

Rational use of PPE and Infection Prevention and Control of COVID-19

Minimum recommendations in Sri Lanka

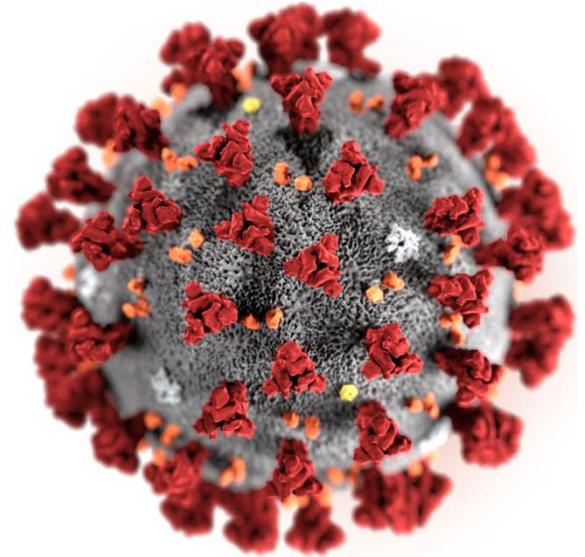
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Introduction

- Coronaviruses (CoV) are a large family of viruses that cause a wide range of illness from the common cold to more severe diseases
i.e., Middle East Respiratory Syndrome [MERS] and Severe Acute Respiratory Syndrome [SARS]
- A novel coronavirus (nCoV) is a new strain that has not been previously identified in humans.
- COVID-19 or Sars-CoV-2 was identified in Wuhan, China in 2019.



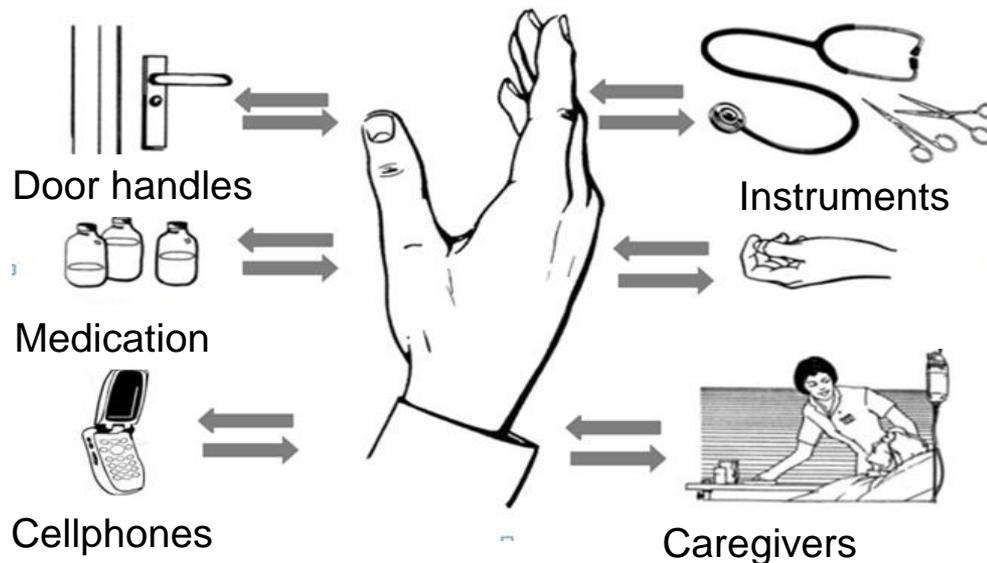
Modes of Transmission of COVID-19

- **Droplets** sprayed by affected individuals through coughing or sneezing
- **Contact** with person's respiratory secretions, or contaminated surfaces and equipment
- There is no current evidence of airborne transmission – unless medically induced aerosol generating procedures (intubation, resuscitation etc.). Thus, we recommend airborne precautions for these procedures.



Hand Hygiene

- **Hand hygiene is the single most effective action** you could do to reduce the spread of pathogens and prevent infections, including the COVID-19 virus.
- Our hands are our main tool for work as health care workers - and they are the key link in the chain of transmission



Hand Hygiene – How to?

