National Guidelines on Clinical Management for COVID-19 in Healthcare Settings

December 2020

Version 2.0 01 December 2020

Table of Contents

Version Control & Document History

Date	Summary of modifications made	Version no
August 2020	Created	V1
December 2020	Full revision including updated case definition, notification, management and infection control	V2

Acknowledgement

These *National Guidelines on Clinical Management for COVID-19 in Healthcare Settings* has been developed through the contributions by the National Department of Health and the World Health Organization.

These guidelines are essential reading for all health workers (HW) and health facility administrators in Papua New Guinea (PNG) as they provide evidence-based solutions to healthcare provision in the context of COVID-19.

I express my appreciation and gratitude to the consultants engaged and the technical advisers and officers within the Department of Health and our development partners for their contributions to this very important document for the healthcare settings in our country.

Dr Osborne Liko
Secretary for Health.

Acronyms

ANC	Antenatal Care
ARDS	Acute Respiratory Distress Syndrome
ART	Antiretroviral Therapy
BP	Blood Pressure
BPM	Beats Per Minute
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus disease 2019
CPAP	Continuous Positive Airway Pressure
DIC	Disseminated Intravascular Coagulation
ED	Emergency Department
FiO_2	Fraction of inspired Oxygen
GI	Gastrointestinal
HFNO	High-flow nasal oxygen
HIV	Human Immunodeficiency Virus
HMEF	Heat and Moisture Exchange Filter
HW	Health Workers
ICU	Intensive Care Unit
ILI	Influenza-like illness
IPC	Infection Prevention and Control
LRT	Lower Respiratory Tract
MAP	Mean Arterial Pressure
MNH	Maternal and Newborn Health
NCD	Non-Communicable Disease
NIV	Non-Invasive Ventilation
NPS	Nasopharyngeal swab
OPS	Oropharyngeal swab
PaO2	Partial pressure arterial Oxygen
PEEP	Positive End-Expiratory Pressure
PNC	Postnatal Care
PNG	Papua New Guinea
PPE	Personal Protective Equipment
RDT	Rapid Diagnostic Test
RT-PCR	Reverse Transcription Polymerase Chain Reaction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SBP	Systolic Blood Pressure
SpO_2	Oxygen saturation
TB	Tuberculosis
VPD	Vaccine Preventable Diseases
UNICEF	United Nations Children's Fund
URT	Upper Respiratory Tract
WHO	World Health Organization

Glossary

Airborne transmission	The spread of an infectious agent caused by the spreading of droplet nuclei, that remain infectious when suspended in air over long distances and time.
Contact transmission	The spread of pathogens by physical contact of a host with people or objects. ● Direct contact transmission involves transmission directly from one person to another (e.g. from the hands of someone to another persons' hand). ● Indirect contact transmission involves an object (e.g. from one person's hands, to a table, then to the hands of someone else).
Droplet transmission	The spread of a pathogen caused by the spreading of droplets during coughing, sneezing and talking. Transmission occurs when these droplets (containing microorganisms) are propelled (usually <1 m) through the air and land on the eyes, mouth or nose of another person. Most pathogens do not remain suspended in the air.
Infection prevention and control (IPC)	The work concerned with preventing healthcare-associated infection. IPC is an essential part of the health care infrastructure. Its purpose is to: prevent healthcare-associated infections; prepare facilities for the early detection and management in health crises; to support efforts to control community-acquired diseases; to support the prevention of antimicrobial resistance and to minimize the impact of these infections in the community and environment.
Influenza like illness (ILI)	An acute respiratory infection with: ● measured fever of ≥ 38°C ● and cough ● with onset within the last 10 days
Isolation precautions	Measures designed to reduce the chance of infections spreading. Isolation precautions can be separated into: ● Standard Precautions – these should be in place for all patient care, and ● Additional empiric precautions – these are required in particular circumstances and include contact, droplet and airborne precautions.
Medical mask	See surgical mask.
Pandemic	An epidemic that affects many countries or regions, usually affecting many people.
Respirator mask	Also known as a filtering respirator or particulate respirator. Examples include N95 and FFP2. A type of facial mask that uses a filter as an integral part of the facepiece, or in which the entire facepiece is composed of the filtering medium and a means of sealing to the face. In this document this is referred to as a *respirator mask.*
Severe acute respiratory infection (SARI)	An acute respiratory infection with: ● history of fever or measured fever of ≥ 38°C ● and cough ● with onset within the last 10 days ● and requires hospitalization Although the range of symptoms varies, the onset is usually fast, ranging from hours to days after infection. The pathogens that cause this disease include influenza virus, respiratory syncytial virus (RSV) and severe acute respiratory syndrome coronavirus (SARS- CoV-2).

