amount of time visitors are allowed to spend in the area; and provide clear instructions about how to put on and remove PPE and perform hand hygiene to ensure visitors avoid self-contamination (see https://www.who.int/csr/resources/publications/putontakeoffPPE/en/).

(2) Ensure PPE use is rationalized and appropriate

PPE should be used based on the risk of exposure (e.g., type of activity) and the transmission dynamics of the pathogen (e.g., contact, droplet or aerosol). The overuse of PPE will have a further impact on supply shortages. Observing the following recommendations will ensure that the use of PPE rationalized.

- The type of PPE used when caring for COVID-19 patients will vary according to the setting and type of personnel and activity (Table 1).
- Healthcare workers involved in the direct care of patients should use the following PPE: gowns, gloves, medical mask and eye protection (goggles or face shield).
- Specifically, for aerosol-generating procedures (e.g., tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, manual ventilation before intubation, bronchoscopy) healthcare workers should use respirators, eye protection, gloves and gowns; aprons should also be used if gowns are not fluid resistant (*1*).
- Respirators (e.g., N95, FFP2 or equivalent standard) have been used for an extended time during previous public health emergencies involving acute respiratory illness when PPE was in short supply (*3*). This refers to wearing the same respirator while caring for multiple patients who have the same diagnosis without removing it, and evidence indicates that respirators maintain their protection when used for extended periods. However, using one respirator for longer than 4 hours can lead to discomfort and should be avoided (*4–6*).
- Among the general public, persons with respiratory symptoms or those caring for COVID-19 patients at home should receive medical masks. For additional information, see *Home care for patients with suspected novel coronavirus (COVID-19) infection presenting with mild symptoms, and management of their contacts* (7).
- For asymptomatic individuals, wearing a mask of any type is not recommended. Wearing medical masks when they are not indicated may cause unnecessary cost and a procurement burden and create a false sense of security that can lead to the neglect of other essential preventive measures. For additional information, see *Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (2019-nCoV) outbreak* (*8*).

(3) Coordinate PPE supply chain management mechanisms.

The management of PPE should be coordinated through essential national and international supply chain management mechanisms that include but are not restricted to:

- using PPE forecasts that are based on rational quantification models to ensure the rationalization of requested supplies;
- monitoring and controlling PPE requests from countries and large responders;
- promoting the use of a centralized request management approach to avoid duplication of stock and ensuring strict adherence to essential stock management rules to limit wastage, overstock and stock ruptures;
- monitoring the end-to-end distribution of PPE;
- monitoring and controlling the distribution of PPE from medical facilities stores.

Handling cargo from affected countries

The rationalized use and distribution of PPE when handling cargo from and to countries affected by the COVID-19 outbreak includes following these recommendations.

- Wearing a mask of any type is not recommended when handling cargo from an affected country.
- Gloves are not required unless they are used for protection against mechanical hazards, such as may occur when manipulating rough surfaces.
- Importantly, the use of gloves does not replace the need for appropriate hand hygiene, which should be performed frequently, as described above.
- When disinfecting supplies or pallets, no additional PPE is required beyond what is routinely recommended. To date, there is no epidemiological information to suggest that contact with goods or products shipped from countries affected by the COVID-19 outbreak have been the source of COVID-19 disease in humans. WHO will continue to closely monitor the evolution of the COVID-19 outbreak and will update recommendations as needed.

Table 1. Recommended type of personal protective equipment (PPE) to be used in the context of COVID-19 disease, according to the setting, personnel and type of activity[a]

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Healthcare facilities			
Inpatient facilities			
Patient room	Healthcare workers	Providing direct care to COVID-19 patients.	Medical mask Gown Gloves Eye protection (goggles or face shield).
		Aerosol-generating procedures performed on COVID-19 patients.	Respirator N95 or FFP2 standard, or equivalent. Gown Gloves Eye protection Apron
	Cleaners	Entering the room of COVID-19 patients.	Medical mask Gown Heavy duty gloves Eye protection (if risk of splash from organic material or chemicals). Boots or closed work shoes
	Visitors[b]	Entering the room of a COVID-19 patient	Medical mask Gown Gloves
Other areas of patient transit (e.g., wards, corridors).	All staff, including healthcare workers.	Any activity that does not involve contact with COVID-19 patients.	No PPE required
Triage	Healthcare workers	Preliminary screening not involving direct contact[c].	Maintain spatial distance of at least 1 m. No PPE required
	Patients with respiratory symptoms.	Any	Maintain spatial distance of at least 1 m. Provide medical mask if tolerated by patient.
	Patients without respiratory symptoms.	Any	No PPE required
Laboratory	Lab technician	Manipulation of respiratory samples.	Medical mask Gown Gloves Eye protection (if risk of splash)
Administrative areas	All staff, including healthcare workers.	Administrative tasks that do not involve contact with COVID-19 patients.	No PPE required

Outpatient facilities			
Consultation room	Healthcare workers	Physical examination of patient with respiratory symptoms.	Medical mask Gown Gloves Eye protection
	Healthcare workers	Physical examination of patients without respiratory symptoms.	PPE according to standard precautions and risk assessment.
	Patients with respiratory symptoms.	Any	Provide medical mask if tolerated.
	Patients without respiratory symptoms.	Any	No PPE required
	Cleaners	After and between consultations with patients with respiratory symptoms.	Medical mask Gown Heavy duty gloves Eye protection (if risk of splash from organic material or chemicals). Boots or closed work shoes
Waiting room	Patients with respiratory symptoms.	Any	Provide medical mask if tolerated. Immediately move the patient to an isolation room or separate area away from others; if this is not feasible, ensure spatial distance of at least 1 m from other patients.
	Patients without respiratory symptoms.	Any	No PPE required
Administrative areas	All staff, including healthcare workers.	Administrative tasks	No PPE required
Triage	Healthcare workers	Preliminary screening not involving direct contact[c].	Maintain spatial distance of at least 1 m. No PPE required
	Patients with respiratory symptoms.	Any	Maintain spatial distance of at least 1 m. Provide medical mask if tolerated.
	Patients without respiratory symptoms.	Any	No PPE required
Community			
Home	Patients with respiratory symptoms.	Any	Maintain spatial distance of at least 1 m. Provide medical mask if tolerated, except when sleeping.
	Caregiver	Entering the patient's room, but not providing direct care or assistance.	Medical mask
	Caregiver	Providing direct care or when handling stool, urine or waste from COVID-19 patient being cared for at home.	Gloves Medical mask Apron (if risk of splash)
	Healthcare workers	Providing direct care or assistance to a COVID-19 patient at home	Medical mask Gown Gloves Eye protection
Public areas (e.g., schools, shopping malls, train stations).	Individuals without respiratory symptoms	Any	No PPE required

Points of entry			
Administrative areas	All staff	Any	No PPE required
Screening area	Staff	First screening (temperature measurement) not involving direct contact[c.]	Maintain spatial distance of at least 1 m. No PPE required
	Staff	Second screening (i.e., interviewing passengers with fever for clinical symptoms suggestive of COVID-19 disease and travel history).	Medical mask Gloves
	Cleaners	Cleaning the area where passengers with fever are being screened.	Medical mask Gown Heavy duty gloves Eye protection (if risk of splash from organic material or chemicals). Boots or closed work shoes
Temporary isolation area	Staff	Entering the isolation area, but not providing direct assistance.	Maintain spatial distance of at least 1 m. Medical mask Gloves
	Staff, healthcare workers	Assisting passenger being transported to a healthcare facility.	Medical mask Gown Gloves Eye protection
	Cleaners	Cleaning isolation area	Medical mask Gown Heavy duty gloves Eye protection (if risk of splash from organic material or chemicals). Boots or closed work shoes
Ambulance or transfer vehicle	Healthcare workers	Transporting suspected COVID-19 patients to the referral healthcare facility.	Medical mask Gowns Gloves Eye protection
	Driver	Involved only in driving the patient with suspected COVID-19 disease and the driver's compartment is separated from the COVID-19 patient.	Maintain spatial distance of at least 1 m. No PPE required
		Assisting with loading or unloading patient with suspected COVID-19 disease.	Medical mask Gowns Gloves Eye protection
		No direct contact with patient with suspected COVID-19, but no separation between driver's and patient's compartments.	Medical mask
	Patient with suspected COVID-19 disease.	Transport to the referral healthcare facility.	Medical mask if tolerated
	Cleaners	Cleaning after and between transport of patients with suspected COVID-19 disease to the referral healthcare facility.	Medical mask Gown Heavy duty gloves Eye protection (if risk of splash from organic material or chemicals). Boots or closed work shoes

Special considerations for rapid response teams assisting with public health investigations[d]			
Community			
Anywhere	Rapid response team investigators.	Interview suspected or confirmed COVID-19 patients or their contacts.	No PPE if done remotely (e.g., by telephone or video conference). Remote interview is the preferred method.
		In-person interview of suspected or confirmed COVID-19 patients without direct contact.	Medical mask Maintain spatial distance of at least 1 m. The interview should be conducted outside the house or outdoors, and confirmed or suspected COVID-19 patients should wear a medical mask if tolerated.
		In-person interview with asymptomatic contacts of COVID-19 patients.	Maintain spatial distance of at least 1 m. No PPE required The interview should be performed outside the house or outdoors. If it is necessary to enter the household environment, use a thermal imaging camera to confirm that the individual does not have a fever, maintain spatial distance of at least 1 m and do not touch anything in the household environment.

[a] In addition to using the appropriate PPE, frequent hand hygiene and respiratory hygiene should always be performed. PPE should be discarded in an appropriate waste container after use, and hand hygiene should be performed before putting on and after taking off PPE.

[b] The number of visitors should be restricted. If visitors must enter a COVID-19 patient's room, they should be provided with clear instructions about how to put on and remove PPE and about performing hand hygiene before putting on and after removing PPE; this should be supervised by a healthcare worker.

[c] This category includes the use of no-touch thermometers, thermal imaging cameras, and limited observation and questioning, all while maintaining a spatial distance of at least 1 m.

[d] All rapid response team members must be trained in performing hand hygiene and how to put on and remove PPE to avoid self-contamination.

For PPE specifications, refer to WHO's novel coronavirus (COVID-19) disease commodity packages at https://www.who.int/emergencies/what-we-do/prevention-readiness/disease-commodity-packages/dcp-ncov.pdf?ua=1.

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Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected

Interim guidance

25 January 2020

World Health Organization

Introduction

This is the first edition of guidance on infection prevention and control (IPC) strategies for use when infection with a novel coronavirus (2019-nCoV) is suspected. It has been adapted from WHO's *Infection prevention and control during health care for probable or confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection*,[1] based on current knowledge of the situation in China and other countries where cases were identified and experiences with severe acute respiratory syndrome (SARS)-CoV and MERS-CoV.[2]

WHO will update these recommendations as new information becomes available.

This guidance is intended for healthcare workers (HCWs), healthcare managers and IPC teams at the facility level but it is also relevant for the national and district/provincial level. Full guidelines are available from WHO.[2]

Principles of IPC strategies associated with health care for suspected nCoV infection

To achieve the highest level of effectiveness in the response to an 2019-nCoV outbreak using the strategies and practices recommended in this document, an 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 *minimum requirements* for IPC are in place as soon as possible, both at the national and facility level, and to gradually progress to the full achievement of all requirements of the IPC core components according to local priority plans.[4]

IPC strategies to prevent or limit transmission in healthcare settings include the following:

1. ensuring triage, early recognition, and source control (isolating patients with suspected nCoV infection);
2. applying standard precautions for all patients;
3. implementing empiric additional precautions (droplet and contact and, whenever applicable, airborne precautions) for suspected cases of nCoV infection;
4. implementing administrative controls;
5. using environmental and engineering controls.

1. Ensuring triage, early recognition, and source control

Clinical triage includes a system for assessing all patients at admission allowing early recognition of possible 2019-nCoV infection and immediate isolation of patients with suspected nCoV infection in an area separate from other patients (source control). To facilitate the early identification of cases of suspected nCoV infection, healthcare facilities should:

- encourage HCWs to have a high level of clinical suspicion;
- establish a well-equipped triage station at the entrance of health care facility, supported by trained staff;
- institute the use of screening questionnaires according to the updated case definition (https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov) and
- post signs in public areas reminding symptomatic patients to alert HCWs.

The promotion of hand hygiene and respiratory hygiene are essential preventive measures.

2. Applying standard precautions for all patients

Standard precautions include hand and respiratory hygiene, the use of appropriate personal protective equipment (PPE) according to risk assessment, injection safety practices, safe waste management, proper linens, environmental cleaning and sterilization of patient-care equipment.

Ensure that the following respiratory hygiene measures are used:

- ensure that all patients cover their nose and mouth with a tissue or elbow when coughing or sneezing;
- offer a medical mask to patients with suspected 2019-nCoV infection while they are in waiting/public areas or in cohorting rooms;
- perform hand hygiene after contact with respiratory secretions.

HCWs should apply the WHO's My 5 Moments for Hand Hygiene approach 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.[5]

- hand hygiene includes either cleansing hands with an alcohol-based hand rub (ABHR) or with soap and water;
- alcohol-based hand rubs are preferred if hands are not visibly soiled;
- wash hands with soap and water when they are visibly soiled.

The rational, correct, and consistent use of PPE also helps to reduce the spread of pathogens. The use of PPE effectiveness strongly depends on adequate and regular supplies, adequate staff training, appropriate hand hygiene and specifically appropriate human behaviour. [2,5,6]

It is important to ensure that environmental cleaning and disinfection procedures are followed consistently and correctly. Thoroughly cleaning environmental surfaces with water and detergent and applying commonly used hospital-level disinfectants (such as sodium hypochlorite) are effective and sufficient procedures.[7] Medical devices and equipment, laundry, food service utensils and medical waste should be managed in accordance with safe routine procedures.[2,8]

3. Implementing empiric additional precautions

3.1 Contact and droplet precautions

- in addition to using standard precautions, all individuals, including family members, visitors and HCWs, should use contact and droplet precautions before entering the room where suspected or confirmed nCoV patients are admitted;
- patients should be placed in adequately ventilated single rooms. For general ward rooms with natural ventilation, adequate ventilation is considered to be 60 L/s per patient;[9]
- when single rooms are not available, patients suspected of being infected with nCoV should be grouped together;
- all patients' beds should be placed at least 1 m apart regardless of whether they are suspected to have nCov infection;
- where possible, a team of HCWs should be designated to care exclusively for suspected or confirmed cases to reduce the risk of transmission;
- HCWs should use a medical mask [a] (for specifications, please see references 2);
- HCWs should wear eye protection (googles) or facial protection (face shield) to avoid contamination of mucous membranes;
- HCWs should wear a clean, non-sterile, long-sleeved gown;
- HCWs should also use gloves;
- the use of boots, coverall and apron is not required during routine care;
- after patient care, appropriate doffing and disposal of all PPE's and hand hygiene should be carried out.[5,6] Also, a new set of PPE's is needed, when care is given to a different patient;
- 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 among patients, clean and disinfect it between use for each individual patient (e.g., by using ethyl alcohol 70%);[8]
- HCWs should refrain from touching eyes, nose or mouth with potentially contaminated gloved or bare hands;
- 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. If transport is required, use predetermined transport routes to minimize exposure for staff, other patients and visitors, and have the patient using a medical mask;
- ensure that HCWs who are transporting patients perform hand hygiene and wear appropriate PPE as described in this section;
- notify the area receiving the patient of any necessary precautions as early as possible before the patient's arrival;
- routinely clean and disinfect surfaces which the patient is in contact;
- limit the number of HCWs, family members and visitors who are in contact with a suspected and confirmed 2019-nCoV patient;
- maintain a record of all persons entering the patient's room, including all staff and visitors.

3.2 Airborne precautions for aerosol-generating procedures

Some aerosol-generating procedures have been associated with an increased risk of transmission of coronaviruses (SARS-CoV and MERS-CoV), such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy.[10,11]

Ensure that HCWs performing aerosol-generating procedures:

- perform procedures in an adequately ventilated room – that is, natural ventilation with air flow of at least 160 L/s per patient or in negative pressure rooms with at least 12 air changes per hour and controlled direction of air flow when using mechanical ventilation;[9]
- use 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.[2,12] When HCWs put on a disposable particulate respirator, they must always perform the seal check.[12] Note that if the wearer has facial hair (i.e., a beard) it may prevent a proper respirator fit;[12]
- use eye protection (i.e., goggles or a face shield);
- wear a clean, non-sterile, long-sleeved gown and gloves. If gowns are not fluid resistant, HCWs should use a waterproof apron for procedures expected to have high volumes of fluid that might penetrate the gown;[2]

[a] Medical masks are surgical or procedure masks that are flat or pleated (some are like cups); they are affixed to the head with straps[2]

- limit the number of persons present in the room to the absolute minimum required for the patient's care and support.

4. **Implementing administrative controls**

Administrative controls[2] and policies for the prevention and control of transmission of 2019-nCoV infections within the healthcare setting include, but may not be limited to: establishing sustainable IPC infrastructures and activities; educating patients' caregivers; developing policies on the early recognition of acute respiratory infection potentially caused by 2019-nCoV; ensuring access to prompt laboratory testing for identification of the etiologic agent; preventing overcrowding, especially in the emergency department; providing dedicated waiting areas for symptomatic patients; appropriately isolating hospitalized patients; ensuring adequate supplies of PPE; ensure the adherence of IPC policies and procedures for all facets of health care.

4.1. **Administrative measures related to healthcare workers**

- provision of adequate training for HCWs;
- ensuring an adequate patient-to-staff ratio;
- establishing a surveillance process for acute respiratory infections potentially caused by nCoV among HCWs;
- ensuring that HCWs and the public understand the importance of promptly seeking medical care;
- monitoring HCW compliance with standard precautions and providing mechanisms for improvement as needed.

5. **Using environmental and engineering controls**

These controls address the basic infrastructure of the health care facility.[13] These controls aim to ensure there is adequate ventilation[9] in all areas in the healthcare facility, as well as adequate environmental cleaning.