- Regularly and thoroughly wash them with soap and water or clean them with alcohol-based hand rub according to the WHO 6 steps: rub the palms, back of palms, interlace fingers, interlock and cup fingers, thumbs and fingertips.
- This proper hand hygiene technique allows all the surfaces of hands being covered and will eliminate the germs in your hands.

1 Perform hand hygiene

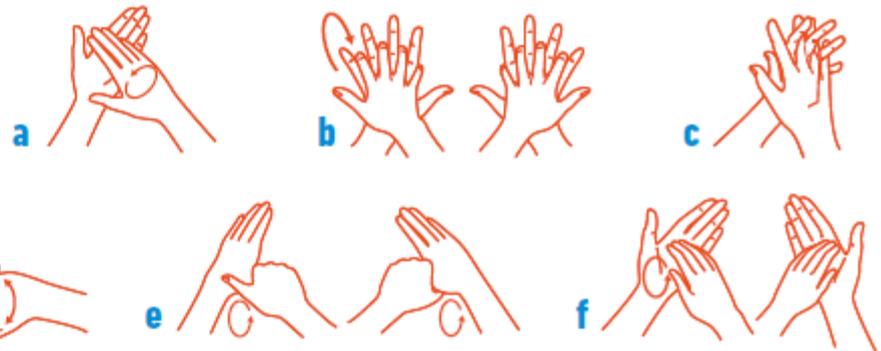
Water and soap

Wash hands for 40–60 seconds.

or

Alcohol based handrub

Rub hands for 20–30 seconds.



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PPE – How to?

1 Perform hand hygiene

- 1** **Alcohol based handrub** **or** **Water and soap**
Rub hands for 20–30 seconds. Wash hands for 40–60 seconds.



2 Put on the gown



3 Eye protection

Put on goggles or face shield.



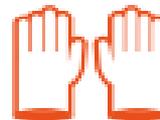
4 Put on the mask

- 4** **Surgical Mask** **or** **Respirator mask** (N95, FFP2, FFP3, or equivalent).



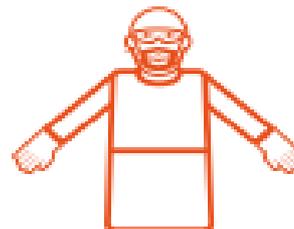
5 Put on gloves

Ensure gloves are placed over the cuff of the gown



Full PPE

Gloves, gown, mask (medical or N95), goggles.