Surgical mask	May also be known as a medical mask. As PPE it is intended to protect caregivers and health-care workers against droplet-transmitted pathogens, or to protect from activities that cause splashes or spills. In this document, the term refers to disposable masks only.
Screening	A system by which people are screened for specific signs, symptoms and epidemiological clues based on the current case definition. This should be done on all persons entering a health facility.

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus identified in 2019. The virus that causes COVID-19 has since been named as SARS CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). Common signs of infection include fever, respiratory symptoms, cough, shortness of breath and breathing difficulties. In more severe cases, infection can cause pneumonia, severe acute respiratory syndrome, kidney failure and even death.

On 11 March 2020, COVID-19 was characterized by the World Health Organization (WHO) as a pandemic. Papua New Guinea remains on high alert while the National Control Centre (NCC) continues to coordinate national preparedness and response measures guided by the Emergency Preparedness and Response Plan for COVID-19.

The outbreak of COVID-19 requires further strengthening of patient care pathways including screening and triage, testing, early diagnosis and isolation, and quality assurance and improvement (QA/QI) of care for the positives to reduce mortality, including provision of intensive care, as well as preventing nosocomial infection at healthcare facilities.

These guidelines have been developed to standardize the delivery of COVID-19 clinical management across the 22 provinces of PNG and also ensure that evidence-based care is delivered as per the emerging findings.

These guidelines are designed to complement information on the Official PNG COVID-19 information website: (https://covid19.info.gov.pg/) where additional information such as the PNG coronavirus toll-free number (1800-200) can be found.

Healthcare workers are recommended to refer to the Annexes where summaries and job aids can be found and printed if necessary.

Purpose of the guideline

The purpose of this document is to provide guidance on clinical management of COVID-19 in PNG.

This guidance applies to:

- All HW providing patient care in PNG
- All health facility managers, directors and administrators in PNG
- All health facilities including hospitals, health clinics and aid posts

Please note, there is a separate **COVID-19 guideline for Paediatric Health Care Workers**, available from: https://pngpaediatricsociety.org/

1. Pathogen and Clinical Features

Pathogen & transmission

Coronaviruses form a large family of viruses that can cause a range of illnesses. These include the common cold as well as more serious diseases like Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS) and of course, COVID-19.

Coronaviruses are not just present in humans. Many animals also have coronavirus-related illnesses and sometimes those viruses can mutate and be passed on to humans. When this happens, the disease can be more severe because the human body has not had to fight this illness before. Both the SARS and MERS diseases are examples of this happening in recent years.

Due to the concerning rate at which COVID-19 has spread as well as the increasing number of infections in many countries, it is critical that health facilities in PNG remain alert and prepared to respond to widespread community transmission of COVID-19.

COVID-19 transmission routes

- **Droplet transmission:** Droplets from infected persons transmitted through coughing, sneezing, speaking and singing which has direct contact with the eyes, nose, mouths of people within close distance (1metre) (**direct** transmission).
- **Contact (fomite) transmission:** Droplets from infected persons transmitted through coughing, sneezing, speaking and singing, landing on surfaces. Transmitted by touching the contaminated surface and then touching the eyes, mouth and nose without washing hands adequately (**indirect** transmission).
- **Airborne transmission:** the spread of an infectious agent caused by the dissemination of droplet nuclei (aerosols) that remain infectious when suspended in air over long distances and time. Airborne transmission of COVID-19 can occur during medical procedures that generate aerosols (“aerosol generating procedures”).