Additionally, spatial separation of at least 1 meter should be maintained between all patients. Both spatial separation and adequate ventilation can help reduce the spread of many pathogens in the healthcare setting.[14]

Ensure that cleaning and disinfection procedures are followed consistently and correctly.[8] Cleaning environmental surfaces with water and detergent and applying commonly used hospital disinfectants (such as sodium hypochlorite) is an effective and sufficient procedure.[7] Manage laundry, food service utensils and medical waste in accordance with safe routine procedures.

Duration of contact and droplet precautions for patients with nCoV infection

Standard precautions should be applied at all times. Additional contact and droplet precautions should continue until the patient is asymptomatic. More comprehensive information about the mode of 2019-nCoV infection transmission is required to define the duration of additional precautions.

Collecting and handling laboratory specimens from patients with suspected 2019-nCoV infection

All specimens collected for laboratory investigations should be regarded as potentially infectious. HCWs who collect, handle or transport any clinical specimens should adhere rigorously to the following standard precaution measures and biosafety practices to minimize the possibility of exposure to pathogens.[15,16,17]

- ensure that HCWs who collect specimens use appropriate PPE (i.e., eye protection, a medical mask, a long-sleeved gown, gloves). If the specimen is collected with an aerosol-generating procedure, personnel should wear a particulate respirator at least as protective as a NIOSH-certified N95, an EU standard FFP2, or the equivalent;
- ensure that all personnel who transport specimens are trained in safe handling practices and spill decontamination procedures;[7]
- 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, according to the type of organism being handled;
- deliver all specimens by hand whenever possible. DO NOT use pneumatic-tube systems to transport specimens;
- document clearly each patient's full name, date of birth and suspected nCoV of potential concern on the laboratory request form. Notify the laboratory as soon as possible that the specimen is being transported.

Recommendation for outpatient care

The basic principles of IPC and standard precautions should be applied in all health care facilities, including outpatient care and primary care. For 2019-nCoV infection, the following measures should be adopted:

- triage and early recognition;
- emphasis on hand hygiene, respiratory hygiene and medical masks to be used by patients with respiratory symptoms;
- appropriate use of contact and droplet precautions for all suspected cases;
- prioritization of care of symptomatic patients;
- when symptomatic patients are required to wait, ensure they have a separate waiting area;
- educate patients and families about the early recognition of symptoms, basic precautions to be used and which health care facility they should refer to.

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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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Global Surveillance for COVID-19 disease caused by human infection with novel coronavirus (COVID-19)

Interim guidance
27 February 2020

World Health Organization

Background

This document summarizes WHO's revised guidance for global surveillance of COVID-19 disease caused by infection with novel coronavirus (COVID-19). WHO will continue to update this guidance as new information about COVID-19 becomes available.

Updated information about COVID-19 can be found here along with other guidance documents. https://www.who.int/health-topics/coronavirus

Purpose of this document

This document provides guidance to Member States on implementation of global surveillance of COVID-19.

Objectives of the surveillance

The objectives of this global surveillance are:

1. Monitor trends of the disease where human-to-human transmission occurs
2. Rapidly detect new cases in countries where the virus is not circulating
3. Provide epidemiological information to conduct risk assessments at the national, regional and global level
4. Provide epidemiological information to guide preparedness and response measures

Case definitions for surveillance

The case definitions are based on the current information available and will be revised as new information accumulates. Countries may need to adapt case definitions depending on their own epidemiological situation.

Suspect case

A. A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness of breath), **AND** with no other aetiology that fully explains the clinical presentation **AND** a history of travel to or residence in a country/area or territory reporting local transmission (See situation report).of COVID-19 disease during the 14 days prior to symptom onset.

OR

B. A patient with any acute respiratory illness **AND** having been in *contact* with a confirmed or probable COVID-19 case (see definition of contact) in the last 14 days prior to onset of symptoms;

OR

C. A patient with severe acute respiratory infection (fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness breath) **AND** requiring hospitalization **AND** with no other aetiology that fully explains the clinical presentation.

Probable case

A suspect case for whom testing for COVID-19 is inconclusive[1].

Confirmed case

A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.

Link for lab page: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/laboratory-guidance

Recommendations for follow-up of contacts

Definition of contact

A contact is a person that is involved in any of the following:

- Providing direct care without proper personal protective equipment (PPE)[2] for COVID-19 patients
- Staying in the same close environment of a COVID-19 patient (including workplace, classroom, household, gatherings).
- Traveling together in close proximity (1 m) with a COVID-19 patient in any kind of conveyance within a 14-day period after the onset of symptoms in the case under consideration.

Recommendations for laboratory testing

Any suspected case should be tested for COVID-19 infection using available molecular tests. However, depending on the intensity of the transmission, the number of cases and the laboratory capacity, only a subset of the suspect cases may be tested.

If resources allow, testing may be done more broadly (for instance through sentinel surveillance) to better assess the full extent of the circulation of the virus.

Based on clinical judgment, clinicians may opt to order a test for COVID-19 in a patient not strictly meeting the case definition, for example, if there are patients involved in a cluster of acute respiratory illness among healthcare workers or of severe acute respiratory infection (SARI) or pneumonia in families, workplaces or social network.

Recommendations for reporting surveillance data to WHO

Case based Reporting:

WHO requests that national authorities report probable and confirmed cases of novel coronavirus COVID-19 infection **within 48 hours** of identification, by providing the minimum data set outlined in *the "Revised case reporting form for 2019 Novel Coronavirus of confirmed and probable cases"*, through the National Focal Point and the Regional Contact Point for International Health Regulations at the appropriate WHO regional office. A template for the revised line listing in Excel format with the data dictionary, which suggests the name of the variables and their specifications is available. If the outcome of the patient is not yet available at first reporting an **update of the report** should be provided as soon as outcome is available latest **within 30 days** of the first report.
Reporting of case-based report is requested as long as feasible for the country. When it is not feasible to report case-based data, countries are requested to provide daily and weekly aggregated data.

Daily aggregated data

WHO requests reporting of the number of new confirmed cases by first administrative level (e.g. region, province, state, municipalities) and deaths

[1] Inconclusive being the result of the test reported by the laboratory.
[2] https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-%28ncov%29-infection-is-suspected-20200125

Weekly aggregated data:

- Weekly number of new confirmed: Patients tested positive for COVID-19 infection
- Weekly number of new probable case: Patient with inconclusive laboratory test result
- Weekly number of new deaths due to COVID-19 infection
- Weekly number of new COVID-19 cases hospitalised
- Weekly number of new COVID-19 cases treated with mechanical ventilation or ECMO or admitted in intensive care unit (ICU).
- Weekly number of new cases and new deaths, by age-group in year (using: 0<2, 2<5, 5<15, 15<50, 50<65 and 65 and above; or similar).
- Cumulative sex ratio of confirmed cases and deaths
- Total number of laboratory tests conducted
- Total number of tests that are positive for COVID-19
- If possible, number of contacts under follow-up and number of new identified contacts

Procedures to report to WHO are similar to that implemented for the case-based reporting.

Recommendations for specimen collection

Lower respiratory specimens likely have a higher diagnostic value than upper respiratory tract specimens for detecting COVID-19 infection. WHO recommends that, if possible, lower respiratory specimens such as sputum, endotracheal aspirate, or bronchoalveolar lavage be collected for COVID-19 testing. If patients do not have signs or symptoms of lower respiratory tract disease or specimen collection for lower respiratory tract disease is clinically indicated but the collection is not possible, upper respiratory tract specimens, such as a nasopharyngeal aspirate or combined nasopharyngeal and oropharyngeal swabs should be collected.

If initial testing is negative in a patient who is strongly suspected to have COVID-19 infection, the patient should be resampled, and specimens collected from multiple respiratory tract sites (nose, sputum, endotracheal aspirate). Additional specimens may be collected such as blood, urine, and stool, to monitor the presence of virus and shedding of virus from different body compartments.

Full details about laboratory guidance for COVID-19 can be found here: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/laboratory-guidance

WHO reference number: WHO/2019-nCoV/SurveillanceGuidance/2020.4

Advice on the use of masks in the community, during home care and in health care settings in the context of the novel coronavirus (2019-nCoV) outbreak

Interim guidance
29 January 2020

World Health Organization

Introduction

This document provides rapid advice on the use of medical masks in communities, at home and at health care facilities in areas that have reported outbreaks caused by the 2019 novel coronavirus (2019-nCoV). It is intended for public health and infection prevention and control (IPC) professionals, health care managers, health care workers and community health workers. It will be revised as more data become available.

With the current information available, it is suggested that the route of human-to-human transmission of 2019-nCoV is either via respiratory droplets or contact. Any person who is in close contact (within 1 meter) with someone who has respiratory symptoms (e.g., sneezing, coughing, etc.) is at risk of being exposed to potentially infective respiratory droplets.

Medical masks are surgical or procedure masks that are flat or pleated (some are like cups); they are affixed to the head with straps[a].

General Advice

Wearing a medical mask is one of the prevention measures to limit spread of certain respiratory diseases, including 2019-nCoV, in affected areas. However, the use of a mask **alone** is insufficient to provide the adequate level of protection and other equally relevant measures should be adopted. If masks are to be used, this measure must be combined with hand hygiene and other IPC measures to prevent the human-to-human transmission of 2019-nCov. WHO has developed guidance for home care[b] and health care settings[c] on infection prevention and control (IPC) strategies for use when infection with 2019-nCoV is suspected.

Wearing medical masks when not indicated may cause unnecessary cost, procurement burden and create a false sense of security that can lead to neglecting other essential measures such as hand hygiene practices. Furthermore, using a mask incorrectly may hamper its effectiveness to reduce the risk of transmission.

Community setting

Individuals without respiratory symptoms should:

- avoid agglomerations and frequency of closed crowded spaces;
- maintain distance of at least 1 meter from any individual with 2019-nCoV respiratory symptoms (e.g., coughing, sneezing);
- perform hand hygiene frequently, using alcohol-based hand rub if hands are not visibly soiled or soap and water when hands are visibly soiled;
- if coughing or sneezing cover nose and mouth with flexed elbow or paper tissue, dispose of tissue immediately after use and perform hand hygiene;
- refrain from touching mouth and nose;
- a medical mask is not required, as no evidence is available on its usefulness to protect non-sick persons. However, masks might be worn in some countries according to local cultural habits. If masks are used, best practices should be followed on how to wear, remove, and dispose of them and on hand hygiene action after removal (see below advice regarding appropriate mask management).

Individuals with respiratory symptoms should:

- wear a medical mask and seek medical care if experiencing fever, cough and difficulty breathing, as soon as possible or in accordance with to local protocols;
- follow the below advice regarding appropriate mask management.

Home Care

In view of the currently available data on the disease and its transmission, WHO recommends that suspected cases of 2019-nCoV infection be cared for using isolation precautions and monitored in a hospital setting. This would ensure both safety and quality of health care (in case patients' symptoms worsen) and public health security.

[a] Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. World Health Organization. (2014). Available at https://apps.who.int/iris/handle/10665/174652

[b] Home care for patients with suspected novel coronavirus (nCoV) infection presenting with mild symptoms and management of contacts. Available at https://www.who.int/publications-detail/home-care-for-patients-with-suspected-novel-coronavirus-(ncov)-infection-presenting-with-mild-symptoms-and-management-of-contacts

[c] Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected. Available at https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125

However, for several possible reasons, including situations when inpatient care is unavailable or unsafe (i.e. limited capacity and resources unable to meet demand for health care services), or in a case of informed refusal of hospitalization, home settings for health care provision may need to be considered. Specific IPC guidance for home care should be followed[b].

Individuals with suspected 2019-nCoV infection with mild respiratory symptoms should:

- perform hand hygiene frequently, using alcohol-based hand rub if hands are not visibly soiled or soap and water when hands are visibly soiled;
- keep distance from well individuals as much as possible (at least 1 meter);
- to contain respiratory secretions, a medical mask should be provided to the individual and worn as much as possible, if it can be tolerated. For individuals who cannot tolerate a medical mask, he/she should rigorously apply respiratory hygiene, i.e. cover mouth and nose when coughing or sneezing with disposable paper tissue. Dispose of the material after use. Clean hands immediately after contact with respiratory secretions;
- improve airflow in living space by opening windows and door as much as possible.

Relatives or caregivers to individuals with suspected 2019-nCoV infection with mild respiratory symptoms should:

- perform hand hygiene frequently, using alcohol-based hand rub if hands are not visibly soiled or soap and water when hands are visibly soiled;
- keep distance from affected individual as much as possible (at least 1 meter);
- wear a medical mask when in the same room with the affected individual;
- dispose of the material immediately after use. Clean hands immediately after contact with respiratory secretions;
- improve airflow in living space by opening windows as much as possible.

Health Care Facilities

Individuals with respiratory symptoms should:

- wear a medical mask while waiting in triage or waiting areas or during transportation within the facility;
- wear a medical mask when staying in cohorting areas dedicated to suspected or confirmed cases;
- do not wear a medical mask when isolated in single rooms but cover mouth and nose when coughing or sneezing with disposable paper tissues. Dispose them appropriately and perform hand hygiene immediately afterwards.

Health care workers should:

- wear a medical mask when entering a room where patients suspected or confirmed of being infected with 2019-nCoV are admitted and in any situation of care provided to a suspected or confirmed case[c];
- use 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, when performing aerosol-generating procedures such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy.

Masks management

If medical masks are worn, appropriate use and disposal is essential to ensure they are effective and to avoid any increase in risk of transmission associated with the incorrect use and disposal of masks.

The following information on correct use of medical masks derives from the practices in health-care settings[d]:

- place mask carefully to cover mouth and nose and tie securely to minimise any gaps between the face and the mask;
- while in use, avoid touching the mask;
- remove the mask by using appropriate technique (i.e. do not touch the front but remove the lace from behind);
- after removal or whenever you inadvertently touch a used mask, clean hands by using an alcohol-based hand rub or soap and water if visibly soiled
- replace masks with a new clean, dry mask as soon as they become damp/humid;
- do not re-use single-use masks;
- discard single-use masks after each use and dispose of them immediately upon removal.

Cloth (e.g. cotton or gauze) masks are not recommended under any circumstance.

WHO reference number: WHO/nCov/IPC_Masks/2020.

[d] Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care. World Health Organization. (2014). Organization. https://apps.who.int/iris/handle/10665/112656

Home care for patients with suspected novel coronavirus (COVID-19) infection presenting with mild symptoms, and management of their contacts

Interim guidance
04 February 2020

World Health Organization

Introduction

WHO has developed this rapid advice to meet the need for recommendations on safe home care for patients with suspected novel coronavirus (COVID-19) infection who present with mild symptoms[1] and on public health measures related to the management of contacts.

This document was adapted from the interim guidance that addressed Middle East respiratory syndrome coronavirus (MERS-CoV) infection that was published in June 2018 (*1*) and is informed by evidence-based guidelines published by WHO, including *Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care* (*2*), and based on current information regarding COVID-19 infection.

This rapid advice is intended to guide public health and infection prevention and control (IPC) professionals, healthcare managers and healthcare workers (HCWs) when addressing issues related to home care for patients with suspected COVID-19 infection who present with mild symptoms and when managing contacts. This guidance is based on evidence about COVID-19 infection and the feasibility of implementing IPC measures at home. For the purpose of this document, caregivers refer to parents, spouses, other family members or friends without formal healthcare training.

For COVID-19 disease case definitions, please refer to https://apps.who.int/iris/bitstream/handle/10665/330857/WHO-2019-nCoV-SurveillanceGuidance-2020.3-eng.pdf.

For guidance on IPC at the facility level, please refer to https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected.

Home care for patients with suspected COVID-19 infection who present with mild symptoms

In view of the current data on the disease and its transmission, WHO recommends that all patients with suspected COVID-19 infection who have severe acute respiratory infection be triaged at the first point of contact with the healthcare system and that emergency treatment should be started based on disease severity. For those presenting with mild illness, hospitalization may not be required unless there is concern about rapid deterioration (*3*). If there is only mild illness, providing care at home may be considered. Other patients who may be cared for at home include those who are symptomatic but no longer require hospitalization and cases in which an informed decision has been made to refuse hospitalization; home care may also be considered when inpatient care is unavailable or unsafe (e.g., capacity is limited, and resources are unable to meet the demand for healthcare services).

In any of these situations, patients with mild symptoms[1] and without underlying chronic conditions − such as lung or heart disease, renal failure or immunocompromising conditions that place the patient at increased risk of developing complications − may be cared for at home. This decision requires careful clinical judgment and should be informed by an assessment of the safety of the patient's home environment.[2]

In cases in which care is to be provided at home, a trained HCW should conduct an assessment to verify whether the residential setting is suitable for providing care; the HCW must assess whether the patient and the family are capable of adhering to the precautions that will be recommended as part of home care isolation (e.g., hand hygiene, respiratory hygiene, environmental cleaning, limitations on movement around or from the house) and can address safety concerns (e.g., accidental ingestion of and fire hazards associated with using alcohol-based hand rubs).

A communication link with a healthcare provider or public health personnel, or both, should be established for the duration of the home care period – that is, until the patient's symptoms have completely resolved. More comprehensive information about the mode of COVID-19 infection and transmission is required to define the duration of home isolation precautions.

Patients and household members should be educated about personal hygiene, basic IPC measures and how to care for the member of the family suspected of having COVID-19 disease as safely as possible to prevent the infection from spreading to household contacts. The patient and the family should be provided with ongoing support and education, and monitoring should continue for the duration of home care. Patients and families should adhere to the following recommendations.

- Place the patient in a well-ventilated single room (i.e., with open windows and an open door).
- Limit the movement of the patient in the house and minimize shared space. Ensure that shared spaces

[1] Mild symptoms include low-grade fever; cough; malaise; rhinorrhoea; or sore throat without any warning signs, such as shortness of breath or difficulty in breathing; increased respiratory difficulty, such as sputum or haemoptysis; gastrointestinal symptoms, such as nausea, vomiting, and/or diarrhoea; and without changes in mental status, such as confusion or lethargy.