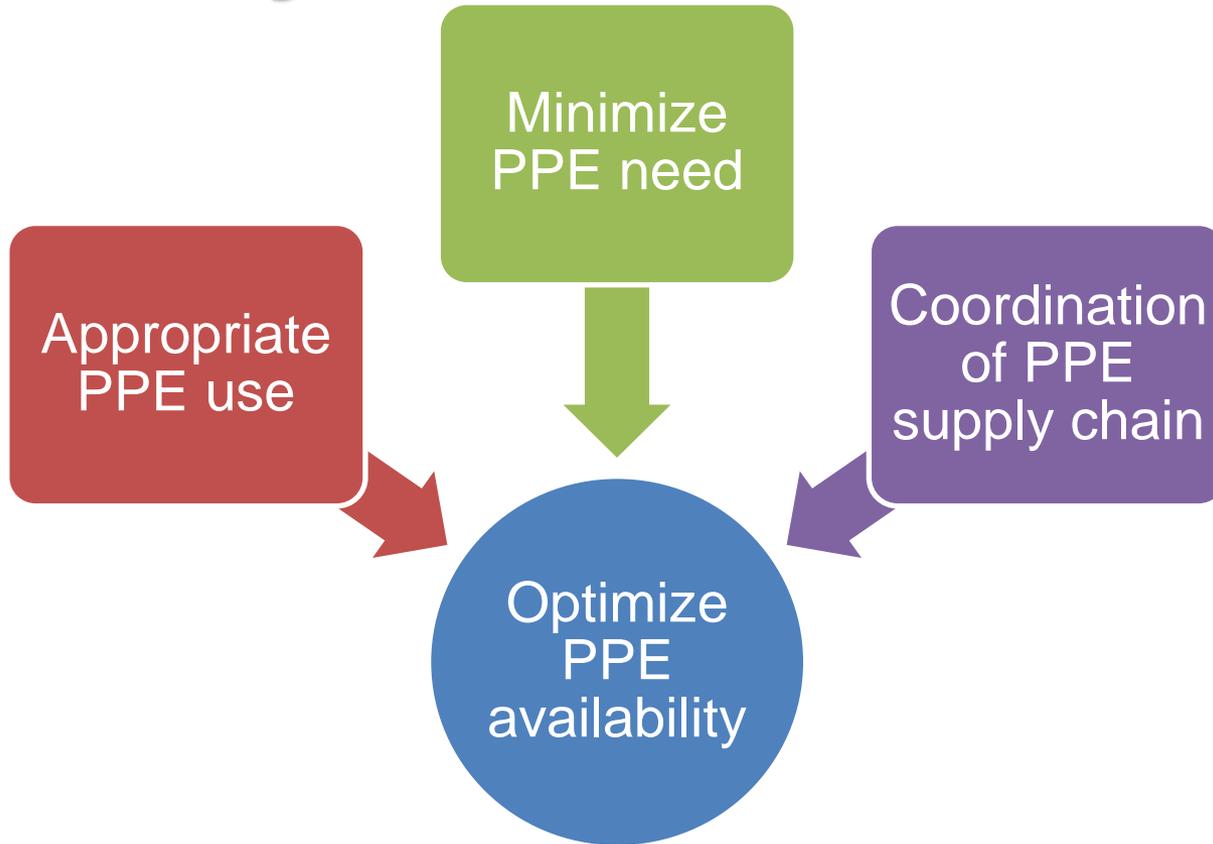


Rational Use of PPE

- **PPEs are in critical shortage globally**
- **Use PPEs only when they are indicated**
- **For the community, WHO recommend ONLY contact and droplet precautions**
- **This presentation is based on the minimum recommendations of PPE for health care workers in Sri Lanka at various settings/activities performed**



Strategies to Optimize PPE Availability



Minimizing the Need for PPE

- Implement **physical barriers** (glass/plastic windows), to reduce exposure to COVID-19 virus, where patients first present: triage areas, registration desk, pharmacy window
- **Limit** number of healthcare **workers/others entering** COVID-19 patients' **rooms**.
- **Plan ahead** what activities will be performed at bedside to avoid multiple entries and exits. Consider **bundle** activities (e.g. check vital signs when administering medication; have health workers deliver food when performing other care).
- Do not allow **visitors** where COVID-19 patients are isolated, or restrict their number and time allowed, and provide clear instructions on how to put on and remove PPE to avoid self-contamination.



Examples of PPE for Use in Health Care Settings for COVID-19

Gown



Body

Gloves



Hands

Face Mask



**Nose +
mouth**

N95 Mask



Nose + mouth

Face shield



Eyes + nose + mouth

Goggle



Eyes



Appropriate PPE Use: Risk Assessment and Standard Precautions

Risk assessment: assessing the risk of exposure and extent of contact anticipated with respiratory droplets, blood, body fluids and/or open skin

- Select which PPE items to wear based on this assessment
- Perform hand hygiene according to the WHO “5 Moments”
- Should be done for each patient, each time!

Make this a routine!



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General guidelines on use of PPE

- In addition to using the appropriate PPE, frequent hand hygiene and respiratory hygiene should always be performed.

Healthcare workers should discard PPE in an appropriate waste container (closed bin with a yellow bag) after use and perform hand hygiene before donning (putting on) and after doffing (taking off) of PPE.

- PPE should be removed immediately after the procedure is completed. Extended use beyond the clinical area will contaminate other settings.
- Having the mask beyond the recommended activity will lead to higher chances of mishandling, which in turn will lead to contamination of hands and face.