Risk factors for COVID-19

Individuals at highest risk for severe disease and death include:

- People aged over 60 years.
- Those with underlying conditions such as:
  - Hypertension
  - Diabetes
  - Obesity

- Cardiovascular disease
- Chronic respiratory disease or smoking
- Chronic kidney disease
- Immunocompromised state (weakened immune system)
- Cancer
- Pregnancy

Clinical characteristics

The clinical presentation of COVID-19 can range from no symptoms (asymptomatic) to severe bilateral pneumonia and death. Usually it takes 5–6 days from exposure to the virus before symptoms to appear, but this incubation period can take up to 14 days. It takes 1-2 weeks from the onset of symptoms to the development of severe disease, including hypoxia. Acute Respiratory Distress Syndrome (ARDS) is the most common complication of severe COVID-19.

Common symptoms of COVID-19 include fever, cough, fatigue, anorexia, shortness of breath (SOB) and myalgia.

Older people and immunosuppressed patients in particular may present with atypical symptoms such as fatigue, reduced alertness, reduced mobility, diarrhoea, loss of appetite, delirium, and absence of fever.

Children and adolescents are just as likely to become infected as any other age group and can spread the disease. However, they are less likely to get severe disease and might not report with fever or cough as frequently as adults. Clinicians also should be aware that among paediatric patients, gastrointestinal symptoms such as nausea, vomiting, and diarrhea are more common than among adult patients[1].

Common symptoms	Less common symptoms	Common symptoms in children
• Fever • Cough • Fatigue • Anorexia • Shortness of breath • Myalgias	• Sore throat • Nasal congestion • Headache • Diarrhoea • Nausea and vomiting • Loss of smell (anosmia) preceding the onset of respiratory symptoms • Loss of taste (ageusia) preceding the onset of respiratory symptoms	• Fever • Cough • Nausea and vomiting • Shortness of breath • Fatigue and malaise • Abdominal pain • Diarrhoea

The median time from onset of symptoms to clinical recovery for mild cases is approximately two weeks and is 3 - 6 weeks for patients with severe or critical disease. The majority of patients can be expected to make a full recovery, although persistent neurological, respiratory and cardiovascular symptoms have been reported in younger patients without pre-existing

[1] Swann *et al.* 2020

comorbidities (termed 'Long COVID'). Further information on long-term complications can be seen in the reference section.

Multisystem inflammatory syndrome in children

Multisystem inflammatory syndrome is a rare condition associated with COVID-19 among children and adolescents and has been reported from various countries in Europe, North America, Asia, and Latin America. Characteristics of the diseases such as epidemiology, pathogenesis, risk factors, and long-term outcome remain unknown. Clinical symptoms include fever, rash, gastrointestinal symptoms, and hypotension which are similar to Kawasaki disease and toxic shock syndrome. Diagnosis is made by clinical feature and laboratory evidence of current or recent SARS-CoV-2 infection or a history of recent COVID-19 exposure. Patients are treated with anti-inflammatory medicines including corticosteroid and intravenous immunoglobulin.[2]

Please note, there is a separate **COVID-19 guideline for Paediatric Health Care Workers**, available from: https://pngpaediatricsociety.org/

[2] WHO, 2020

2. Case definition, Diagnosis, Screening and Notification

Case definition & diagnosis

There are three case definitions for COVID-19; suspect, probable and confirmed. These definitions are to be used to guide patient management. Case definitions combine clinical criteria such as signs and symptoms with epidemiological data.

Suspected COVID-19 case

A person who meets the clinical **OR** epidemiological criteria:

Clinical criteria

a) A patient with respiratory illness presenting with at least 1 or more of the following signs or symptoms:

- Fever (≥37.5°C or history of fever)
- Cough
- Shortness of breath
- Sore throat
- Loss of smell or taste

Epidemiological criteria

a) Close contact with a confirmed COVID-19 case in the 14 days prior to onset of symptoms

Probable COVID-19 case

a) A person meeting both clinical AND epidemiological criteria OR

b) **Clinically suspected case** for whom testing could not be performed for any reason OR

c) A **suspected case** for whom testing for COVID-19 is inconclusive by testing laboratory

Confirmed COVID-19 case

a) A person with laboratory confirmation (rt-PCR or GeneXpert) of COVID-19 infection, irrespective of clinical signs and symptoms.