[2] A sample checklist for assessing environmental conditions in the home is available in the Annex C of reference 2.

(e.g., kitchen, bathroom) are well ventilated (e.g., keep windows open).

- Household members should stay in a different room or, if that is not possible, maintain a distance of at least 1 m from the ill person (e.g., sleep in a separate bed).[3]
- Limit the number of caregivers. Ideally, assign one person who is in a good health and has no underlying chronic or immunocompromising conditions (*3*). Visitors should not be allowed until the patient has completely recovered and has no signs and symptoms.
- Perform hand hygiene after any type of contact with patients or their immediate environment (*4*). Hand hygiene should also be performed before and after preparing food, before eating, after using the toilet and whenever hands look dirty. If hands are not visibly dirty, an alcohol-based hand rub can be used. For visibly dirty hands, use soap and water.
- When washing hands with soap and water, it is preferable to use disposable paper towels to dry hands. If these are not available, use clean cloth towels and replace them when they become wet.
- To contain respiratory secretions, a medical mask[4] should be provided to the patient and worn as much as possible. Individuals who cannot tolerate a medical mask should use rigorous respiratory hygiene – that is, the mouth and nose should be covered with a disposable paper tissue when coughing or sneezing. Materials used to cover the mouth and nose should be discarded or cleaned appropriately after use (e.g., wash handkerchiefs using regular soap or detergent and water).
- Caregivers should wear a tightly fitted medical mask that covers their mouth and nose when in the same room as the patient. Masks should not be touched or handled during use. If the mask gets wet or dirty from secretions, it must be replaced immediately with a new clean, dry mask. Remove the mask using the appropriate technique – that is, do not touch the front, but instead untie it. Discard the mask immediately after use and perform hand hygiene.
- Avoid direct contact with body fluids, particularly oral or respiratory secretions, and stool. Use disposable gloves and a mask when providing oral or respiratory care and when handling stool, urine and other waste. Perform hand hygiene before and after removing gloves and the mask.
- Do not reuse masks or gloves.
- Use dedicated linen and eating utensils for the patient; these items should be cleaned with soap and water after use and may be re-used instead of being discarded.
- Clean and disinfect daily surfaces that are frequently touched in the room where the patient is being cared for, such as bedside tables, bedframes and other bedroom furniture. Regular household soap or detergent should be used first for cleaning, and then, after rinsing, regular household disinfectant containing 0.5% sodium hypochlorite (i.e., equivalent to 5000 pm or 1 part bleach[5] to 9 parts water) should be applied.
- Clean and disinfect bathroom and toilet surfaces at least once daily. Regular household soap or detergent should be used first for cleaning, and then, after rinsing, regular household disinfectant containing 0.5% sodium hypochlorite should be applied.[5]
- Clean the patient's clothes, bed linen, and bath and hand towels using regular laundry soap and water or machine wash at 60–90 °C with common household detergent, and dry thoroughly. Place contaminated linen into a laundry bag. Do not shake soiled laundry and avoid contaminated materials coming into contact with skin and clothes.
- Gloves and protective clothing (e.g., plastic aprons) should be used when cleaning surfaces or handling clothing or linen soiled with body fluids. Depending on the context, either utility or single-use gloves can be used. After use, utility gloves should be cleaned with soap and water and decontaminated with 0.5% sodium hypochlorite solution. Single-use gloves (e.g., nitrile or latex) should be discarded after each use. Perform hand hygiene before and after removing gloves.
- Gloves, masks and other waste generated during at-home patient care should be placed into a waste bin with a lid in the patient's room before being disposed of as infectious waste.[6]
- Avoid other types of exposure to contaminated items from the patient's immediate environment (e.g., do not share toothbrushes, cigarettes, eating utensils, dishes, drinks, towels, washcloths or bed linen).
- When HCWs provide home care, they should perform a risk assessment to select the appropriate personal protective equipment and follow the recommendations for droplet and contact precautions.

Management of contacts

Persons (including caregivers and HCWs) who have been exposed to individuals with suspected COVID-19disease are considered contacts and should be advised to monitor their health for 14 days from the last possible day of contact.

A contact is a person who has had any of the following exposures:

- a healthcare-associated exposure, including providing direct care for patients with COVID-19 disease, working with HCWs infected with the virus that causes COVID-19 disease, visiting patients or staying in the same environment as a patient with COVID-19 disease;
- an exposure through working together in close proximity to or sharing the same classroom with a patient with COVID-19 disease;
- an exposure through traveling with a patient who has COVID-19 disease in any kind of vehicle;
- an exposure through living in the same household as a patient with COVID-19 disease within 14 days after the onset of symptoms in the patient (*5*).

[3] An exception may be made for breastfeeding mothers. Considering the benefits of breastfeeding and the insignificant role of breast milk in the transmission of other respiratory viruses, a mother could can continue breastfeeding. The mother should wear a medical mask when she is near her baby and perform hand hygiene before and after having close contact with the baby. She will also need to follow the other hygiene measures described in this document.

[4] Medical masks are surgical or procedure masks that are flat or pleated (some are shaped like a cup); they are held in place by strings that tie around the back of the head.

[5] Most household bleach solutions contain 5% sodium hypochlorite. Recommendations on how to calculate the dilution from a given concentration of bleach can be found at https://www.cdc.gov/hai/pdfs/resource-limited/environmental-cleaning-508.pdf.

[6] The local sanitary authority should adopt measures to ensure that the waste is disposed of at a sanitary landfill and not at an unmonitored open dump.

A way for caregivers to communicate with a healthcare provider should be established for the duration of the observation period. Also, healthcare personnel should review the health of contacts regularly by phone but, ideally and if feasible, through daily in-person visits, so specific diagnostic tests can be performed as necessary.

The healthcare provider should give instructions to contacts in advance about when and where to seek care if they become ill, what is the most appropriate mode of transportation to use, when and where to enter the designated healthcare facility, and which IPC precautions should be followed.

If a contact develops symptoms, the following steps should be taken.

- Notify the receiving medical facility that a symptomatic contact will be arriving.
- While traveling to seek care, the person who is ill should wear a medical mask.
- The contact should avoid taking public transportation to the facility if possible; an ambulance can be called, or the ill contact can be transported in a private vehicle with all of the windows open, if possible.
- The symptomatic contact should be advised to always perform respiratory hygiene and hand hygiene and to stand or sit as far away from others as possible (at least 1 m) when in transit and when in the healthcare facility.
- Any surfaces that become soiled with respiratory secretions or other body fluids during transport should be cleaned with soap or detergent and then disinfected with a regular household product containing a 0.5% diluted bleach solution.

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Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19)

Interim guidance
29 February 2020

World Health Organization

On 30 January 2020, the WHO Director General determined that the outbreak of coronavirus disease (COVID-19) constitutes a Public Health Emergency of International Concern.[1] As the outbreak continues to evolve, Member States are considering options to prevent introduction of the disease to new areas or to reduce human-to-human transmission in areas where COVID-19 virus is already circulating.

Public health measures to achieve these goals may include quarantine, which involves the restriction of movement or separation of healthy individuals who may have been exposed to the virus, from the rest of the population, with the objective of monitoring symptoms and the early detection of cases. Many countries have legal authority to impose quarantine. When doing so, quarantine should be implemented as part of a comprehensive package of public health response and containment measures and, as per Article 3 of the International Health Regulations (2005), be fully respectful of the dignity, human rights and fundamental freedoms of persons.[2]

The purpose of this document is to offer guidance to Member States on quarantine measures for individuals in the context of COVID-19. It is intended for those responsible for establishing local or national policy for quarantine of individuals, and adherence to infection prevention and control measures.

This document is informed by current knowledge of the COVID-19 outbreak and by similar considerations for other respiratory pathogens, including SARS-CoV, MERS-CoV and influenza viruses. WHO will continue to update these recommendations as new information becomes available.

Quarantine of persons is the restriction of activities or separation of persons who are not ill, but who may be exposed to an infectious agent or disease, with the objective of monitoring symptoms and early detection of cases. Quarantine is different from isolation, which is the separation of ill or infected persons from others, so as to prevent the spread of infection or contamination.

Quarantine is included within the legal framework of the International Health Regulations (2005), specifically:

- Article 30. Travellers under public health observation
- Article 31. Health measures relating to entry of travellers
- Article 32. Treatment of travellers.[2]

Member States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to legislate, and to implement legislation, in pursuance of their health policies, even if this involves the restriction of movement of individuals.

Before implementing quarantine, countries should properly communicate and socialize such measures, in order to reduce panic and improve compliance:[3]

- People must be provided by authorities of clear, up-to-date, transparent and consistent guidelines, and reliable information about quarantine measures;
- Constructive engagement with communities is essential if quarantine measures are to be accepted;
- Persons who are quarantined need to be provided with health care, financial, social and psychosocial support, and basic needs including as food, water and other essentials. The needs of vulnerable populations should be prioritised;
- Cultural, geographic and economic factors affect the effectiveness of quarantine. Rapid assessment of the local context should evaluate both the drivers of success and the potential barriers to quarantine and inform the design of the most appropriate and culturally accepted measures.

When to use quarantine measures

Introducing quarantine measures early in an outbreak may delay the introduction of the disease to a country or area and/or may delay the peak of an epidemic in an area where local transmission is ongoing. However, if not implemented properly, quarantine may also create additional sources of contamination and dissemination of the disease.

In the context of the current COVID-19 outbreak, the global containment strategy includes the rapid identification of

[1] World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV)

[2] World Health Organization International Health Regulations (2005)

[3] Key considerations: quarantine in the context of COVID-Social science in humanitarian action. www.socialscienceinaction.org.

laboratory-confirmed cases, and their isolation and management in either a medical facility[4] or at home[5]

For contacts of laboratory-confirmed cases WHO recommends that such persons be quarantined for 14 days from the last time they were exposed to a COVID-19 patient.

For the purpose of implementing quarantine, a contact is defined as a person:

- Providing direct care without proper personal protective equipment (PPE)[6] for COVID-19 patients;
- Staying in the same close environment of a COVID-19 patient (including workplace, classroom, household, gatherings);
- Traveling together in close proximity (within 1 meter) with a COVID-19 patient in any kind of conveyance within a 14-day period after the onset of symptoms in the case under consideration.[7]

Recommendations for implementation of quarantine measures.

If a decision to implement quarantine is taken, the authorities, should ensure:

1. Appropriate quarantine setting and adequate provisions for the quarantine period;
2. Minimum infection prevention and control measures;
3. Minimum requirements for health monitoring of quarantined persons during the quarantine period.

1. Appropriate quarantine setting and adequate provisions for quarantine period

Quarantine implies the use or creation of appropriate facilities in which a person or persons are physically separated from the community while being attended to.

Appropriate quarantine arrangements include the following:

- those in quarantine be placed in adequately ventilated, spacious single rooms, with ensuite toilet (hand hygiene and toilet facilities). If single rooms are not available, beds should be placed at least 1 meter apart;
- suitable environmental infection controls, such as adequate air ventilation, filtration systems and waste-management protocols;
- maintenance of social distancing (more than 1 meter) of the persons quarantined;
- accommodation with an appropriate level of comfort, including:
    - food, water and hygiene provisions;
    - protection for baggage and other possessions;
    - appropriate medical treatment for existing conditions;
    - communication in a language that they can understand explaining: their rights; provisions that will be made available to them; how long they will need to stay; what will happen if they get sick; contact information of their local embassy or consular support;
- assistance for quarantined travellers, isolated or subject to medical examinations or other procedures for public health purposes;
- assistance with communication with family members outside the quarantine facility;
- if possible, access to the internet, news and entertainment;
- psychosocial support; and
- special considerations for older individuals and individuals with co-morbid conditions, due to their increased risk for severe COVID-19 disease.

Possible quarantine settings are hotels, dormitories, other facilities catering to groups, or the home of the contact. Regardless of the setting, an assessment must ensure that the appropriate conditions for safe and effective quarantine are being met.

When home quarantine is chosen, the person should occupy a well-ventilated single room, or if a single room is not possible, maintain a distance of at least 1 meter from other household members, minimizing the use of shared spaces and cutlery and ensuring that shared spaces (kitchen, bathroom) are well ventilated.

2. Minimum infection prevention and control measures

The following infection prevention and control measures should be used to ensure a safe environment for quarantined persons.

Early recognition and control

- Any person in quarantine who develops febrile illness or respiratory symptoms, at any point during the quarantine period, should be treated and managed as a suspect COVID-19 case;
- Apply standard precautions for all persons quarantined and quarantine personnel:
    - Perform hand hygiene frequently, particularly after contact with respiratory secretions, before eating and after using the toilet. Hand hygiene includes either cleaning hands with soap and water or with an alcohol-based hand rub. Alcohol-based hand rubs are preferred if hands are not visibly soiled; wash hands with soap and water when they are visibly soiled;
    - Ensure that all persons quarantined are practicing respiratory hygiene, and are aware of the importance of covering their nose and mouth with a flexed elbow or paper tissue when coughing or sneezing and disposing immediately of the tissue and performing hand hygiene;
    - Refrain from touching mouth and nose;

[4] World Health Organization. Clinical management of severe acute respiratory infection when novel coronavirus (nCoV) infection is suspected
[5] World Health Organization. Home care for patients with suspected novel coronavirus (nCoV) infection presenting with mild symptoms and management of contacts
[6] World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected
[7] World Health Organization. Global Surveillance for human infection with coronavirus disease (COVID-19)

- A medical mask is not required for persons with no symptoms. There is no evidence that wearing a mask of any type protects people who are not sick.[8]

Administrative controls

Administrative controls and policies for IPC within quarantine facilities include, but may not be limited to:

- establishing sustainable IPC infrastructures (design of facility) and activities;
- educating persons quarantined and quarantine personnel about IPC; all personnel working in the quarantine facility need to have training on standard precautions before the quarantine measures are implemented. The same advice on standard precautions should be given to all quarantined persons on arrival. Both personnel and quarantined persons should understand the importance of promptly seeking medical care if they develop symptoms;
- developing policies on the early recognition and referral of a suspect COVID-19 case.

Environmental controls

Environmental cleaning and disinfection procedures must be followed consistently and correctly. Cleaning personnel need to be educated and protected from COVID-19 infection and ensure that environmental surfaces are regularly and thoroughly cleaned throughout the quarantine period:

- Clean and disinfect frequently touched surfaces such as bedside tables, bedframes, and other bedroom furniture daily with regular household disinfectant containing a diluted bleach solution (1-part bleach to 99 parts water). For surfaces that do not tolerate bleach, 70% ethanol can be used;
- Clean and disinfect bathroom and toilet surfaces at least once daily with regular household disinfectant containing a diluted bleach solution (1-part bleach to 99 parts water);
- Clean clothes, bedclothes, bath and hand towels, etc., using regular laundry soap and water or machine wash at 60–90 °C with common laundry detergent and dry thoroughly;
- Countries should consider measures to ensure that waste is disposed of in a sanitary landfill, and not in an unmonitored open area;
- Cleaning personnel should wear disposable gloves when cleaning or handling surfaces, clothing or linen soiled with body fluids, and should perform hand hygiene before and after removing gloves.

3. Minimum requirements for health monitoring of quarantined persons during the quarantine period

Daily follow-up of persons quarantined should be conducted within the quarantine facility for the duration of the quarantine and should include daily body temperature and symptom screening. Groups of persons at higher risk of infection and severe disease may require additional surveillance for chronic conditions or specific medical treatments.

Consideration should be given to the resources, personnel and rest period of staff at quarantine facilities. This is particularly important in the context of an ongoing outbreak, during which limited public health resources may be better prioritised towards health care facilities and case-detection activities.

Laboratory testing of a respiratory sample from quarantined persons, irrespective of symptoms, is advised at the end of the quarantine period.

WHO reference number: WHO/2019-nCov/IHR_Quarantine/2020.1

[8] Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (2019-nCoV) outbreak.

Guidelines on Clinical management of severe acute respiratory illness (SARI) in suspect/confirmed novel coronavirus (nCoV) cases

An infection with a novel coronavirus has been reported from China. As 25th January 2020, a total of 1287 cases and 41 deaths were reported in 29 provinces (districts and cities) of China. In addition, 28 cases have been confirmed outside Chinese mainland: 5 cases in Hong Kong, 2 cases in Macao, 3 cases in Taiwan, 4 cases in Thailand (2 cases cured), 2 cases in Japan (1 case cured), 2 cases in South Korea, 2 cases in the United States, 2 cases in Vietnam, 3 cases in Singapore, 1 case in Nepal and 2 cases in France.

Purpose and scope of document

This document is intended for clinicians taking care of hospitalised adult and paediatric patients with severe acute respiratory infection (SARI) when an nCoV infection is suspected. It is not meant to replace clinical judgment or specialist consultation but rather to strengthen clinical management of these patients and provide to up-to-date guidance. Best practices for SARI including IPC and optimized supportive care for severely ill patients are essential.

This document aims to provide clinicians with updated interim guidance on timely, effective, and safe supportive management of patients with nCoV and SARI, particularly those with critical illness. The recommendations in this document are derived from WHO publications.

A. Triage: Early recognition of patients with SARI associated with nCoV infection.

The purpose of triage is to recognize and sort all patients with SARI at first point of contact with health care system (such as the emergency department). Consider nCOV as a possible etiology of SARI under certain conditions (see Table 1). Triage patients and start emergency treatments based based on disease severity.