Minimum PPE Recommendations for Various Settings (01)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Triage	Health care workers	Preliminary screening not involving direct contact	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • Surgical mask
	Patients with respiratory symptoms	Any	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • Provide a surgical mask
	Patients without respiratory symptoms	Any	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • Encourage use of a mask



Minimum PPE Recommendations for Various Settings (02)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Emergency Treatment Unit	Health care workers	Providing care for patients with respiratory symptoms- within one-meter distance	<ul style="list-style-type: none"> • Surgical mask • Gown • Gloves • Apron • Eye Protection (goggles or face shield)
		Emergency procedures such as intubation where there is a possibility of aerosol generation	<ul style="list-style-type: none"> • NIOSH approved N-95 or FFP2 standard or equal mask • Impermeable gown • Gloves • Eye protection (goggles or face shield) • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots



Minimum PPE Recommendations for Various Settings (03)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Emergency Treatment Unit	Cleaners	Cleaning after an aerosol generating procedure	<ul style="list-style-type: none"> • Surgical masks • Impermeable gown • Heavy duty gloves • Eye protection (if risk of splash from organic material or chemicals) • Boots or closed work shoes and shoe covers • Surgical cap or surgical hood (Masks and eye protection can be shared between rooms of confirmed cases or between rooms of suspected cases)



Minimum PPE Recommendations for Various Settings (04)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Waiting room	Patients with respiratory symptoms	Any	<ul style="list-style-type: none"> • Provide a surgical mask • 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 meter from other patients
	Patients without respiratory symptoms	Any	<ul style="list-style-type: none"> • Encourage use of a mask • Maintain spatial distance of at least 1 meter
Patient transit (e.g. to the ward or in-between departments/wards)	Health care workers	Any	<ul style="list-style-type: none"> • Surgical mask • Gloves



Minimum PPE Recommendations for Various Settings (05)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Entrance/corridors/ all areas	Security personnel	When performing security related checking etc.	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • Surgical mask when 1 meter distance cannot be maintained • Gloves if body checks are needed (avoid as much as possible)



Minimum PPE Recommendations for Various Settings (06)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Patient room/ward (COVID-19 patients)	Health care workers	Providing direct care to COVID-19 patients	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Gloves • Eye protection (goggles or face shield) • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots
		Aerosol generating procedures performed on COVID -19 patients	<ul style="list-style-type: none"> • NIOSH approved N95 mask or FFP2 standard, or equivalent • Impermeable gown • Gloves • Eye Protection (goggles or face shield) • Apron • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots
		Transporting specimens to laboratories	<ul style="list-style-type: none"> • Surgical mask • Gloves



Minimum PPE Recommendations for Various Settings (07)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Patient room/ward (COVID-19 patients)	Cleaners	Entering the room of COVID-19 patients	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Heavy duty gloves • Eye protection • Boots or closed work shoes and shoe covers • Surgical cap or surgical Hood <p>(Masks and eye protection can be shared between rooms of confirmed cases or between rooms of suspected cases)</p>
	Visitors (limit visitors)	Entering the room of COVID-19 patients	<ul style="list-style-type: none"> • Surgical mask • Gown • Gloves



Minimum PPE Recommendations for Various Settings (08)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Patient room/ward <ul style="list-style-type: none"> Patients with fever and/ or respiratory symptoms (not confirmed as COVID-19 patients) in an emergency when history is not available 	Healthcare workers	Providing care beyond one-meter distance	<ul style="list-style-type: none"> Maintain spatial distance of at least 1 meter Surgical mask
		Providing care within one-meter distance	<ul style="list-style-type: none"> Surgical mask Gown Gloves Apron Eye Protection (goggles or face shield) (if risk of splash from organic material or chemicals)
		Providing care where aerosol generating procedures performed	<ul style="list-style-type: none"> NIOSH approved N95 mask or FFP2 standard, or equivalent. Impermeable gown Gloves Eye Protection (goggles or face shield) Surgical hood or cap Covered shoes and fluid resistant shoe cover or boots

Minimum PPE Recommendations for Various Settings (09)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Patient room/ward • Patients without fever and/ or respiratory symptoms	Healthcare workers	Providing care beyond one-meter distance	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • Surgical mask
		Providing care within one-meter distance	<ul style="list-style-type: none"> • Surgical mask
		Providing care where aerosol generating procedures performed	<ul style="list-style-type: none"> • Surgical mask • Gown • Gloves • Apron • Eye Protection (goggles or face shield) (if risk of splash from organic material or chemicals)