COVID-19 death definition

A COVID-19 death is defined for surveillance purposes as: A death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID-19 disease (e.g. trauma). There should be no period of complete recovery between the illness and death.

Reference: PNG COVID-19 Surveillance SOP Version 5, 22 October 2020

It is important to know that case definitions can change as more information is gathered about the virus. Therefore, all clinicians and those working on screening stations must refer to the latest case definitions to guide their care. Clinicians should refer to the latest SOP for up-to-date information on the case definition.

Testing for COVID-19 and alternative diagnoses

COVID-19 testing should be offered according to the following PNG testing criteria[3]:

Testing criteria	• Any person that meets the suspected COVID-19 case definition.
Enhanced Testing criteria	The enhanced testing criteria compliments the testing criteria and requires to the collection of nasopharyngeal swabs from all persons presenting with any respiratory illness such as: • Pneumonia (inpatient or outpatient) • SARI • Influenza-like Illness (ILI) • Simple cough • Including all respiratory illness admissions to Intensive Care Unit (ICU) and Emergency Department (ED).

Laboratory tests for COVID-19 and additional investigations are summarised as follows:

Laboratory Tests for COVID-19

- **Reverse transcription polymerase chain reaction (RT-PCR)** assay which detects the viral RNA. This is the currently recommended test to confirm COVID-19 infection
- **Rapid antigen tests** that detect the presence of viral proteins (antigens) are expected to become available in PNG in early 2021
- **Antibody tests** are NOT recommended for the diagnosis of COVID-19

Laboratory diagnosis of COVID-19 currently is performed on **nasopharyngeal swabs (NPS)** and **oropharyngeal swabs (OPS)** from patients who meet the case definition and on surveillance cases. The following samples must be collected:

- Upper respiratory tract (URT) samples – NPS and OPS (combined in the same universal transport medium tube) for testing by reverse transcription polymerase chain reaction (RT-PCR) for all suspected cases.
- When URT specimens are negative and clinical suspicion remains, collect specimens from the lower respiratory tract (LRT) when readily available (expectorated sputum, or endotracheal aspirate/bronchoalveolar lavage in ventilated patients).

For details on NPS and OPS sample collection see Annex 2: Procedure for sample collection and the latest PNG COVID-19 **Sample Collection SOP**"

[3] PNG COVID-19 Surveillance SOP Version 5, 22 October 2020

Other investigations

People with suspected COVID-19 might have an alternative diagnosis and the following additional investigations may be required:

- Blood cultures
- Complete blood count
- Renal function and electrolytes
- Liver function tests
- **Malaria** (a rapidly evolving, life-threatening febrile illness with symptoms that overlap with COVID-19, and therefore needs to be excluded in areas with malaria transmission)
- **Dengue** rapid diagnostic test (co-infection with COVID-19 may also occur and a positive test for dengue does not exclude the need to test for COVID-19)
- GeneXpert where **TB** is suspected
- ECG
- If available, consider using a chest X-ray for patients with moderate disease or severe diseases, with a portable X-ray machine where possible.

Screening and assessment

Screening

Ideally there should only be one entry point to each health facility with a screening station set up in a way that in a way that all people have to move though the screening station before they can go elsewhere. Screening is essential to help identify all suspected COVID-19 cases as quickly as possible to avoid people spreading infection within the facility and elsewhere. There should be posters, pamphlets and billboards posted at all entrances to the health facility to reinforce this message.

The purpose of screening is to identify individuals who might be a suspected case of COVID-19, then separate them from other people, and refer them to the COVID-19 assessment area for examination and triage. All people (visitors, staff, patients) must be screened prior to entry. The screening person must check two things for EVERY person who enters the hospital site:

- Check if they meet the suspected case definition for COVID-19
- Check their temperature

It is recommended that the person conducting screening has a copy of the latest case definition available at the screening station to refer to.

If a screened individual meets the suspected case definition and/or has a temperature above 37.5^{o}C, the person at the screening site should give them a mask and tell them how to put it on. They should then ask the screened person to perform hand hygiene and send them to the COVID-19 assessment area.