Table 1: Definitions of patients with SARI, suspected of nCoV*

SARI	An ARI with history of fever or measured temperature ≥38 C° and cough; onset within the last ~10 days; and requiring hospitalization. However, the absence of fever does NOT exclude viral infection.
Surveillance case definitions for nCoV*	**1.** Severe acute respiratory infection (SARI) in a person, with history of fever and cough requiring admission to hospital, with no other etiology that fully explains the clinical presentation[1] (clinicians should also be alert to the possibility of atypical presentations in patients who are immunocompromised); AND any of the following: a) A history of travel to Wuhan, Hubei Province China in the 14 days prior to symptom onset; or **b) the disease occurs in a health care worker who has been working in an environment where patients with severe acute respiratory infections are being cared for, without regard to place of residence or history of travel; or** **c)** the person develops an unusual or unexpected clinical course, especially sudden deterioration despite appropriate treatment, without regard to place of residence or history of travel, even if another etiology has been identified that fully explains the clinical presentation **2.** A person with acute respiratory illness of any degree of severity who,

	within 14 days before onset of illness, had any of the following exposures: a) close physical contact[2] with a confirmed case of nCoV infection, while that patient was symptomatic; or b) a healthcare facility in a country where hospital-associated nCoV infections have been reported;

*** see https://mohfw.gov.in/media/disease-alerts for latest case definition**

1- Testing should be according to local guidance for management of community-acquired pneumonia. Examples of other etiologies include Streptococcus pneumoniae, Haemophilus influenza type B, Legionella pneumophila, other recognized primary bacterial pneumonias, influenza viruses, and respiratory syncytial virus.

2- Close contact is defined as:

- Health care associated exposure, including providing direct care for nCoV patients, working with health care workers infected with nCoV, visiting patients or staying in the same close environment of a nCoV patient
- Working together in close proximity or sharing the same classroom environment with a with nCoV patient
- Traveling together with nCoV patient in any kind of conveyance
- Living in the same household as a nCoV patient

The epidemiological link may have occurred within a 14-day period before or after the onset of illness in the case under consideration

Novel Coronavirus may present with mild, moderate, or severe illness; the latter includes severe pneumonia, ARDS, sepsis and septic shock. Early recognition of suspected patients allows for timely initiation of IPC (see Table 2). Early identification of those with severe manifestations (see Table 2) allows for immediate optimized supportive care treatments and safe, rapid admission (or referral) to intensive care unit according to institutional or national protocols. For those with mild illness, hospitalization may not be required unless there is concern for rapid deterioration. All patients discharged home should be instructed to return to hospital if they develop any worsening of illness.

Table 2: Clinical syndromes associated with nCoV infection

Uncomplicated illness	Patients with uncomplicated upper respiratory tract viral infection, may have non-specific symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache, muscle pain or malaise. The elderly and immunosuppressed may present with atypical symptoms. These patients do not have any signs of dehydration, sepsis or shortness of breath
Mild pneumonia	Patient with pneumonia and no signs of severe pneumonia. Child with non-severe pneumonia has cough or difficulty breathing + fast breathing: fast breathing (in breaths/min): <2 months, ≥60; 2–11 months, ≥50; 1–5 years, ≥40 and no signs of severe pneumonia
Severe pneumonia	Adolescent or adult: fever or suspected respiratory infection, plus one of respiratory rate >30 breaths/min, severe respiratory distress, or SpO2 <90% on room air Child with cough or difficulty in breathing, plus at least one of the following: central cyanosis or SpO2 <90%; severe respiratory distress (e.g. grunting, very severe chest indrawing); signs of pneumonia with a general danger sign: inability to breastfeed or drink, lethargy or unconsciousness, or convulsions. Other signs of pneumonia may be present: chest indrawing, fast breathing (in breaths/min): <2 months, ≥60; 2–11 months, ≥50; 1–5 years, ≥40. The diagnosis is clinical; chest imaging can exclude complications.
Acute Respiratory Distress Syndrome	**Onset**: new or worsening respiratory symptoms within one week of known clinical insult. **Chest imaging (radiograph, CT scan, or lung ultrasound)**: bilateral opacities, not fully explained by effusions, lobar or lung collapse, or nodules.

	Origin of oedema: respiratory failure not fully explained by cardiac failure or fluid overload. Need objective assessment (e.g. echocardiography) to exclude hydrostatic cause of oedema if no risk factor present. **Oxygenation (adults)**: • Mild ARDS: 200 mmHg < PaO2/FiO2 ≤ 300 mmHg (with PEEP or CPAP ≥5 cm H_2O, or non-ventilated) • Moderate ARDS: 100 mmHg < PaO2/FiO2 ≤200 mmHg with PEEP ≥5 cm H_2O, or non-ventilated) • Severe ARDS: PaO2/FiO2 ≤ 100 mmHg with PEEP ≥5 cmH2O, or non-ventilated) • When PaO_2 is not available, SpO_2/FiO_2 ≤315 suggests ARDS (including in non-ventilated patients) Oxygenation (children; note OI = Oxygenation Index and OSI = Oxygenation Index using SpO_2) • Bilevel NIV or CPAP ≥5 cmH2O via full face mask: PaO_2/FiO_2 ≤ 300 mmHg or SpO_2/FiO_2 ≤264 • Mild ARDS (invasively ventilated): 4 ≤ OI < 8 or 5 ≤ OSI < 7.5 • Moderate ARDS (invasively ventilated): 8 ≤ OI < 16 or 7.5 ≤ OSI < 12.3 • Severe ARDS (invasively ventilated): OI ≥ 16 or OSI ≥ 12.3
Sepsis	**Adults**: life-threatening organ dysfunction caused by a dysregulated host response to suspected or proven infection, with organ dysfunction. Signs of organ dysfunction include: altered mental status, difficult or fast breathing, low oxygen saturation, reduced urine output, fast heart rate, weak pulse, cold extremities or low blood pressure, skin mottling, or laboratory evidence of coagulopathy, thrombocytopenia, acidosis, high lactate or hyperbilirubinemia. **Children**: suspected or proven infection and ≥2 SIRS criteria, of which one must be abnormal temperature or white blood cell count
Septic shock	**Adults**: persisting hypotension despite volume resuscitation, requiring vasopressors to maintain MAP ≥65 mmHg and serum lactate level >2 mmol/L **Children**: any hypotension (SBP <5th centile or >2 SD below normal for age) or 2-3 of the following: altered mental state; tachycardia or bradycardia (HR <90 bpm or >160 bpm in infants and HR <70 bpm or >150 bpm in children); prolonged capillary refill (>2 sec) or warm vasodilation with bounding pulses; tachypnea; mottled skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia

B. Immediate implementation of appropriate IPC measures

IPC is a critical and integral part of clinical management of patients and should be initiated at the point of entry of the patient to hospital (typically the Emergency Department). Standard precautions should always be routinely applied in all areas of health care facilities. Standard precautions include hand hygiene; use of PPE to avoid direct contact with patients' blood, body fluids, secretions (including respiratory secretions) and non-intact skin. Standard precautions also include prevention of needle-stick or sharps injury; safe waste management; cleaning and disinfection of equipment; and cleaning of the environment.

Table 3: How to implement infection prevention and control measures for patients with suspected or confirmed nCoV infection

At triage	• Give suspect patient a medical mask and direct patient to separate area, an isolation room if available. Keep at least 1meter distance between suspected patients and other patients. Instruct all patients to cover nose and mouth during coughing or sneezing with tissue or flexed elbow for others. Perform

	hand hygiene after contact with respiratory secretions
Apply droplet precautions	• Droplet precautions prevent large droplet transmission of respiratory viruses. Use a medical mask if working within 1-2 metres of the patient. Place patients in single rooms, or group together those with the same etiological diagnosis. If an etiological diagnosis is not possible, group patients with similar clinical diagnosis and based on epidemiological risk factors, with a spatial separation. When providing care in close contact with a patient with respiratory symptoms (e.g. coughing or sneezing), use eye protection (face-mask or goggles), because sprays of secretions may occur. Limit patient movement within the institution and ensure that patients wear medical masks when outside their rooms
Apply contact precautions	• Droplet and contact precautions prevent direct or indirect transmission from contact with contaminated surfaces or equipment (i.e. contact with contaminated oxygen tubing/interfaces). Use PPE (medical mask, eye protection, gloves and gown) when entering room and remove PPE when leaving. If possible, use either disposable or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared among patients, clean and disinfect between each patient use. Ensure that health care workers refrain from touching their eyes, nose, and mouth with potentially contaminated gloved or ungloved hands. Avoid contaminating environmental surfaces that are not directly related to patient care (e.g. door handles and light switches). Ensure adequate room ventilation. Avoid movement of patients or transport. Perform hand hygiene
Apply airborne precautions when performing an aerosol generating procedure	• Ensure that healthcare workers performing aerosol-generating procedures (i.e. open suctioning of respiratory tract, intubation, bronchoscopy, cardiopulmonary resuscitation) use PPE, including gloves, long-sleeved gowns, eye protection, and fit-tested particulate respirators (N95 or equivalent, or higher level of protection). (The scheduled fit test should not be confused with user seal check before each use.) Whenever possible, use adequately ventilated single rooms when performing aerosol-generating procedures, meaning negative pressure rooms with minimum of 12 air changes per hour or at least 160 litres/second/patient in facilities with natural ventilation. Avoid the presence of unnecessary individuals in the room. Care for the patient in the same type of room after mechanical ventilation commences

Abbreviations: ARI, acute respiratory infection; PPE, personal protective equipment

C. Early supportive therapy and monitoring

a. Give supplemental oxygen therapy immediately to patients with SARI and respiratory distress, hypoxaemia, or shock: Initiate oxygen therapy at 5 L/min and titrate flow rates to reach target SpO_2 ≥90% in non-pregnant adults and SpO_2 ≥92-95 % in pregnant patients. Children with emergency signs (obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma or convulsions) should receive oxygen therapy during resuscitation to target SpO_2 ≥94%; otherwise, the target SpO_2 is ≥90%. All areas where patients with SARI are cared for should be equipped with pulse oximeters, functioning oxygen systems and disposable, single-use, oxygen-delivering interfaces (nasal cannula, simple face mask, and mask with reservoir bag). Use contact precautions when handling contaminated oxygen interfaces of patients with nCoV infection
b. Use conservative fluid management in patients with SARI when there is no evidence of shock: Patients with SARI should be treated cautiously with intravenous fluids, because aggressive fluid

resuscitation may worsen oxygenation, especially in settings where there is limited availability of mechanical ventilation

c. Give empiric antimicrobials to treat all likely pathogens causing SARI. Give antimicrobials within one hour of initial patient assessment for patients with sepsis: Although the patient may be suspected to have nCoV, administer appropriate empiric antimicrobials within ONE hour of identification of sepsis. Empiric antibiotic treatment should be based on the clinical diagnosis (community-acquired pneumonia, health care-associated pneumonia [if infection was acquired in healthcare setting], or sepsis), local epidemiology and susceptibility data, and treatment guidelines. Empiric therapy includes a neuraminidase inhibitor for treatment of influenza when there is local circulation or other risk factors, including travel history or exposure to animal influenza viruses.18 Empiric therapy should be de-escalated on the basis of microbiology results and clinical judgment
d. Do not routinely give systemic corticosteroids for treatment of viral pneumonia or ARDS outside of clinical trials unless they are indicated for another reason: A systematic review of observational studies of corticosteroids administered to patients with SARS reported no survival benefit and possible harms (avascular necrosis, psychosis, diabetes, and delayed viral clearance). A systematic review of observational studies in influenza found a higher risk of mortality and secondary infections with corticosteroids; the evidence was judged as very low to low quality due to confounding by indication. A subsequent study that addressed this limitation by adjusting for time-varying confounders found no effect on mortality. Finally, a recent study of patients receiving corticosteroids for MERS used a similar statistical approach and found no effect of corticosteroids on mortality but delayed lower respiratory tract (LRT) clearance of MERS-CoV. Given lack of effectiveness and possible harm, routine corticosteroids should be avoided unless they are indicated for another reason. See section F for the use of corticosteroids in sepsis.
e. Closely monitor patients with SARI for signs of clinical deterioration, such as rapidly progressive respiratory failure and sepsis, and apply supportive care interventions immediately: Application of timely, effective, and safe supportive therapies is the cornerstone of therapy for patients that develop severe manifestations of nCoV
f. Understand the patient's co-morbid condition(s) to tailor the management of critical illness and appreciate the prognosis: During intensive care management of SARI, determine which chronic therapies should be continued and which therapies should be stopped temporarily
g. Communicate early with patient and family: Communicate proactively with patients and families and provide support and prognostic information. Understand the patient's values and preferences regarding life-sustaining interventions

D. Collection of specimens for laboratory diagnosis

Guidance on specimen collection, processing, transportation, including related biosafety procedures, is available on **https://mohfw.gov.in/media/disease-alerts**

Points to remember

- Collect blood cultures for bacteria that cause pneumonia and sepsis, ideally before antimicrobial therapy. DO NOT delay antimicrobial therapy to collect blood cultures
- Collect specimens from BOTH the upper respiratory tract (URT; nasopharyngeal and oropharyngeal) AND lower respiratory tract (LRT; expectorated sputum, endotracheal aspirate, or bronchoalveolar lavage) for nCoV testing by RT-PCR. Clinicians may elect to collect only LRT samples when these are readily available (for example, in mechanically ventilated patients)

- Use appropriate PPE for specimen collection (droplet and contact precautions for URT specimens; airborne precautions for LRT specimens). When collecting URT samples, use viral swabs (sterile Dacron or rayon, not cotton) and viral transport media. Do not sample the nostrils or tonsils. In a patient with suspected novel coronavirus, especially with pneumonia or severe illness, a single URT sample does not exclude the diagnosis, and additional URT and LRT samples are recommended. LRT (vs. URT) samples are more likely to be positive and for a longer period. Clinicians may elect to collect only LRT samples when these are readily available (for example, in mechanically ventilated patients). Sputum induction should be avoided due to increased risk of increasing aerosol transmission.

Dual infections with other respiratory viral infections have been found in SARS and MERS cases. At this stage we need detailed microbiologic studies in all suspected cases. Both URT and LRT specimens can tested for other respiratory viruses, such as influenza A and B (including zoonotic influenza A), respiratory syncytial virus, parainfluenza viruses, rhinoviruses, adenoviruses, enteroviruses (e.g. EVD68), human metapneumovirus, and endemic human coronaviruses (i.e. HKU1, OC43, NL63, and 229E). LRT specimens can also be tested for bacterial pathogens, including Legionella pneumophila

In hospitalized patients with confirmed nCoV infection, repeat URT and LRT samples should be collected to demonstrate viral clearance. The frequency of specimen collection will depend on local circumstances but should be at least every 2 to 4 days until there are two consecutive negative results (both URT and LRT samples if both are collected) in a clinically recovered patient at least 24 hours apart. If local infection control practice requires two negative results before removal of droplet precautions, specimens may be collected as often as daily

E. Management of hypoxemic respiratory failure and ARDS

Recognize severe hypoxemic respiratory failure when a patient with respiratory distress is failing standard oxygen therapy. Patients may continue to have increased work of breathing or hypoxemia even when oxygen is delivered via a face mask with reservoir bag (flow rates of 10-15 L/min, which is typically the minimum flow required to maintain bag inflation; FiO_2 0.60-0.95). Hypoxemic respiratory failure in ARDS commonly results from intrapulmonary ventilation-perfusion mismatch or shunt and usually requires mechanical ventilation

High-flow nasal oxygen (HFNO) or non-invasive ventilation (NIV) should only be used in selected patients with hypoxemic respiratory failure. The risk of treatment failure is high in patients with MERS treated with NIV, and patients treated with either HFNO or NIV should be closely monitored for clinical deterioration. HFNO systems can deliver 60 L/min of gas flow and FiO_2 up to 1.0; paediatric circuits generally only handle up to 15 L/min, and many children will require an adult circuit to deliver adequate flow. Compared to standard oxygen therapy, HFNO reduces the need for intubation. Patients with hypercapnia (exacerbation of obstructive lung disease, cardiogenic pulmonary oedema), hemodynamic instability, multi-organ failure, or abnormal mental status should generally not receive HFNO, although emerging data suggest that HFNO may be safe in patients with mild-moderate and non-worsening hypercapnia.25 Patients receiving HFNO should be in a monitored setting and cared for by experienced personnel capable of endotracheal intubation in case the patient acutely deteriorates or does not improve after a short trial (about 1 hr). Evidence-based guidelines on HFNO do not exist, and reports on HFNO in MERS patients are limited.

NIV guidelines make no recommendation on use in hypoxemic respiratory failure (apart from cardiogenic pulmonary oedema and post-operative respiratory failure) or pandemic viral illness (referring to studies of SARS and pandemic influenza). Risks include delayed intubation, large tidal volumes, and injurious transpulmonary pressures. Limited data suggest a high failure rate when MERS patients receive NIV. Patients receiving a trial of NIV should be in a monitored setting and cared for by experienced personnel capable of endotracheal intubation in case the patient acutely deteriorates or does not improve after a short trial (about 1 hr). Patients with hemodynamic instability, multiorgan failure, or abnormal mental status should not receive NIV.

Recent publications suggest that newer HFNO and NIV systems with good interface fitting do not create widespread dispersion of exhaled air and therefore should be associated with low risk of airborne transmission.

Endotracheal intubation should be performed by a trained and experienced provider using airborne precautions. Patients with ARDS, especially young children or those who are obese or pregnant, may desaturate quickly during intubation. Pre-oxygenate with 100% FiO_2 for 5 minutes, via a face mask with reservoir bag, bag-valve mask, HFNO, or NIV. Rapid sequence intubation is appropriate after an airway assessment that identifies no signs of difficult intubation.

Implement mechanical ventilation using lower tidal volumes (4–8 ml/kg predicted body weight, PBW) and lower inspiratory pressures (plateau pressure <30 cmH_2O). This is a strong recommendation from a clinical guideline for patients with ARDS, and is suggested for patients with sepsis-induced respiratory failure who do not meet ARDS criteria. The initial tidal volume is 6 ml/kg PBW; tidal volume up to 8 ml/kg PBW is allowed if undesirable side effects occur (e.g. dyssynchrony, pH <7.15). Hypercapnia is permitted if meeting the pH goal of 7.30-7.45. Ventilator protocols are available. The use of deep sedation may be required to control respiratory drive and achieve tidal volume targets. Although high driving pressure (plateau pressure−PEEP) may more accurately predict increased mortality in ARDS compared to high tidal volume or plateau pressure, RCTs of ventilation strategies that target driving pressure are not currently available.