Minimum PPE Recommendations for Various Settings (10)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Inpatient facilities			
Laboratory	Lab technician	Manipulation of respiratory samples (while working inside the safety cabinet)	<ul style="list-style-type: none"> • Surgical mask • Gown • Gloves • Eye protection (if risk of splash)
		Handling specimens other than respiratory samples	<ul style="list-style-type: none"> • Follow guidelines as before • No special precautions needed for COVID 19
Administrative areas	All staff, including health care workers	Administrative tasks that do not involve contact with patients	<ul style="list-style-type: none"> • Maintain spatial distance of 1 meter
Other areas (Eg: corridors and tea rooms)	All staff including health care workers	Any activity that does not involve contact with patients with respiratory symptoms	<ul style="list-style-type: none"> • Maintain spatial distance of 1 meter

Minimum PPE Recommendations for Various Settings (11)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Operating theatre			
Operating theatre- Patients confirmed COVID-19 / suspected of COVID-19 /in emergency surgeries where COVID-19 cannot be excluded	Anaesthetist	Intubation / providing general anaesthesia/If the surgery has aerosol generating procedure	<ul style="list-style-type: none"> • NIOSH approved N95 mask or FFP2 standard, or equivalent. • Impermeable gown / Gown and Apron • Gloves • Eye protection (goggles or face shield) • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots
		During spinal or local anesthesia /If the surgery has no aerosol generating procedure	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown / Gown and Apron • Gloves • Surgical hood or cap • Eye protection (goggles or face shield) • Covered shoes and fluid resistant shoe cover or boots

Minimum PPE Recommendations for Various Settings (12)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Operating theatre			
Operating theatre- Patients confirmed COVID-19 / suspected of COVID-19 /in emergency surgeries where COVID 19 cannot be excluded	Scrub team	If a surgery has no aerosol generating procedure involved irrespective of the surgical specialty	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown/ Gown and Apron • Gloves • Surgical hood or cap • Eye protection (goggles or face shield) • Covered shoes and fluid resistant shoe cover or boots
		If the surgery has aerosol generating procedure	<ul style="list-style-type: none"> • NIOSH approved N95 mask or FFP2 standard, or equivalent. • Impermeable gown/Gown and Apron • Gloves • Eye protection (goggles or face shield) • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots



Minimum PPE Recommendations for Various Settings (13)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Operating theatre			
Operating theatre- Patients without fever and/ or respiratory symptoms	Anaesthetist	Intubation / providing general anaesthesia/ During spinal or local anesthesia	<ul style="list-style-type: none"> Routine theatre attire
	Scrub team	Any	<ul style="list-style-type: none"> Routine theatre attire



Minimum PPE Recommendations for Various Settings (14)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Outpatient facilities			
Consultation rooms	Health care worker	Physical examination of patients with respiratory symptoms	<ul style="list-style-type: none"> • Surgical mask • Gown • Gloves • Eye protection
		Physical examination of patients without respiratory symptoms	<ul style="list-style-type: none"> • Surgical mask
	Patients with respiratory symptoms	Any	<ul style="list-style-type: none"> • Provide a surgical mask
	Patients without respiratory symptoms	any	<ul style="list-style-type: none"> • Encourage use of a mask
	Cleaners	After and between consultations with patients with respiratory symptoms	<ul style="list-style-type: none"> • Surgical mask • Fluid resistant gown • Heavy duty gloves • Eye protection (if risk of splash from organic material or chemicals) • Boots or closed work shoes

Minimum PPE Recommendations for Various Settings (15)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Health care facilities			
Outpatient facilities			
Administrative areas	All staff, including health care workers	Administrative tasks	<ul style="list-style-type: none"> Maintain spatial distance of at least 1 meter



Minimum PPE Recommendations for Various Settings (16)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Points of entry / transfers between health care facilities			
Ambulance or transit vehicle	Health care workers	Transporting suspected COVID-19 patients to the referral health care facility in the same compartment of the ambulance	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Gloves • Eye protection
	Driver	Involved only in driving the patient with suspected COVID-19 disease	<ul style="list-style-type: none"> • Maintain spatial distance of 1 meter • Surgical mask
		Assisting with loading or unloading patient with suspected COVID-19	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Gloves • Eye protection



Minimum PPE Recommendations for Various Settings (17)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Points of entry / transfers between health care facilities			
Ambulance or transit vehicle	Patient with suspected COVID-19 and any accompanying person e.g. mother of a paediatric patient	Transport to the referral health care facility	<ul style="list-style-type: none"> • Surgical mask
	Cleaners	Cleaning after and between transport of patients suspected COVID-19 to the referral health care facility	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Heavy duty gloves • Eye protection (if risk of splash from organic material or chemicals) • Boots or closed work shoes