If a person does not have a fever and does not have any symptoms they may enter the health facility as per usual once they have performed hand hygiene

Assessment area

People who have a fever or meet the suspected case definition should be sent to the COVID-19 assessment area. The function of the COVID-19 assessment area is to swab the person for COVID-19 and assess severity of disease for hospitalization, or stabilize the patient prior to transfer to a facility where COVID-19 testing is available. The assessment area should be set up so that people can observe social distancing at least of 1.5 meters. Oxygen should be ready to give if needed (oxygen cylinder, regulator, nasal cannula, reservoir oxygen masks, pulse oximeter).

When someone arrives at the COVID assessment area they must first be swabbed for COVID-19 if testing is available. See Annex 2: Procedure for sample collection for more information. After swabbing the clinician needs to take a set of vital signs and check for danger signs (respiratory distress, decreased consciousness, signs of a stroke). The clinician also needs to determine 3 things:

1) **How severe is the patient (mild/moderate/severe):** Use their vital signs and clinical examination to assess severity of the patient
2) **Could the patient have another condition that requires urgent treatment?** Not all suspect cases will have COVID-19. Assess any other conditions that require urgent care, including malaria, dengue fever, bacterial pneumonia, asthma, or tuberculosis. If the patient's illness is not COVID-19, what else could it be? Common examples include bacterial pneumonia (take blood cultures and give urgent antibiotics) or asthma (give salbutamol through a metered dose inhaler with a spacer) or tuberculosis. Send a malaria or dengue test and blood cultures if required.
3) **Does the patient require hospitalization?** A key decision to make is to decide whether they require hospitalisation or can be considered for a care at an isolation facility or home care. If the patient is asymptomatic or has mild symptoms, they can then go home after. If the symptoms are moderate, severe or life threatening, the patient will need to be admitted to hospital or stabilized and referred to a hospital where testing is available. If the patient does not require hospital level treatment and has no risk factors for deterioration, they need symptomatic treatment like paracetamol for fever and strict infection control measures while waiting for the results of COVID-19 testing. This can take place at an isolation facility or at home.

The process for screening and assessment is outlined in Annex 1: Health facility screening and assessment process.

Isolation

If a suspect or confirmed COVID-19 case is to be admitted to your health facility it is essential that they are isolated from the rest of the patient population. This can be done in a purpose-built

isolation unit or in an area that has been repurposed for the isolation of COVID-19 cases. The isolation area must be well ventilated and adheres to IPC guidelines.

It is possible to cohort confirmed COVID-19 cases in the same isolation area. See Section 4 Infection Prevention and Control for further detail on additional precautions for suspected or confirmed COVID-19 cases.

Patient referral

Health workers should be aware of the referral pathways in their region so that they can refer patients appropriately. If referring a patient to another health facility for swabbing or treatment there are a few important considerations:

- Explain clearly to the patient and their family why this is necessary
- Notify the receiving facility
- Educate the patient to wear a face mask and distance from others
- Notify the family if the patient is transferred without their knowledge.

National notification and laboratory reporting system

A Case Investigation Form (CIF) should be completed for all suspected cases and should be sent with diagnostic samples.

All laboratory confirmed COVID-19 cases and deaths must be reported to the COVID-19 NCC surveillance team immediately (within 24hrs of confirmation).

Notification of COVID-19 death

All health facilities are required to report a COVID-19 death immediately. For each COVID-19 death, report the following to the Provincial Health Authority (PHA) through the office of the provincial disease control officer (PDCO) or provincial surveillance officer who must then report to the NCC surveillance team within 24 hours.

1. Case investigation form for positive case
2. Death notification form or death certificate

Refer to the latest **COVID-19 surveillance SOP** for up-to-date forms information on notification procedures.

3. Severity Classification and Case Management

General considerations

- Remember the importance of clear communication with the patient and family: introduce yourself and your role, provide clear explanations, let the patient ask questions, provide reassurance where needed, give a COVID-19 patient information leaflet if available and explain the contents.
- Ask patients about their symptoms and treat where possible – many COVID-19 patients experience pain and breathlessness which can be distressing for the patient but both can be improved with medicine.
- All patients should be given supportive treatment such as paracetamol for fever and pain. Encourage them to drink enough water or give them appropriate volume of intravenous fluid in case of dehydration.
- Food and drink should be delivered to the patient by a HW. If disposable utensils are not available, the patient should have dedicated dishes, cups, and eating utensils. If possible, they should be washed with soap and water in the isolation room by the HW.
- Remember that COVID-19 patients are at increased risk of blood clots in the legs and the lungs. Encourage all patients to stay active and give anti-embolism stockings and prophylactic enoxaparin to severe cases.
- All patients should be given a way to contact help if required – a phone number to call or an alarm or rattle to attract attention.