In patients with severe ARDS, prone ventilation for >12 hours per day is recommended. Application of prone ventilation is strongly recommended for adult and paediatric patients with severe ARDS but requires sufficient human resources and expertise to be performed safely.

Use a conservative fluid management strategy for ARDS patients without tissue hypoperfusion.

In patients with moderate or severe ARDS, higher PEEP instead of lower PEEP is suggested. PEEP titration requires consideration of benefits (reducing atelectrauma and improving alveolar recruitment) vs. risks (end-inspiratory overdistension leading to lung injury and higher pulmonary vascular resistance). Tables are available to guide PEEP titration based on the FiO_2 required to maintain SpO_2. A related intervention of recruitment manoeuvres (RMs) is delivered as episodic periods of high continuous positive airway pressure [30–40 cm H_2O], progressive incremental increases in PEEP with constant driving pressure, or high driving pressure; considerations of benefits vs. risks are similar. Higher PEEP and RMs were both conditionally recommended in a clinical practice guideline. For PEEP, the guideline considered an individual patient data meta-analysis of 3 RCTs. However, a subsequent RCT of high PEEP and prolonged high-pressure RMs showed harm, suggesting that the protocol in this RCT should be avoided. Monitoring of patients to identify those who respond to the

initial application of higher PEEP or a different RM protocol, and stopping these interventions in non-responders, is suggested.

In patients with moderate-severe ARDS (PaO_2/FiO_2 <150), neuromuscular blockade by continuous infusion should not be routinely used. One trial found that this strategy improved survival in patients with severe ARDS (PaO2/FiO2 <150) without causing significant weakness, but results of a recent larger trial found that use of neuromuscular blockage with high PEEP strategy was not associated with survival when compared to a light sedation strategy without neuromuscular blockade. Continuous neuromuscular blockade may still be considered in patients with ARDS in certain situations: ventilator dyssnchony despite sedation, such that tidal volume limitation cannot be reliably achieved; or refractory hypoxemia or hypercapnia.

In settings with access to expertise in extracorporeal life support (ECLS), consider referral of patients with refractory hypoxemia despite lung protective ventilation. A recent guideline made no recommendation about ECLS in patients with ARDS. Since then, an RCT of ECLS for patients with ARDS was stopped early and found no statistically significant difference in the primary outcome of 60-day mortality between ECLS and standard medical management (including prone positioning and neuromuscular blockade). However, ECLS was associated with a reduced risk of the composite outcome of mortality and crossover to ECLS, and a post hoc Bayesian analysis of this RCT showed that ECLS is very likely to reduce mortality across a range of prior assumptions. In patients with MERS-CoV infection, ECLS vs. conventional treatment was associated with reduced mortality in a cohort study. ECLS should only be offered in expert centres with a sufficient case volume to maintain expertise and that can apply the IPC measures required for nCoV patients

Avoid disconnecting the patient from the ventilator, which results in loss of PEEP and atelectasis. Use in-line catheters for airway suctioning and clamp endotracheal tube when disconnection is required (for example, transfer to a transport ventilator)

F. Management of septic shock

Recognize septic shock in adults when infection is suspected or confirmed AND vasopressors are needed to maintain mean arterial pressure (MAP) ≥65 mmHg AND lactate is ≥2 mmol/L, in absence of hypovolemia. Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] <5th centile or >2 SD below normal for age) or 2-3 of the following: altered mental state; tachycardia or bradycardia (HR <90 bpm or >160 bpm in infants and HR <70 bpm or >150 bpm in children); prolonged capillary refill (>2 sec) or warm vasodilation with bounding pulses; tachypnea; mottled skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.

In the absence of a lactate measurement, use MAP and clinical signs of perfusion to define shock. Standard care includes early recognition and the following treatments within 1 hour of recognition: antimicrobial therapy and fluid loading and vasopressors for hypotension. The use of central venous and arterial catheters should be based on resource availability and individual patient needs. Detailed guidelines are available for the management of septic shock in adults and children.

In resuscitation from septic shock in adults, give at least 30 ml/kg of isotonic crystalloid in adults in the first 3 hours. In resuscitation from septic shock in children in well-resourced settings, give 20 ml/kg as a rapid bolus and up to 40-60 ml/kg in the first 1 hr.

Do not use hypotonic crystalloids, starches, or gelatins for resuscitation.

Fluid resuscitation may lead to volume overload, including respiratory failure. If there is no response to fluid loading and signs of volume overload appear (for example, jugular venous distension, crackles on lung auscultation, pulmonary oedema on imaging, or hepatomegaly in children), then reduce or discontinue fluid administration. This step is particularly important where mechanical ventilation is not available. Alternate fluid regimens are suggested when caring for children in resource-limited settings.

Crystalloids include normal saline and Ringer's lactate. Determine need for additional fluid boluses (250-1000 ml in adults or 10-20 ml/kg in children) based on clinical response and improvement of perfusion targets. Perfusion targets include MAP (>65 mmHg or age-appropriate targets in children), urine output (>0.5 ml/kg/hr in adults, 1 ml/kg/hr in children), and improvement of skin mottling, capillary refill, level of consciousness, and lactate. Consider dynamic indices of volume responsiveness to guide volume administration beyond initial resuscitation based on local resources and experience. These indices include passive leg raises, fluid challenges with serial stroke volume measurements, or variations in systolic pressure, pulse pressure, inferior vena cava size, or stroke volume in response to changes in intrathoracic pressure during mechanical ventilation.

Starches are associated with an increased risk of death and acute kidney injury vs. crystalloids. The effects of gelatins are less clear, but they are more expensive than cyrstalloids. Hypotonic (vs. isotonic) solutions are less effective at increasing intravascular volume. Surviving Sepsis also suggests albumin for resuscitation when patients require substantial amounts of crystalloids, but this conditional recommendation is based on low-quality evidence.

Administer vasopressors when shock persists during or after fluid resuscitation. The initial blood pressure target is MAP ≥65 mmHg in adults and age-appropriate targets in children.

If central venous catheters are not available, vasopressors can be given through a peripheral IV, but use a large vein and closely monitor for signs of extravasation and local tissue necrosis. If extravasation occurs, stop infusion. Vasopressors can also be administered through intraosseous needles.

If signs of poor perfusion and cardiac dysfunction persist despite achieving MAP target with fluids and vasopressors, consider an inotrope such as dobutamine

Vasopressors (i.e. norepinephrine, epinephrine, vasopressin, and dopamine) are most safely given through a central venous catheter at a strictly controlled rate, but it is also possible to safely administer them via peripheral vein and intraosseous needle. Monitor blood pressure frequently and titrate the vasopressor to the minimum dose necessary to maintain perfusion and prevent side effects. Norepinephrine is considered first-line in adult patients; epinephrine or vasopressin can be added to achieve the MAP target. Because of the risk of tachyarrhythmia, reserve dopamine for selected patients with low risk of tachyarrhythmia or those with bradycardia. In children with cold shock (more common), epinephrine is considered first-line, while norepinephrine is used in patients with warm shock (less common).

G. Prevention of complications

Implement the following interventions (Table 4) to prevent complications associated with critical illness. These interventions are based on Surviving Sepsis or other guidelines, and are generally limited to feasible recommendations based on high quality evidence.

Table 4: Prevention of complications

Anticipated Outcome	Interventions
Reduce days of invasive mechanical ventilation	• Use weaning protocols that include daily assessment for readiness to breathe spontaneously • Minimize continuous or intermittent sedation, targeting specific titration endpoints (light sedation unless contraindicated) or with daily interruption of continuous sedative infusions
Reduce incidence of ventilator associated pneumonia	• Oral intubation is preferable to nasal intubation in adolescents and adults • Keep patient in semi-recumbent position (head of bed elevation 30-45º) • Use a closed suctioning system; periodically drain and discard condensate in tubing • Use a new ventilator circuit for each patient; once patient is ventilated, change circuit if it is soiled or damaged but not routinely • Change heat moisture exchanger when it malfunctions, when soiled, or every 5–7 days
Reduce incidence of venous thromboembolism	• Use pharmacological prophylaxis (low molecular-weight heparin [preferred if available] or heparin 5000 units subcutaneously twice daily) in adolescents and adults without contraindications. For those with contraindications, use mechanical prophylaxis (intermittent pneumatic compression devices).
Reduce incidence of catheter related bloodstream infection	• Use a checklist with completion verified by a real-time observer as reminder of each step needed for sterile insertion and as a daily reminder to remove catheter if no longer needed
Reduce incidence of pressure ulcers	• Turn patient every two hours
Reduce incidence of stress ulcers and gastrointestinal bleeding	• Give early enteral nutrition (within 24–48 hours of admission) • Administer histamine-2 receptor blockers or proton-pump inhibitors in patients with risk factors for GI bleeding. Risk factors for gastrointestinal bleeding include mechanical ventilation for ≥48 hours, coagulopathy, renal replacement • therapy, liver disease, multiple comorbidities, and higher organ failure score
Reduce incidence of ICU-related weakness	• Actively mobilize the patient early in the course of illness when safe to do so

H. Specific anti-Novel-CoV treatments and clinical research

There is no current evidence from RCTs to recommend any specific anti-nCoV treatment for patients with suspected or confirmed nCoV. Unlicensed treatments should be administered only in the context of ethically-approved clinical trials or the Monitored Emergency Use of Unregistered Interventions Framework (MEURI), with strict monitoring.

Clinical characterization protocols are available, including the SPRINT-SARI https://isaric.tghn.org/sprint-sari/ and WHOISARIC forms available at https://isaric.tghn.org/protocols/severe-acute-respiratory-infection-data-tools/.

I. Special considerations for pregnant patients

Pregnant women with suspected or confirmed nCoV should be treated with supportive therapies as described above, taking into account the physiologic adaptations of pregnancy.

The use of investigational therapeutic agents outside of a research study should be guided by individual risk-benefit analysis based on potential benefit for mother and safety to fetus, with consultation from an obstetric specialist and ethics committee.

Emergency delivery and pregnancy termination decisions are challenging and based on many factors: gestational age, maternal condition, and fetal stability. Consultations with obstetric, neonatal, and intensive care specialists (depending on the condition of the mother) are essential.

Note: These guidelines are preliminary in nature and will be updated as soon as more information on clinical profile and treatment are available.

Laboratory biosafety guidance related to coronavirus disease 2019 (COVID-19)

Interim guidance
12 February 2020

World Health Organization

1. Introduction

The purpose of this document is to provide interim guidance on laboratory biosafety related to the testing of clinical specimens of patients that meet the case definition of the novel pathogen identified in Wuhan, China, that is, 2019 novel coronavirus (2019-nCoV), now known as the virus responsible for coronavirus disease 2019 (COVID-19).

As our understanding of COVID-19 is limited but rapidly growing, the World Health Organization (WHO) continues to monitor developments and will revise these recommendations as necessary.

Highlights of COVID-19 laboratory biosafety

- All procedures must be performed based on risk assessment and only by personnel with demonstrated capability, in strict observance of any relevant protocols at all times.
- Initial processing (before inactivation) of all specimens should take place in a validated biological safety cabinet (BSC) or primary containment device.
- Non-propagative diagnostic laboratory work (for example, sequencing, nucleic acid amplification test [NAAT]) should be conducted at a facility using procedures equivalent to Biosafety Level 2 (BSL-2)
- Propagative work (for example, virus culture, isolation or neutralization assays) should be conducted at a containment laboratory with inward directional airflow (BSL-3).
- Appropriate disinfectants with proven activity against enveloped viruses should be used (for example, hypochlorite [bleach], alcohol, hydrogen peroxide, quaternary ammonium compounds and phenolic compounds).
- Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B". Viral cultures or isolates should be transported as Category A, UN2814, "infectious substance, affecting humans".

2. Laboratory biosafety

It is essential to ensure that health laboratories adhere to appropriate biosafety practices. Any testing for the presence of the virus responsible for COVID-19 or of clinical specimens from patients meeting the suspected case definition *(1)* should be performed in appropriately equipped laboratories, by staff trained in the relevant technical and safety procedures. National guidelines on the laboratory biosafety should be followed in all circumstances. For general information on laboratory biosafety guidelines, see the WHO *Laboratory biosafety manual*, 3rd edition *(2)* in the interim before the 4th edition is released.

Key points

- Each laboratory should conduct a local (that is, institutional) risk assessment to ensure it is competent to safely perform the intended testing with appropriate risk control measures in place.
- When handling and processing specimens, including blood for serological testing, laboratory practices and procedures that are basic to good microbiological practices and procedures (GMPP) should be followed.
- The handling and processing of specimens from cases with suspected or confirmed COVID-19 infection that are intended for additional laboratory tests, such as haematology or blood gas analysis, should follow local guidelines for processing potentially infectious material.
- Non-propagative diagnostic laboratory work, including sequencing and NAAT, on clinical specimens from patients who are suspected or confirmed to be infected with COVID-19, should be conducted adopting the practices and procedures of "core requirements",[1] as detailed in **Annex 1**, and an appropriate selection of "heightened control measures",[2] as informed by the local risk assessment. In the interim, BSL-2 in the WHO *Laboratory biosafety manual*, 3rd edition *(2)* remains appropriate until the 4th edition replaces it.
- Handling of material with high concentrations of live virus (such as when performing virus propagation, virus isolation or neutralization assays) or large volumes of infectious materials should be performed **only by**

[1] **Core requirements:** A set of minimum requirements defined in the 4th edition of the WHO *Laboratory biosafety manual* to describe a combination of risk control measures that are both the foundation for, and an integral part of, laboratory biosafety. These measures reflect international standards and best practice in biosafety that are necessary to work safely with biological agents, even where the associated risks are minimal.

[2] **Heightened control measures:** A set of risk control measures that may need to be applied in a laboratory facility because the outcome of a risk assessment indicates that the biological agents being handled and/or the activities to be performed with them are associated with a relatively high risk that cannot be acceptable solely with the core requirements.

properly trained and competent personnel in laboratories capable of meeting additional essential containment requirements and practices, that is, BSL-3.

- Initial processing (before inactivation) of all specimens, including those for sequencing and NAAT, should take place in an appropriately maintained and validated BSC or primary containment device.
- Appropriate disinfectants with proven activity against enveloped viruses should be used for the recommended contact time, at the correct dilution and within the expiry date after the working solution is prepared.
- All technical procedures should be performed in a way that minimizes the generation of aerosols and droplets.
- Appropriate personal protective equipment (PPE), as determined by a detailed risk assessment, should be worn by all laboratory personnel handling these specimens.
- Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B". Viral cultures or isolates should be transported as Category A UN2814, "infectious substance, affecting humans" *(3)*.

3. Recommendations addressing minimal/essential working conditions associated with specific manipulations in laboratory settings

The additional recommendations provided in this section address the minimal/essential working conditions associated with specific manipulations in laboratory settings.

a. Risk assessment

Risk assessment is a systematic process of gathering information and evaluating the likelihood and consequences of exposure to or release of workplace hazard(s) and determining the appropriate risk control measures to reduce the risk to an acceptable level. It is important to note that hazards alone do not pose a risk to humans or animals. Consideration therefore must also be given to the types of equipment used and the procedure(s) that will be performed with the biological agent.

It is highly recommended to start with performing a local risk assessment for each process step, that is, from sample collection, sample reception, clinical testing, polymerase chain reaction (PCR) to virus isolation (only when and where applicable). Certain hazards will then be considered for each process step, such as aerosol exposure during sample processing; eye splash during sample processing; infectious culture material spill; and leaking sample (in the case of sample reception), with an assessed grade of risk. For each identified risk, appropriate risk control measures, including but not limited to the following recommendations, should be selected and implemented, in order to mitigate the residual risks to an acceptable level.

A risk assessment template is provided in **Annex 2;** this is intended to serve as an example and to facilitate the process.

b. Routine laboratory procedures, including non-propagative diagnostic work and PCR analysis

Non-culture-based diagnostic laboratory work, and PCR analysis on clinical specimens from patients who are suspected or confirmed to be infected with the virus responsible for COVID-19, should be conducted adopting practices and procedures described for conventional clinical and microbiology laboratories as described in the "core requirements" (see **Annex 1**).

However, all manipulations of potentially infectious materials, including those that may cause splashes, droplets or aerosols of infectious materials (for example, loading and unloading of sealed centrifuge cups, grinding, blending, vigorous shaking or mixing, sonic disruption, opening of containers of infectious materials whose internal pressure may be different from the ambient pressure), should be performed in appropriately maintained and validated BSCs or primary containment devices, by personnel with demonstrated capability.

Examples of routine laboratory procedures include:

• diagnostic testing of serum; blood (including haematology and clinical chemistry); respiratory specimens such as nasopharyngeal and oropharyngeal swabs, sputum and/or endotracheal aspirate or bronchoalveolar lavage; stool; or other specimens;

• routine examination of mycotic and bacterial cultures developed from respiratory tract specimens. When handling and processing specimens, "core requirements" (see **Annex 1**), including GMPP, should be followed at all times, including but not limited to those under the following subheadings. More details are explained and demonstrated in the WHO Biosafety video series *(4)*.

c. Use of appropriate disinfectants

• While little is known about this novel virus, the comparable genetic characteristics between the virus responsible for COVID-19 and MERS-CoV suggest that the COVID-19 virus may be susceptible to disinfectants with proven activity against enveloped viruses, including sodium hypochlorite (bleach; for example, 1000 parts per million [ppm] (0.1%) for general surface disinfection and 10 000 ppm (1%) for disinfection of blood spills);

62–71% ethanol; 0.5% hydrogen peroxide; quaternary ammonium compounds; and phenolic compounds, if used according to the manufacturer's recommendations. Other biocidal agents such as 0.05–0.2% benzalkonium chloride or 0.02% chlorhexidine digluconate can be less effective.