Minimum PPE Recommendations for Various Settings (18)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Immunization Clinics/ Antenatal Clinics/ Well women Clinics/ Healthy Life Style Clinics			
Waiting room/ clinic area	Parents/ Clients	Any	<ul style="list-style-type: none"> • Ensure spatial distance of at least 1 meter between clients • Encourage use of a mask
	Health care worker	Physical examination /performing procedures	<ul style="list-style-type: none"> • Surgical mask



Minimum PPE Recommendations for Various Settings (19)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Home visits for post partum mothers			
Homes of patients	Health care worker	Physical examination /performing procedures	<ul style="list-style-type: none">● Surgical mask● Apron



Minimum PPE Recommendations for Various Settings (20)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Community			
Public areas (e.g. schools, shopping malls, train stations)	Individuals	Any	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter from each other • Encourage use of a mask



Minimum PPE Recommendations for Various Settings (21)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Special considerations for teams assisting with public health investigations			
Community			
Anywhere	Rapid-response team investigations	In-person interview of suspected COVID-19 patients or contacts of COVID-19 patients	<ul style="list-style-type: none"> • Surgical mask • Maintain spatial distance of at least 1 meter • Interview should be conducted outside the house or outdoors, and suspected COVID-19 patients should wear a surgical mask
	Public health investigation teams	Performing nasopharyngeal / oropharyngeal swabbing	<ul style="list-style-type: none"> • NIOSH approved N95 mask or FFP2 standard, or equivalent • Impermeable gown • Gloves • Eye Protection (goggles or face shield) • Apron • Surgical hood or cap • Covered shoes and fluid resistant shoe cover or boots

Minimum PPE Recommendations for Various Settings (22)

Setting	Target personnel or patients	Activity	Type of PPE or procedure
Special considerations for Teams supporting general COVID prevention measures (health and non-health)			
Community			
Anywhere	Teams supporting general COVID prevention measures (health and non-health) E.g.: security related functions, supporting public health investigation teams	Security related general functions	<ul style="list-style-type: none"> • Maintain spatial distance of at least 1 meter • A surgical mask when 1 meter distance cannot be maintained • Gloves if body checks are needed (avoid as much as possible)
		Security related duties that require body contact such as having to encounter person/s	<ul style="list-style-type: none"> • Surgical mask • Impermeable gown • Gloves

PUTTING on PPE

1 Perform hand hygiene

Alcohol based handrub

Rub hands for 20–30 seconds.

or

Water and soap

Wash hands for 40–60 seconds.



2 Put on the gown



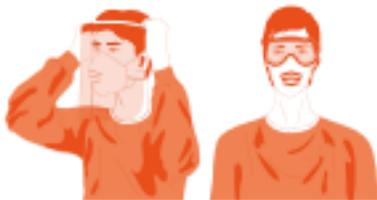
3 Put on the mask

Medical mask.



4 Put on eye protection

Put on goggles or face shield.



5 Put on gloves

Ensure glove is placed over the cuff of the gown.



Full PPE



TAKING off PPE

Order is important

1 Remove gloves



2 Remove the gown

Ensure gown is taken off in a manner in which it does not spread anything off of the gown



3 Perform hand hygiene

Alcohol based handrub

Rub hands for 20–30 seconds.

or

Water and soap

Wash hands for 40–60 seconds.



4 Remove eye protection

Remove goggles or face shield.



5 Remove the mask



6 Perform hand hygiene

Alcohol based handrub

Rub hands for 20–30 seconds.

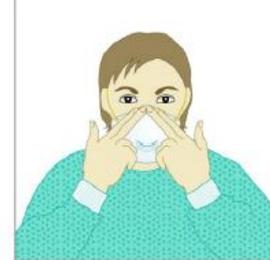
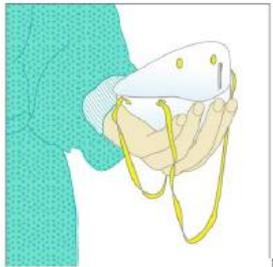
or

Water and soap

Wash hands for 40–60 seconds.



N95 Mask Fitting – Do a seal check before you enter the room!



5A Positive seal check

- Exhale sharply. A positive pressure inside the respirator = no leakage. If leakage, adjust position and/or tension straps. Retest the seal.
- Repeat the steps until respirator is sealed properly.

5B Negative seal check

- Inhale deeply. If no leakage, negative pressure will make respirator cling to your face.
- Leakage will result in loss of negative pressure in the respirator due to air entering through gaps in the seal.



Coordination of PPE supply chain management mechanism

- Heads of institutions perform PPE forecasts based on rational quantification models and also monitoring and control of PPE requests
- An institutionalized (preferably IT-based) request management approach to be in place to avoid wastage or stock-out, with strict adherence to essential stock management rules, including: monitoring end-to-end distribution, and monitoring & controlling consumption in medical facilities storage



Extended use and reprocessing of PPE

- Considering the severe global shortage of Personal Protective Equipment (PPE), WHO has listed temporary measures to extended use or reprocess the PPE.

References

Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages: interim guidance of WHO

[https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-\(covid-19\)-and-considerations-during-severe-shortages](https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages)

Decontamination and Reuse of Filtering Facepiece Respirators. Centre for Disease Control and Prevention.

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html>

- All efforts should be taken to provide adequate amount of PPE for the healthcare worker (HCW)s based on a risk assessment taking into account their intended practices
- Engineering controls such as having a glass barrier between the patient and the HCW should be encouraged to minimise exposure of the healthcare workers



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Extended use and reprocessing of N95 mask or FFP2 standard, or equivalent

Type of PPE	Measure	Description
Respirators (FFP2, FFP3 or N95)	Extended use	The use without removing up to 6h, when caring for a cohort of COVID-19 patients.
	Reprocessing For scientific evidence see Annex 1 of Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages: interim guidance of WHO (https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages)	Process to decontaminate a respirator using disinfection or sterilization methods. Methods (not validated) for respirator reprocessing: <ul style="list-style-type: none"> • Vapor of hydrogen peroxide • UV radiation lamp



Summary of the decontamination method and effect on FFR performance and antimicrobial efficacy

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Vaporous hydrogen peroxide (VHP)	Battelle report: Bioquell Clarus C HPV generator: The HPV cycle included a 10 min conditioning phase, 20 min gassing phase at 2 g/min, 150 min dwell phase at 0.5 g/min, and 300 min of aeration.	Passed	FFR fit was shown to be unaffected for up to 20 VHP treatments cycles using a head form	<i>Geobacillus stearothermophilus</i> spores T1, T7, and phi-6 bacteriophages - >99.999%	Degradation of straps after 30 cycles (Battelle report)
	Bergman et. al.: Room Bio-Decontamination Service (RBDS™, BIOQUELL UK Ltd, Andover, UK), which utilizes four portable modules: the Clarus® R HPV generator (utilizing 30% H ₂ O ₂), the Clarus R20 aeration unit, an instrumentation module and a control computer. Room concentration = 8 g/m ³ , 15 min dwell, 125 min total cycle time.				
Ultraviolet germicidal irradiation (UVGI)	0.5–950 J/cm ²	Passed	90–100% passing rate after 3 cycles depending on model	Influenza , MERS-CoV, SARS-CoV MS2 bacteriophage 99.9% for all tested viruses at 0.5–1.8 J/cm ²	
Ethylene oxide	1 hour at 55°C; conc. range: 725–833/L	Passed	Not evaluated	Not evaluated	

Summary - Rational Use of PPE

- Always practice hand hygiene
- Always follow above guidelines according to the health care setting and activity performed
- PPE are in global shortage, be responsible for rational use
- Assess the risk of exposure and use PPEs **only when they are really necessary**



Resources for COVID-19

WHO Coronavirus Homepage

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

All coronavirus (COVID-19) technical guidance documents

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>

IPC documents

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control>

<https://www.who.int/infection-prevention/publications/en/>

Questions and Answers

<https://www.who.int/news-room/q-a-detail/q-a-coronaviruses>

Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages: interim guidance of WHO

[https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-\(covid-19\)-and-considerations-during-severe-shortages](https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages)

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