• Particular attention should be paid not only to the selection of the disinfectant but also the contact time (for example, 10 minutes), dilution (that is, concentration of the active ingredient) and expiry date after the working solution is prepared.

• Human coronaviruses in general are known to persist on inanimate surfaces such as metal, glass or plastic for up to 9 days *(5)*.

d. Viral isolation

Unless a country decides otherwise, considering the newly acquired knowledge and effective preventive measures described above, viral isolation on clinical specimens from patients who are suspected or confirmed to be infected with the virus responsible for COVID-19 should be performed only in laboratories capable of meeting the following additional containment criteria:

• a controlled ventilation system maintains inward directional airflow into the laboratory room;

• exhaust air from the laboratory room is not recirculated to other areas within the building. Air must be HEPA (high-efficiency particulate air) filtered, if reconditioned and recirculated within the laboratory. When exhaust air from the laboratory is discharged to the outdoors, it must be dispersed away from occupied buildings and air intakes. This air should be discharged through HEPA filters;

• a dedicated hand-wash sink is available in the laboratory;

• all manipulations of infectious or potentially infectious materials must be performed in appropriately maintained and validated BSCs;

• laboratory workers should wear protective equipment, including disposable gloves; solid-front or wrap-around gowns, scrub suits, or coveralls with sleeves that fully cover the forearms; head coverings; shoe covers or dedicated shoes; and eye protection (goggles or face shield). Risk assessment should inform the use of respiratory protection (fit-tested particulate respirator, for example, EU FFP2, US 6 NIOSH-certified N95 or equivalent, or higher protection);

• centrifugation of specimens should be performed using sealed centrifuge rotors or sample cups. These rotors or cups should be loaded and unloaded in a BSC.

e. Additional risks associated with virus isolation studies

Certain experimental procedures may carry additional risks of virus mutations with possible increased pathogenicity and/or transmissibility, or viruses with altered antigenicity or drug susceptibility. Specific risk assessments should be conducted, and specific risk-reduction measures adopted, before any of the following procedures are conducted:

• coinfection of cell cultures with different coronaviruses, or any procedures that may result in a coinfection;

• culture of viruses in the presence of antiviral drugs;

• deliberate genetic modification of viruses.

f. Work with animals infected with the virus responsible for COVID-19

The following activities require an animal facility – BSL-3 facilities and work practices, as detailed in the WHO *Laboratory biosafety manual*, 3rd edition *(2)*:

• inoculation of animals for potential recovery of the agent from specimens of the virus responsible for COVID-19;

• any protocol involving animal inoculation for confirmation and/or characterization of putative agents of the COVID-19 virus.

g. Referral of specimens to laboratories with appropriate containment measures in place

Laboratories that are not able to meet the above biosafety recommendations should consider transferring specimens to national, regional or international referral laboratories with COVID-19-detection capacity that can meet the biosafety requirements.

4. Packaging and shipment

All materials transported within and between laboratories should be placed in a secondary container, to minimize the potential for breakage or a spill. An example includes transfer of materials from the BSC to an incubator and vice versa. Specimens leaving the BSC should be surface decontaminated. Detailed guidance is provided in the WHO Biosafety video series *(4)*, in particular *Good microbiological practices and procedures (GMPP) 7: transport*.

Transport of specimens within national borders should comply with applicable national regulations. Cross-boundary transport of specimens of the virus responsible for COVID-19 should follow the United Nations model regulations, *Technical instructions for the safe transport of*

dangerous goods by air (Doc 9284) of the International Civil Aviation Organization *(6)*, for airlifted transport, and any other applicable regulations depending on the mode of transport being used. More information may be found in the WHO *Guidance on regulations for the transport of infectious substances 2019-2020* (applicable as from 1 January 2019) *(3)*. A summary on transport of infectious substances can also be found in Tool box 4 of the WHO handbook, *Managing epidemics: key facts about deadly diseases (7)*.

Patient specimens from suspected or confirmed cases should be transported as UN3373, "Biological Substance Category B", when they are transported for diagnostic or investigational purposes. Viral cultures or isolates should be transported as Category A UN2814, "infectious substance, affecting humans" *(3)*. All specimens being transported (whether UN3373 or UN2814) should have appropriate packaging, labelling and documentation, as described in the documents mentioned earlier.

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Annex 1. Core requirements

1. Good microbiological practice and procedure (GMPP)

Best practice

• Never store food or drink, or personal items such as coats and bags in the laboratory. Activities such as eating, drinking, smoking and/or applying cosmetics are only to be performed outside the laboratory.

• Never put materials, such as pens, pencils or gum in the mouth while inside the laboratory, regardless of having gloved hands or not.

• Thoroughly wash hands *(8)*, preferably with warm running water and soap, after handling any biological material, including animals, before leaving the laboratory, and any time contamination is known or suspected to be present on the hands.

• Ensure open flames or heat sources are never placed near flammable supplies and are never left unattended.

• Ensure that coverings are placed over any cuts or broken skin prior to entering the laboratory.

• Ensure, prior to entry into the laboratory, that supplies of laboratory equipment and consumables, including reagents, PPE and disinfectants, are sufficient and appropriate for the activities being performed.

• Ensure supplies are stored appropriately (that is, according to storage instructions) and safely, to reduce the chance of accidents and incidents such as spills, trips or falls for laboratory personnel.

• Ensure proper labelling of all biological agents and chemical and radioactive material.

• Protect written documents from contamination using barriers (such as plastic coverings), particularly those that may need to be removed from the laboratory.

• Ensure work is performed with care, in a timely manner and without rushing. Working when fatigued should be avoided.

• Keep the work area tidy, clean and free of clutter and materials that are not necessary for the work being done.

• Prohibit the use of earphones, which can distract personnel and prevent equipment or facility alarms from being heard.

• Appropriately cover or remove any jewellery that could tear glove material, easily become contaminated or act as a fomite for infection. If worn regularly, cleaning and decontamination of the jewellery or spectacles should be considered.

• Refrain from using mobile electronic devices (for example, mobile telephones, tablets, laptops, flash drives, memory sticks, cameras and/or other portable devices, including those used for DNA/RNA sequencing) when not specifically required for the laboratory procedures being performed.

• Keep mobile electronic devices in areas where they could not easily become contaminated or act as a fomite for infection. Where close proximity of such devices to biological agents is unavoidable, ensure they are either protected by a physical barrier or decontaminated before leaving the laboratory.

Technical procedures

• Avoid inhalation of biological agents. Use good techniques to minimize the formation of aerosols and droplets when manipulating specimens.

• Avoid ingestion of biological agents and contact with the skin and eyes.

• Wear disposable gloves at all times when handling specimens.

• Avoid contact of gloved hands with the face.

• Shield or otherwise protect the mouth, eyes and face during procedures where splashes may occur.

• Wherever possible, replace any glassware with plasticware

• For work needing scissors, use scissors with blunt or rounded ends in preference to those with pointed ends.

• Handle all sharps, syringes and needles, if necessary, with care so as to prevent injury and injection of biological agents.

• Use ampoule openers for safe handling of ampoules.

• Never re-cap, clip or remove needles from disposable syringes.

• Dispose of any sharps materials (for example, needles, needles combined with syringes, blades, broken glass) in puncture-proof or puncture-resistant containers fitted with sealed covers.

• Preventing dispersal of biological agents:
  – discard specimens and cultures for disposal in leak-proof containers with the tops appropriately secured before disposal in dedicated waste containers;
  – consider opening tubes with disinfectant-soaked pad/gauze;
  – decontaminate work surfaces with a suitable disinfectant at the end of the work procedures and

if any material is spilled or obviously contaminated;
– ensure the disinfectant is efficacious against the pathogen being handled and is left in contact with infectious waste materials for sufficient time to effect complete inactivation.

2. Personnel competence and training

General familiarization and awareness training
General training should include an introduction to laboratory layout, codes of practice, local guidelines, safety manuals, risk assessments, legislative requirements and emergency response procedures.

Job-specific training
• Training requirements may vary depending on the job functions.

• However, in general, all personnel involved in the handling of biological agents must be trained on GMPP.

• Competency and proficiency assessment must be used and verified before working independently, followed by regular review and refresher training.

• Relevant information such as new procedures must be updated and communicated to applicable personnel.

Safety and security training
• All personnel must be aware of hazards present in the laboratory and their associated risks; safe working procedures; security measures; and emergency preparedness and response.

3. Facility design

• Ample space and a designated hand-washing basin must be provided, with appropriate restriction to access.

• Doors must be appropriately labelled, and laboratory walls, floors and furniture must be smooth, easy to clean, impermeable to liquids and resistant to the chemicals and disinfectants normally used in the laboratory.

• Laboratory ventilation, where provided (including heating/cooling systems and especially fans/local cooling split-system air-conditioning units – specifically when retrofitted) should ensure airflows do not compromise safe working. Consideration must be made of resultant airflow speeds and directions, and turbulent airflows should be avoided; this applies also to natural ventilation.

• Laboratory space and facilities must be adequate and appropriate for safe handling and storage of infectious and other hazardous materials, such as chemicals and solvents.

• Facilities for eating and drinking must be provided outside the laboratory, and first-aid-facilities must be accessible.

• Appropriate methods for decontamination of waste, for example disinfectants and autoclaves, must be available in proximity to the laboratory.

• The management of waste must be considered in the laboratory design. Safety systems must cover fire, electrical emergencies and emergency/incident response facilities, based on risk assessment.

• There must be a reliable and adequate electricity supply and lighting to permit safe exit.

• Emergency situations must be considered in the design, as indicated in the local risk assessment, and should include the geographical/meteorological context.

4. Specimen receipt and storage

• A specimen received by the laboratory must be accompanied by sufficient information to identify what it is, when and where it was taken or prepared, and which tests and/or procedures (if any) are to be performed

• Consider unpacking the items in the BSC. Personnel unpacking and receiving specimens must be adequately trained in awareness of the hazards involved; how to adopt necessary precautions according to GMPP described earlier; how to handle broken or leaking containers; and how to handle spills and use disinfectants to manage any contamination.

• Specimens must be stored in containers with adequate strength, integrity and volume to contain the specimen; leakproof when the cap or stopper is correctly applied; made of plastic whenever possible; free of any biological material on the outside of the packaging; correctly labelled, marked and recorded to facilitate identification; and made of an appropriate material for the type of storage required.

• Inactivation methods must be appropriately validated whenever an inactivation step is used, before transferring the specimens to other areas for further manipulation, such as PCR analysis.

5. Decontamination and waste management

• Any surface or material known to be, or potentially be, contaminated by biological agents during laboratory operations must be correctly disinfected to control infectious risks.

• Proper processes for the identification and segregation of contaminated materials must be adopted before decontamination and/or disposal.

• Where decontamination cannot be performed in the laboratory area or onsite, the contaminated waste must be packaged in an approved (that is, leakproof) manner, for transfer to another facility with decontamination capacity.

6. Personal protective equipment

• Laboratory coats must be used in laboratories to prevent personal clothing from getting splashed or contaminated by biological agents. Laboratory coats must have long sleeves, preferably with elasticated or fitted cuffs, and must be worn closed. Sleeves should never be rolled up. Coats must be long enough to cover the knees, but not trail on the floor. They should be fastened when worn in the laboratory. Where possible, the fabric of the laboratory coat should be splash-resistant and overlap to provide a solid front. Laboratory coats must only be worn in designated areas. When not in use, they should be stored appropriately; they should not be hung on top of other laboratory coats, or in lockers or hooks with personal items.

• Appropriate disposable gloves must be worn for all procedures that may involve planned or inadvertent contact with blood, body fluids or other potentially infectious materials. They must not be disinfected or reused, as exposure to disinfectants and prolonged wear will reduce the integrity of the glove and decrease protection to the user. Gloves should always be inspected before use, to check they are intact.

• Safety glasses, safety goggles, face shields (visors) or other protective devices must be worn whenever it is necessary to protect the eyes and face from splashes, impacting objects or artificial ultraviolet radiation. Eye protection can be reused, but must be regularly cleaned after every use. If splashed, it must be decontaminated with an appropriate disinfectant

• Footwear must be worn in the laboratory and must be of a design that minimizes slips and trips and can reduce the likelihood of injury from falling objects and exposure to biological agents.

• Respiratory protection is generally not a part of the core requirements. In this particular context, however, a local risk assessment should be conducted to determine whether the use of respiratory protection is needed, especially when procedures that may create aerosols and droplets will be performed outside the BSC, for example, centrifugation, handling leaking samples and procedures that can cause splashes (for example, loading and unloading of sealed centrifuge cups, grinding, blending, vigorous shaking or mixing, sonic disruption, opening of containers of infectious materials whose internal pressure may be different from the ambient pressure).

7. Laboratory equipment

• When used effectively together with GMPP, the safe use of laboratory equipment will help to minimize the likelihood of exposure of personnel when handling or manipulating biological agents.

• For equipment to effectively reduce risks, laboratory management must make sure sufficient space is provided for its use. An appropriate budget must be available for the equipment's operation and maintenance, including equipment incorporated into the facility design, which should be accompanied by specifications that outline its safety features. All personnel operating or maintaining a piece of equipment must be properly trained and be able to demonstrate proficiency.

8. Emergency/incident response plan

• Even when carrying out low-risk work and following all core requirements for biosafety, incidents can still occur. To reduce the likelihood of exposure to/release of a biological agent, or to reduce the consequences of such incidents, a contingency plan must be developed that provides specific standard operating procedures (SOPs) to be followed in possible emergency scenarios that apply to the work and local environment. Personnel must be trained on these procedures and have periodic refresher training in order to maintain competency.

• First-aid kits, including medical supplies such as bottled eye washes and bandages, must be available and easily accessible to personnel. These must be checked routinely to make sure products are within their use-by dates and are in sufficient supply.

• All incidents must be reported to the appropriate personnel in a timely manner. A written record of accidents and incidents must be maintained, in line with national regulations where applicable. Any incident that occurs must be reported and investigated in a timely manner and used for updating laboratory procedures and emergency response plans.

• Spill kits, including disinfectant, must be easily accessible to personnel. Depending on the size, location, concentration and/or volume of the spill, different protocols may be necessary. Written procedures for cleaning and decontaminating spills must be developed for the laboratory and followed by suitably trained personnel.

9. Occupational health

• The employing authority, through the laboratory director, must take responsibility for ensuring that the health of laboratory personnel is adequately checked and reported.

• Medical examination or health status information of laboratory personnel may be required to ensure that it is safe for them to work in the laboratory.

Annex 2 Risk assessment template

Although a qualitative approach to combining likelihood and severity parameters in a risk matrix is provided as a method for risk evaluation here, it is important to note that quantitative (for example, from simple numerical scoring schemes to complex mathematical models) and hybrid (semi-quantitative) methods can also be used for risk evaluation. Laboratories should use a risk-evaluation/assessment method that best meets their unique needs, without excluding the possibility of developing customized evaluation approaches, scoring methods and definitions of the parameters.

While this template was primarily developed for biosafety risk assessment, it can also be used for general safety risk assessment of laboratory activities, especially when the biosafety and general safety risks are interlinked, for example, sample collection and transport, where appropriate and applicable.

Institution/Facility name	
Laboratory name	
Laboratory manager/Supervisor	
Project titles/Relevant standard operating procedures (SOPs)	
Date	

If using this template, complete all sections following the instructions in the grey boxes. The instructions and bullet points in the grey boxes can be copied into the text boxes beneath the instructions and used as prompts to gather and record the necessary site-specific information. The grey instruction boxes can then be deleted, and the text remaining will form a risk assessment draft. This draft must be carefully reviewed, edited as necessary and approved by the members of the risk assessment team.

STEP 1. Gather information (hazard identification)

Instructions: *Provide a brief overview of the laboratory work and summarize the laboratory activities to be conducted that are included in the scope of this risk assessment.*	
Describe the biological agents and other potential hazards (for example, transmission, infectious dose, treatment/preventive measures, pathogenicity).	
Describe the laboratory procedures to be used (for example, culturing, centrifugation, work with sharps, waste handling, frequency of performing the laboratory activity).	
Describe the types of equipment to be used (personal protective equipment [PPE], centrifuges, autoclaves, biological safety cabinets [BSCs]).	
Describe the type and condition of the facility where work is conducted.	
Describe relevant human factors (for example, competency, training, experience and attitude of personnel).	
Describe any other factors that may affect laboratory operations (for example, legal, cultural, socioeconomic).	

STEP 2. Evaluate the risks

Instructions: *Describe how exposure and/or release could occur.*	
What potential situations are there in which exposure or release could occur?	
What is the likelihood of an exposure/release occurring? • Unlikely: not very possible to occur in the near future • Possible: feasible to occur in the near future • Likely: very possible to occur in the near future	
What is the severity of the consequences of an exposure/release (negligible, moderate, severe)?	

Instructions: *Evaluate the risk and prioritize the implementation of risk control measures. Circle the initial (inherent) risk of the laboratory activities before additional risk control measures have been put in place.*
Note:
- *When assigning priority, other factors may need to be considered, for example, urgency, feasibility/sustainability of risk control measures, delivery and installation time and training availability.*
- *To estimate the overall risk, take into consideration the risk ratings for the individual laboratory activities/procedures, separately or collectively as appropriate for the laboratory.*

		Likelihood of exposure/release		
		Unlikely	Possible	Likely
Consequence of exposure/release	Severe	Medium	High	Very high
	Moderate	Low	Medium	High
	Negligible	Very low	Low	Medium
Laboratory activity/procedure		**Initial risk (very low, low, medium, high, very high)**	**Is the initial risk above the tolerance level? (yes/no)**	**Priority (high/medium/low)**

Select the overall **initial** risk.	☐ Very low	☐ Low	☐ Medium	☐ High	☐ Very high
Should work proceed without additional risk control measures?	☐Yes ☐No				

STEP 3. Develop a risk control strategy

Instructions: *List any requirements that have been prescribed by international and national regulations, legislation, guidelines, policies and strategies on biosafety and biosecurity.*	
Describe the measures required by national legislation or regulations (if any).	
Describe the measures advised by guidelines, policies and strategies (if any).	

Instructions: *Describe the resources available for risk control and consider their applicability, availability and sustainability in the local context, including management support.*

Are resources sufficient to secure and maintain potential risk control measures?	
What factors exist that may limit or restrict any of the risk control measures?	
Will work be able to proceed without any of the risk control measures; are there alternatives?	

STEP 4. Select and implement risk control measures

Instructions: *Describe where and when risk control measures are needed, the level of* ***residual*** *(remaining) risk when these risk control measures are in place, and an assessment of the availability, effectiveness and sustainability of the risk control measures.*				
Laboratory activity/procedure	**Selected risk control measure(s)**	**Residual risk (very low, low, medium, high, very high)**	**Is the residual risk above the tolerance level? (yes/no)**	**Are risk control measures available, effective and sustainable? (yes/no)**

Instructions: *Evaluate the* ***residual*** *risk that remains after risk control measures have been selected, to determine whether that level of risk is now below the tolerance level and whether work should proceed. Circle the* ***residual*** *risk of the laboratory activities after risk control measures are in place.*

		Likelihood of exposure/release		
		Unlikely	Possible	Likely
Consequence of exposure/release	Severe	Medium	High	Very high
	Moderate	Low	Medium	High
	Negligible	Very low	Low	Medium

Overall **residual** risk:	☐ Very low	☐ Low	☐ Medium	☐ High	☐ Very high

If the residual risk is still above the risk tolerance level, further action is necessary, such as additional risk control measures, based on the initial risk evaluated in STEP 2, redefining the scope of work such that it falls below the risk tolerance level with existing risk control measures in place, or identifying an alternative laboratory with appropriate risk control strategies already in place that is capable of conducting the work as planned.

Should work proceed with selected risk control measures?	☐Yes ☐No
Approved by (name and title)	
Approved by (signature)	
Date	

Instructions: *Describe how to communicate risks and risk mitigation strategies to personnel. Provide a mechanism of communication within the laboratory. Describe the process and timeline for ensuring that all identified risk control measures are purchased and have associated SOPs and training has been completed before starting the laboratory work.*	
Communication of the hazards, risks and risk control measures	
Purchase (and budgeting) of risk control measures	
Operational and maintenance procedures	

Training of personnel	

STEP 5. Review risks and risk control measures

Instructions: *Establish a periodic review cycle to identify: changes in laboratory activities, biological agents, personnel, equipment or facilities; changes in knowledge of biological agents or processes; and lessons learnt from audits/inspections, personnel feedback, incidents and/or near misses.*	
Frequency of the review	
Person to conduct the review	
Describe updates/changes	
Personnel/procedures to implement the changes	
Reviewed by (name and title)	
Reviewed by (signature)	
Date	

5. Acknowledgements

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Clinical management of severe acute respiratory infection when novel coronavirus (2019-nCoV) infection is suspected

Interim guidance

28 January 2020

World Health Organization

Introduction

This is the first edition of this document for novel coronavirus, an adaption of WHO Clinical management of severe acute respiratory infection when MERS-CoV infection is suspected publication (2019).

This document is intended for clinicians taking care of hospitalised adult and paediatric patients with severe acute respiratory infection (SARI) when 2019-nCoV infection is suspected. It is not meant to replace clinical judgment or specialist consultation but rather to strengthen clinical management of these patients and provide to up-to-date guidance. Best practices for SARI including IPC and optimized supportive care for severely ill patients are essential.

This document is organized into the following sections:

1. Triage: recognize and sort patients with SARI
2. Immediate implementation of appropriate infection prevention and control (IPC) measures
3. Early supportive therapy and monitoring
4. Collection of specimens for laboratory diagnosis
5. Management of hypoxemic respiratory failure and acute respiratory distress syndrome (ARDS)
6. Management of septic shock
7. Prevention of complications
8. Specific anti-nCoV treatments
9. Special considerations for pregnant patients

These symbols are used to flag interventions:

- Do: the intervention is beneficial (strong recommendation) **OR** the intervention is a best practice statement
- Don't: the intervention is known to be harmful.
- Consider: the intervention may be beneficial in selected patients (conditional recommendation) **OR** be careful when considering this intervention.

This document aims to provide clinicians with updated interim guidance on timely, effective, and safe supportive management of patients with 2019-nCoV and SARI, particularly those with critical illness.

The recommendations in this document are derived from WHO publications.[1-4] Where WHO guidance is not available, we refer to evidence-based guidelines. Members of a WHO global network of clinicians, and clinicians who have treated SARS, MERS or severe influenza patients have reviewed the recommendations (see Acknowledgements). For queries, please email outbreak@who.int with '2019-nCoV clinical question' in the subject line.

1. Triage: early recognition of patients with SARI associated with 2019-nCoV infection

Triage: recognize and sort all patients with SARI at first point of contact with health care system (such as the emergency department). Consider 2019-nCOV as a possible etiology of SARI under certain conditions (see Table 1). Triage patients and start emergency treatments based based on disease severity.

Remarks: 2019-nCoV infection may present with mild, moderate, or severe illness; the latter includes severe pneumonia, ARDS, sepsis and septic shock. Early recognition of suspected patients allows for timely initiation of IPC (see Table 2). Early identification of those with severe manifestations (see Table 2) allows for immediate optimized supportive care treatments and safe, rapid admission (or referral) to intensive care unit according to institutional or national protocols. For those with mild illness, hospitalization may not be required unless there is concern for rapid deterioration. All patients discharged home should be instructed to return to hospital if they develop any worsening of illness.

Table 1. Definitions of patients with SARI, suspected of 2019-nCoV infection*

SARI	An ARI with history of fever or measured temperature ≥38 C° and cough; onset within the last ~10 days; and requiring hospitalization.[5] However, the absence of fever does NOT exclude viral infection.[6]
Surveillance case definitions for 2019-nCoV*	A. Patients with severe acute respiratory infection (fever, cough, and requiring admission to hospital), AND with no other etiology that fully explains the clinical presentation[1] AND at least one of the following: • a history of travel to or residence in the city of Wuhan, Hubei Province, China in the 14 days prior to symptom onset, or • patient is a health care worker who has been working in an environment where severe acute respiratory infections of unknown etiology are being cared for. B. Patients with any acute respiratory illness AND at least one of the following: • close contact[2] with a confirmed or probable case of 2019-nCoV in the 14 days prior to illness onset, or • visiting or working in a live animal market in Wuhan, Hubei Province, China in the 14 days prior to symptom onset, or • worked or attended a health care facility in the 14 days prior to onset of symptoms where patients with hospital-associated 2019-nCov infections have been reported.

*see https://www.who.int/health-topics/coronavirus for latest case definitions

[1] clinicians should also be alert to the possibility of atypical presentations in patients who are immunocompromised;

[2]: Close contact' is defined as:

- Health care associated exposure, including providing direct care for nCoV patients, working with health care workers infected with novel coronavirus, visiting patients or staying in the same close environment as a nCoV patient.
- Working together in close proximity or sharing the same classroom environment with a nCoV patient
- Traveling together with a nCoV patient in any kind of conveyance
- Living in the same household as a nCoV patient

The epidemiological link may have occurred within a 14-day period from onset of illness in the case under consideration.

Table 2. Clinical syndromes associated with 2019-nCoV infection

Uncomplicated illness	Patients with uncomplicated upper respiratory tract viral infection, may have non-specific symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache, muscle pain or malaise. The elderly and immunosuppressed may present with atypical symptoms. These patients do not have any signs of dehydration, sepsis or shortness of breath.
Mild pneumonia	Patient with pneumonia and no signs of severe pneumonia. Child with non-severe pneumonia has cough or difficulty breathing + fast breathing: fast breathing (in breaths/min): <2 months, ≥60; 2–11 months, ≥50; 1–5 years, ≥40 and no signs of severe pneumonia.
Severe pneumonia	Adolescent or adult: fever or suspected respiratory infection, plus one of respiratory rate >30 breaths/min, severe respiratory distress, or SpO_2 <90% on room air (adapted from [1]). Child with cough or difficulty in breathing, plus at least one of the following: central cyanosis or SpO_2 <90%; severe respiratory distress (e.g. grunting, very severe chest indrawing); signs of pneumonia with a general danger sign: inability to breastfeed or drink, lethargy or unconsciousness, or convulsions. Other signs of pneumonia may be present: chest indrawing, fast breathing (in breaths/min): <2 months, ≥60; 2–11 months, ≥50; 1–5 years, ≥40.[2] The diagnosis is clinical; chest imaging can exclude complications.
Acute Respiratory Distress Syndrome[7-9]	**Onset:** new or worsening respiratory symptoms within one week of known clinical insult. **Chest imaging (radiograph, CT scan, or lung ultrasound):** bilateral opacities, not fully explained by effusions, lobar or lung collapse, or nodules. **Origin of oedema:** respiratory failure not fully explained by cardiac failure or fluid overload. Need objective assessment (e.g. echocardiography) to exclude hydrostatic cause of oedema if no risk factor present. **Oxygenation (adults):** • Mild ARDS: 200 mmHg < PaO_2/FiO_2 ≤ 300 mmHg (with PEEP or CPAP ≥5 cmH_2O,[7] or non-ventilated[8]) • Moderate ARDS: 100 mmHg < PaO_2/FiO_2 ≤200 mmHg with PEEP ≥5 cmH_2O,[7] or non-ventilated[8]) • Severe ARDS: PaO_2/FiO_2 ≤ 100 mmHg with PEEP ≥5 cmH_2O,[7] or non-ventilated[8]) • When PaO_2 is not available, SpO_2/FiO_2 ≤315 suggests ARDS (including in non-ventilated patients) **Oxygenation (children; note OI = Oxygenation Index and OSI = Oxygenation Index using SpO_2):** • Bilevel NIV or CPAP ≥5 cmH_2O via full face mask: PaO_2/FiO_2 ≤ 300 mmHg or SpO_2/FiO_2 ≤264 • Mild ARDS (invasively ventilated): 4 ≤ OI < 8 or 5 ≤ OSI < 7.5 • Moderate ARDS (invasively ventilated): 8 ≤ OI < 16 or 7.5 ≤ OSI < 12.3 • Severe ARDS (invasively ventilated): OI ≥ 16 or OSI ≥ 12.3
Sepsis[10,11]	Adults: life-threatening organ dysfunction caused by a dysregulated host response to suspected or proven infection, with organ dysfunction*. Signs of organ dysfunction include: altered mental status, difficult or fast breathing, low oxygen saturation, reduced urine output, fast heart rate, weak pulse, cold extremities or low blood pressure, skin mottling, or laboratory evidence of coagulopathy, thrombocytopenia, acidosis, high lactate or hyperbilirubinemia. Children: suspected or proven infection and ≥2 SIRS criteria, of which one must be abnormal temperature or white blood cell count.
Septic shock[10,12]	Adults: persisting hypotension despite volume resuscitation, requiring vasopressors to maintain MAP ≥65 mmHg and serum lactate level >2 mmol/L. Children (based on [12]): any hypotension (SBP <5th centile or >2 SD below normal for age) or 2-3 of the following: altered mental state; tachycardia or bradycardia (HR <90 bpm or >160 bpm in infants and HR <70 bpm or >150 bpm in children); prolonged capillary refill (>2 sec) or warm vasodilation with bounding pulses; tachypnea; mottled skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.

Abbreviations: ARI, acute respiratory infection; BP, blood pressure; bpm, beats/minute; CPAP, continuous positive airway pressure; FiO_2, fraction of inspired oxygen; MAP, mean arterial pressure; NIV, noninvasive ventilation; OI, Oxygenation Index; OSI, Oxygenation Index using SpO_2; PaO_2, partial pressure of oxygen; PEEP, positive end-expiratory pressure; SBP, systolic blood pressure; SD, standard deviation; SIRS, systemic inflammatory response syndrome; SpO_2, oxygen saturation. *If altitude is higher than 1000m, then correction factor should be calculated as follows: PaO_2/FiO_2 x Barometric pressure/760.

* The SOFA score ranges from 0 to 24 and includes points related to 6 organ systems: respiratory (hypoxemia defined by low PaO_2/FiO_2), coagulation (low platelets), liver (high bilirubin), cardiovascular (hypotension), central nervous system (low level of consciousness defined by Glasgow Coma Scale), and renal (low urine output or high creatinine). Sepsis is defined by an increase in the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score[13] of ≥2 points. Assume the baseline score is zero if data are not available

2. Immediate implementation of appropriate IPC measures

IPC is a critical and integral part of clinical management of patients and should be initiated at the point of entry of the patient to hospital (typically the Emergency Department). Standard precautions should always be routinely applied in all areas of health care facilities. Standard precautions include hand hygiene; use of PPE to avoid direct contact with patients' blood, body fluids, secretions (including respiratory secretions) and non-intact skin. Standard precautions also include prevention of needle-stick or sharps injury; safe waste management; cleaning and disinfection of equipment; and cleaning of the environment.

Table 2. How to implement infection prevention and control measures for patients with suspected or confirmed 2019-nCoV infection [14,15]

At triage	Give suspect patient a medical mask and direct patient to separate area, an isolation room if available. Keep at least 1meter distance between suspected patients and other patients. Instruct all patients to cover nose and mouth during coughing or sneezing with tissue or flexed elbow for others. Perform hand hygiene after contact with respiratory secretions
Apply droplet precautions	Droplet precautions prevent large droplet transmission of respiratory viruses. Use a medical mask if working within 1-2 metre s of the patient. Place patients in single rooms, or group together those with the same etiological diagnosis. If an etiological diagnosis is not possible, group patients with similar clinical diagnosis and based on epidemiological risk factors, with a spatial separation. When providing care in close contact with a patient with respiratory symptoms (e.g. coughing or sneezing), use eye protection (face-mask or goggles), because sprays of secretions may occur. Limit patient movement within the institution and ensure that patients wear medical masks when outside their rooms.
Apply contact precautions	Droplet and contact precautions prevent direct or indirect transmission from contact with contaminated surfaces or equipment (i.e. contact with contaminated oxygen tubing/interfaces). Use PPE (medical mask, eye protection, gloves and gown) when entering room and remove PPE when leaving. If possible, use either disposable or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared among patients, clean and disinfect between each patient use. Ensure that health care workers refrain from touching their eyes, nose, and mouth with potentially contaminated gloved or ungloved hands. Avoid contaminating environmental surfaces that are not directly related to patient care (e.g. door handles and light switches). Ensure adequate room ventilation. Avoid movement of patients or transport. Perform hand hygiene.
Apply airborne precautions when performing an aerosol generating procedure	Ensure that healthcare workers performing aerosol-generating procedures **(i.e. open suctioning of respiratory tract, intubation, bronchoscopy, cardiopulmonary resuscitation)** use PPE, including gloves, long-sleeved gowns, eye protection, and fit-tested particulate respirators (N95 or equivalent, or higher level of protection). (The scheduled fit test should not be confused with user seal check before each use.) Whenever possible, use adequately ventilated single rooms when performing aerosol-generating procedures, meaning negative pressure rooms with minimum of 12 air changes per hour or at least 160 litres/second/patient in facilities with natural ventilation. Avoid the presence of unnecessary individuals in the room. Care for the patient in the same type of room after mechanical ventilation commences.

Abbreviations: ARI, acute respiratory infection; PPE, personal protective equipment

3. Early supportive therapy and monitoring

Give supplemental oxygen therapy immediately to patients with SARI and respiratory distress, hypoxaemia, or shock.

Remarks: Initiate oxygen therapy at 5 L/min and titrate flow rates to reach target SpO_2 ≥90% in non-pregnant adults and SpO_2 ≥92-95 % in pregnant patients.[1,2] Children with emergency signs (obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma or convulsions) should receive oxygen therapy during resuscitation to target SpO_2 ≥94%; otherwise, the target SpO_2 is ≥90%.[4] All areas where patients with SARI are cared for should be equipped with pulse oximeters, functioning oxygen systems and disposable, single-use, oxygen-delivering interfaces (nasal cannula, simple face mask, and mask with reservoir bag). Use contact precautions when handling contaminated oxygen interfaces of patients with nCoV infection.

Use conservative fluid management in patients with SARI when there is no evidence of shock.

Remarks: Patients with SARI should be treated cautiously with intravenous fluids, because aggressive fluid resuscitation may worsen oxygenation, especially in settings where there is limited availability of mechanical ventilation.[16]

Give empiric antimicrobials to treat all likely pathogens causing SARI. Give antimicrobials within one hour of initial patient assessment for patients with sepsis.

Remarks: Although the patient may be suspected to have nCoV, administer appropriate empiric antimicrobials within **ONE hour** of identification of sepsis.[17] Empiric antibiotic treatment should be based on the clinical diagnosis (community-acquired pneumonia, health care-associated pneumonia [if infection was acquired in healthcare setting], or sepsis), local epidemiology and susceptibility data, and treatment guidelines. Empiric therapy includes a neuraminidase inhibitor for treatment of influenza when there is local circulation or other risk factors, including travel history or exposure to animal influenza viruses.[18] Empiric therapy should be de-escalated on the basis of microbiology results and clinical judgment.

Do not routinely give systemic corticosteroids for treatment of viral pneumonia or ARDS outside of clinical trials unless they are indicated for another reason.

Remarks: A systematic review of observational studies of corticosteroids administered to patients with SARS reported no survival benefit and possible harms (avascular necrosis, psychosis, diabetes, and delayed viral clearance).[19] A systematic review of observational studies in influenza found a higher risk of mortality and secondary infections with corticosteroids; the evidence was judged as very low to low quality due to confounding by indication.[20] A subsequent study that addressed this limitation by adjusting for time-varying confounders found no effect on mortality.[21] Finally, a recent study of patients receiving corticosteroids for MERS used a similar statistical approach and found no effect of corticosteroids on mortality but delayed lower respiratory

tract (LRT) clearance of MERS-CoV.[22] Given lack of effectiveness and possible harm, routine corticosteroids should be avoided unless they are indicated for another reason. See section 6 for the use of corticosteroids in sepsis.

Closely monitor patients with SARI for signs of clinical deterioration, such as rapidly progressive respiratory failure and sepsis, and apply supportive care interventions immediately.

Remarks: Application of timely, effective, and safe supportive therapies is the cornerstone of therapy for patients that develop severe manifestations of 2019-nCoV.

Understand the patient's co-morbid condition(s) to tailor the management of critical illness and appreciate the prognosis. Communicate early with patient and family.

Remarks: During intensive care management of SARI, determine which chronic therapies should be continued and which therapies should be stopped temporarily. Communicate proactively with patients and families and provide support and prognostic information. Understand the patient's values and preferences regarding life-sustaining interventions.

4. Collection of specimens for laboratory diagnosis

WHO guidance on specimen collection, processing, and laboratory testing, including related biosafety procedures, is available.[23]

Collect blood cultures for bacteria that cause pneumonia and sepsis, ideally before antimicrobial therapy. DO NOT delay antimicrobial therapy to collect blood cultures.

Collect specimens from BOTH the upper respiratory tract (URT; nasopharyngeal and oropharyngeal) AND lower respiratory tract (LRT; expectorated sputum, endotracheal aspirate, or bronchoalveolar lavage) for 2019-nCoV testing by RT-PCR. Clinicians may elect to collect only LRT samples when these are readily available (for example, in mechanically ventilated patients).

Serology for diagnostic purposes is recommended only when RT-PCR is not available.[23]

Remarks: Use appropriate PPE for specimen collection (droplet and contact precautions for URT specimens; airborne precautions for LRT specimens). When collecting URT samples, use viral swabs (sterile Dacron or rayon, not cotton) and viral transport media. Do not sample the nostrils or tonsils. In a patient with suspected novel coronavirus, especially with pneumonia or severe illness, a single URT sample does not exclude the diagnosis, and additional URT and LRT samples are recommended.[23] LRT (vs. URT) samples are more likely to be positive and for a longer period.[23] Clinicians may elect to collect only LRT samples when these are readily available (for example, in mechanically ventilated patients). Sputum induction should be avoided due to increased risk of increasing aerosol transmission.

Remarks: Dual infections with other respiratory viral infections have been found in SARS and MERS cases. At this stage we need detailed microbiologic studies in all suspected cases. Both URT and LRT specimens can tested for other respiratory viruses, such as influenza A and B (including zoonotic influenza A), respiratory syncytial virus, parainfluenza viruses, rhinoviruses, adenoviruses, enteroviruses (e.g. EVD68), human metapneumovirus, and endemic human coronaviruses (i.e. HKU1, OC43, NL63, and 229E). LRT specimens can also be tested for bacterial pathogens, including *Legionella pneumophila*.

In hospitalized patients with confirmed 2019-nCoV infection, repeat URT and LRT samples should be collected to demonstrate viral clearance. The frequency of specimen collection will depend on local circumstances but should be at least every 2 to 4 days until there are two consecutive negative results (both URT and LRT samples if both are collected) in a clinically recovered patient at least 24 hours apart. If local infection control practice requires two negative results before removal of droplet precautions, specimens may be collected as often as daily.

5. Management of hypoxemic respiratory failure and ARDS

Recognize severe hypoxemic respiratory failure when a patient with respiratory distress is failing standard oxygen therapy.

Remarks: Patients may continue to have increased work of breathing or hypoxemia even when oxygen is delivered via a face mask with reservoir bag (flow rates of 10-15 L/min, which is typically the minimum flow required to maintain bag inflation; FiO_2 0.60-0.95). Hypoxemic respiratory failure in ARDS commonly results from intrapulmonary ventilation-perfusion mismatch or shunt and usually requires mechanical ventilation.

High-flow nasal oxygen (HFNO) or non-invasive ventilation (NIV) should only be used in selected patients with hypoxemic respiratory failure. The risk of treatment failure is high in patients with MERS treated with NIV, and patients treated with either HFNO or NIV should be closely monitored for clinical deterioration.

Remark 1: HFNO systems can deliver 60 L/min of gas flow and FiO_2 up to 1.0; paediatric circuits generally only handle up to 15 L/min, and many children will require an adult circuit to deliver adequate flow. Compared to standard oxygen therapy, HFNO reduces the need for intubation.[24] Patients with hypercapnia (exacerbation of obstructive lung disease, cardiogenic pulmonary oedema), hemodynamic instability, multi-organ failure, or abnormal mental status should generally not receive HFNO, although emerging data suggest that HFNO may be safe in patients with mild-moderate and non-worsening hypercapnia.[25] Patients receiving HFNO should be in a monitored setting and cared for by experienced personnel capable of endotracheal intubation in case the patient acutely deteriorates or does not improve after a short trial (about 1 hr). Evidence-based guidelines on HFNO do not exist, and reports on HFNO in MERS patients are limited.[26]

Remark 2: NIV guidelines make no recommendation on use in hypoxemic respiratory failure (apart from cardiogenic pulmonary oedema and post-operative respiratory failure) or pandemic viral illness (referring to studies of SARS and pandemic influenza).[27] Risks include delayed intubation, large tidal volumes, and injurious transpulmonary pressures. Limited data suggest a high failure rate when MERS patients receive NIV.[28] Patients receiving a trial of NIV should be in a monitored setting and cared for by experienced personnel capable of endotracheal intubation in case the patient acutely deteriorates or does not improve after a short trial (about 1 hr). Patients with hemodynamic instability, multiorgan failure, or abnormal mental status should not receive NIV.

Remark 3: Recent publications suggest that newer HFNO and NIV systems with good interface fitting do not create widespread dispersion of exhaled air and therefore should be associated with low risk of airborne transmission.[29-31]

Endotracheal intubation should be performed by a trained and experienced provider using airborne precautions.

Remarks: Patients with ARDS, especially young children or those who are obese or pregnant, may desaturate quickly during intubation. Pre-oxygenate with 100% FiO_2 for 5 minutes, via a face mask with reservoir bag, bag-valve mask, HFNO, or NIV. Rapid sequence intubation is appropriate after an airway assessment that identifies no signs of difficult intubation[32].

The following recommendations in this section pertain to mechanically ventilated patients with ARDS.[17,33] *These focus on adults; consensus-based recommendations for children are available*.[34]

Implement mechanical ventilation using lower tidal volumes (4–8 ml/kg predicted body weight, PBW) and lower inspiratory pressures (plateau pressure <30 cmH_2O).

Remarks: This is a strong recommendation from a clinical guideline for patients with ARDS,[33] and is suggested for patients with sepsis-induced respiratory failure who do not meet ARDS criteria.[17] The initial tidal volume is 6 ml/kg PBW; tidal volume up to 8 ml/kg PBW is allowed if undesirable side effects occur (e.g. dyssynchrony, pH <7.15). Hypercapnia is permitted if meeting the pH goal of 7.30-7.45. Ventilator protocols are available.[35] The use of deep sedation may be required to control respiratory drive and achieve tidal volume targets. Although high driving pressure (plateau pressure−PEEP) may more accurately predict increased mortality in ARDS compared to high tidal volume or plateau pressure,[36] RCTs of ventilation strategies that target driving pressure are not currently available.

In patients with severe ARDS, prone ventilation for >12 hours per day is recommended.

Remarks: Application of prone ventilation is strongly recommended for adult and paediatric patients with severe ARDS[33] but requires sufficient human resources and expertise to be performed safely.[37,38]

Use a conservative fluid management strategy for ARDS patients without tissue hypoperfusion.

Remarks: This is a strong guideline recommendation;[17] the main effect is to shorten the duration of ventilation. See reference [39] for details of a sample protocol.

In patients with moderate or severe ARDS, higher PEEP instead of lower PEEP is suggested.

Remarks: PEEP titration requires consideration of benefits (reducing atelectrauma and improving alveolar recruitment) vs. risks (end-inspiratory overdistension leading to lung injury and higher pulmonary vascular resistance). Tables are available to guide PEEP titration based on the FiO_2 required to maintain SpO_2.[35] A related intervention of recruitment manoeuvres (RMs) is delivered as episodic periods of high continuous positive airway pressure [30–40 cm H_2O], progressive incremental increases in PEEP with constant driving pressure, or high driving pressure; considerations of benefits vs. risks are similar. Higher PEEP and RMs were both conditionally recommended in a clinical practice guideline.[33] For PEEP, the guideline considered an individual patient data meta-analysis[40] of 3 RCTs. However, a subsequent RCT of high PEEP and prolonged high-pressure RMs showed harm, suggesting that the protocol in this RCT should be avoided.[41] Monitoring of patients to identify those who respond to the initial application of higher PEEP or a different RM protocol, and stopping these interventions in non-responders, is suggested.[42]

In patients with moderate-severe ARDS (PaO_2/FiO_2 <150), neuromuscular blockade by continuous infusion should not be routinely used.

Remarks: One trial found that this strategy improved survival in patients with severe ARDS (PaO_2/FiO_2 <150) without causing significant weakness,[43] but results of a recent larger trial found that use of neuromuscular blockage with high PEEP strategy was not associated with survival when compared to a light sedation strategy without neuromuscular blockade[44]. Continuous neuromuscular blockade may still be considered in patients with ARDS in certain situations: ventilator dyssnchony despite sedation, such that tidal volume limitation cannot be reliably achieved; or refractory hypoxemia or hypercapnia.

In settings with access to expertise in extracorporeal life support (ECLS), consider referral of patients with refractory hypoxemia despite lung protective ventilation.

Remarks: A recent guideline made no recommendation about ECLS in patients with ARDS.[33] Since then, an RCT of ECLS for patients with ARDS was stopped early and found no statistically significant difference in the primary outcome of 60-day mortality between ECLS and standard medical management (including prone positioning and neuromuscular blockade).[45] However, ECLS was associated with a reduced risk of the composite outcome of mortality and crossover to ECLS,[45] and a *post hoc* Bayesian analysis of this RCT showed that ECLS is very likely to reduce mortality across a range of prior assumptions.[46] In patients with MERS-CoV infection, ECLS vs. conventional treatment was associated with reduced mortality in a cohort study.[47] ECLS should

only be offered in expert centres with a sufficient case volume to maintain expertise and that can apply the IPC measures required for 2019-nCoV patients.[48]

Avoid disconnecting the patient from the ventilator, which results in loss of PEEP and atelectasis. Use in-line catheters for airway suctioning and clamp endotracheal tube when disconnection is required (for example, transfer to a transport ventilator).

6. Management of septic shock

Recognize septic shock in adults when infection is suspected or confirmed AND vasopressors are needed to maintain mean arterial pressure (MAP) ≥65 mmHg AND lactate is ≥2 mmol/L, in absence of hypovolemia.
Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] <5th centile or >2 SD below normal for age) or 2-3 of the following: altered mental state; tachycardia or bradycardia (HR <90 bpm or >160 bpm in infants and HR <70 bpm or >150 bpm in children); prolonged capillary refill (>2 sec) or warm vasodilation with bounding pulses; tachypnea; mottled skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.

Remarks: In the absence of a lactate measurement, use MAP and clinical signs of perfusion to define shock. Standard care includes early recognition and the following treatments within 1 hour of recognition: antimicrobial therapy and fluid loading and vasopressors for hypotension.[49] The use of central venous and arterial catheters should be based on resource availability and individual patient needs. Detailed guidelines are available for the management of septic shock in adults[17] and children.[2,3,12]

In resuscitation from septic shock in adults, give at least 30 ml/kg of isotonic crystalloid in adults in the first 3 hours. In resuscitation from septic shock in children in well-resourced settings, give 20 ml/kg as a rapid bolus and up to 40-60 ml/kg in the first 1 hr.

Do not use hypotonic crystalloids, starches, or gelatins for resuscitation.

Fluid resuscitation may lead to volume overload, including respiratory failure. If there is no response to fluid loading and signs of volume overload appear (for example, jugular venous distension, crackles on lung auscultation, pulmonary oedema on imaging, or hepatomegaly in children), then reduce or discontinue fluid administration. This step is particularly important where mechanical ventilation is not available. Alternate fluid regimens are suggested when caring for children in resource-limited settings[50]

Remarks: Crystalloids include normal saline and Ringer's lactate. Determine need for additional fluid boluses (250-1000 ml in adults or 10-20 ml/kg in children) based on clinical response and improvement of perfusion targets. Perfusion targets include MAP (>65 mmHg or age-appropriate targets in children), urine output (>0.5 ml/kg/hr in adults, 1 ml/kg/hr in children), and improvement of skin mottling, capillary refill, level of consciousness, and lactate. Consider dynamic indices of volume responsiveness to guide volume administration beyond initial resuscitation based on local resources and experience.[17] These indices include passive leg raises, fluid challenges with serial stroke volume measurements, or variations in systolic pressure, pulse pressure, inferior vena cava size, or stroke volume in response to changes in intrathoracic pressure during mechanical ventilation.

Starches are associated with an increased risk of death and acute kidney injury vs. crystalloids. The effects of gelatins are less clear, but they are more expensive than cyrstalloids.[51,52] Hypotonic (vs. isotonic) solutions are less effective at increasing intravascular volume. Surviving Sepsis also suggests albumin for resuscitation when patients require substantial amounts of crystalloids, but this conditional recommendation is based on low-quality evidence.[17]

Administer vasopressors when shock persists during or after fluid resuscitation. The initial blood pressure target is MAP ≥65 mmHg in adults and age-appropriate targets in children.

If central venous catheters are not available, vasopressors can be given through a peripheral IV, but use a large vein and closely monitor for signs of extravasation and local tissue necrosis. If extravasation occurs, stop infusion. Vasopressors can also be administered through intraosseous needles.

If signs of poor perfusion and cardiac dysfunction persist despite achieving MAP target with fluids and vasopressors, consider an inotrope such as dobutamine.

Remarks: Vasopressors (i.e. norepinephrine, epinephrine, vasopressin, and dopamine) are most safely given through a central venous catheter at a strictly controlled rate, but it is also possible to safely administer them via peripheral vein[53] and intraosseous needle. Monitor blood pressure frequently and titrate the vasopressor to the minimum dose necessary to maintain perfusion and prevent side effects. Norepinephrine is considered first-line in adult patients; epinephrine or vasopressin can be added to achieve the MAP target. Because of the risk of tachyarrhythmia, reserve dopamine for selected patients with low risk of tachyarrhythmia or those with bradycardia. In children with cold shock (more common), epinephrine is considered first-line, while norepinephrine is used in patients with warm shock (less common).

No RCTs have compared dobutamine to placebo for clinical outcomes.[17]

7. Prevention of complications

Implement the following interventions (Table 3) to prevent complications associated with critical illness. These interventions are based on Surviving Sepsis[17] or other guidelines,[54-57] and are generally limited to feasible recommendations based on high quality evidence.

Table 3. Prevention of complications

Anticipated Outcome	Interventions
Reduce days of invasive mechanical ventilation	• Use weaning protocols that include daily assessment for readiness to breathe spontaneously • Minimize continuous or intermittent sedation, targeting specific titration endpoints (light sedation unless contraindicated) or with daily interruption of continuous sedative infusions
Reduce incidence of ventilator-associated pneumonia	• Oral intubation is preferable to nasal intubation in adolescents and adults • Keep patient in semi-recumbent position (head of bed elevation 30-45º) • Use a closed suctioning system; periodically drain and discard condensate in tubing • Use a new ventilator circuit for each patient; once patient is ventilated, change circuit if it is soiled or damaged but not routinely • Change heat moisture exchanger when it malfunctions, when soiled, or every 5–7 days
Reduce incidence of venous thromboembolism	• Use pharmacological prophylaxis (low molecular-weight heparin [preferred if available] or heparin 5000 units subcutaneously twice daily) in adolescents and adults without contraindications. For those with contraindications, use mechanical prophylaxis (intermittent pneumatic compression devices).
Reduce incidence of catheter-related bloodstream infection	• Use a checklist with completion verified by a real-time observer as reminder of each step needed for sterile insertion and as a daily reminder to remove catheter if no longer needed
Reduce incidence of pressure ulcers	• Turn patient every two hours
Reduce incidence of stress ulcers and gastrointestinal bleeding	• Give early enteral nutrition (within 24–48 hours of admission) • Administer histamine-2 receptor blockers or proton-pump inhibitors in patients with risk factors for GI bleeding. Risk factors for gastrointestinal bleeding include mechanical ventilation for ≥48 hours, coagulopathy, renal replacement therapy, liver disease, multiple comorbidities, and higher organ failure score
Reduce incidence of ICU-related weakness	• Actively mobilize the patient early in the course of illness when safe to do so

8. Specific anti-Novel-CoV treatments and clinical research

There is no current evidence from RCTs to recommend any specific anti-nCoV treatment for patients with suspected or confirmed 2019-nCoV infection.

Unlicensed treatments should be administered only in the context of ethically-approved clinical trials or the Monitored Emergency Use of Unregistered Interventions Framework (MEURI), with strict monitoring.
https://www.who.int/ethics/publications/infectious-disease-outbreaks/en/

Clinical characterization protocols are available, at the WHO 2019 nCoV website:
https://www.who.int/emergencies/diseases/novel-coronavirus-2019. WHO has established Global 2019-nCoV Clinical Data Platform, for member countries to contribute. Contact EDCARN@who.int for additional questions.

9. Special considerations for pregnant patients

Pregnant women with suspected or confirmed 2019-nCoV infection should be treated with supportive therapies as described above, taking into account the physiologic adaptations of pregnancy.

The use of investigational therapeutic agents outside of a research study should be guided by individual risk-benefit analysis based on potential benefit for mother and safety to fetus, with consultation from an obstetric specialist and ethics committee.

Emergency delivery and pregnancy termination decisions are challenging and based on many factors: gestational age, maternal condition, and fetal stability. Consultations with obstetric, neonatal, and intensive care specialists (depending on the condition of the mother) are essential.

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