Severity classification and case management

Severity of COVID-19 is categorized into; mild, moderate, severe and critical disease. People with severe or critical COVID-19 require hospitalization, and people with moderate COVID-19 with risk factors for deterioration might need hospitalization. Most people with COVID-19 develop only mild (40%) or moderate (40%) disease, whereas approximately 15% develop severe disease that requires hospitalization and oxygen support, and 5% have critical disease, requiring mechanical ventilation or other forms of support in the intensive care unit (ICU). The proportion of people with asymptomatic infections is unclear.

Management of all suspect and confirmed cases of COVID-19 is defined by the severity of the patient. The WHO has defined the clinical symptoms associated with each disease status: mild, moderate, and severe or critical disease (see summary below). Clinical staff should be familiar with the clinical syndromes associated with each stage and classify patient status accordingly to guide further management. In addition, close monitoring is needed and do not hesitate to reclassify patients when clinical symptoms worsen.

COVID-19 disease severity assessment for adults and children

Severity	Clinical Syndromes	SpO_2	Respiratory rate
Mild	• Any symptoms (as table below) • Without evidence of pneumonia	≥90%	Normal
Moderate	Adolescent or adult • Clinical signs of pneumonia (cough, dyspnea, fast breathing) • Without signs of severe disease	≥90%	< 30
	Child • Clinical signs of pneumonia (cough or difficulty breathing + tachypnea and/or chest indrawing) • Without signs of severe disease	≥90%	< 2months: ≥ 60 2-11 months: ≥ 50 1-5 years: ≥ 40
Severe	Adolescent or adult: Pneumonia with following clinical manifestations • SpO_2 < 90% • Respiratory rate ≥ 30bpm • Severe respiratory distress	<90%	≥30
	Child Pneumonia with following clinical manifestations • Central cyanosis • SpO_2 < 90% • Fast breathing • Grunting • Severe chest indrawing • General danger sign (inability to breastfeed or drink, lethargy, unconsciousness, or convulsions) While the diagnosis is made on clinical grounds; chest imaging may identify or exclude some pulmonary complications.	<90%	< 2months: ≥ 60 2-11 months: ≥ 50 1-5 years: ≥ 40
Critical	• Severe disease requiring mechanical ventilation. • Severe disease with sepsis or septic shock.		
Common symptoms	**Less common symptoms**	**Common symptoms in children**	

• Fever • Cough • Fatigue • Anorexia • Shortness of breath • Myalgias	• Sore throat • Nasal congestion • Headache • Diarrhoea • Nausea and vomiting • Loss of smell preceding the onset of respiratory symptoms • Loss of taste preceding the onset of respiratory symptoms	• Fever • Cough • Nausea and vomiting • Shortness of breath • Fatigue and malaise • Abdominal pain • Diarrhoea

Summary of case management

Status	Hospitalization	Treatment	Monitoring and education
Mild	Not required	Symptomatic treatment	Check vital signs twice a day or more often if vital signs are getting worse or if they have risk factors. Counsel patients about signs and symptoms of complications that should prompt urgent care (e.g. difficulty breathing, chest pain, dehydration)
Moderate	Not required but decide on a case-by-case basis.	Symptomatic treatment	
Severe	Isolation ward	Supplemental oxygen Empiric antibiotics Consider corticosteroid	Continuous monitoring of oxygen saturation. Enter the room to check on the patient at least four times a day.
Critical	Intensive care unit	Refer to the section "Management of critical COVID-19 cases at the ICU"	

Drug treatment

1. Corticosteroids

Several studies have been conducted to investigate the effect of corticosteroids on COVID-19. Dexamethasone has been shown to reduce mortality by about one fifth for patients requiring oxygen and by about one third for patients on ventilators. There was no benefit of giving dexamethasone to patients who did not require oxygen[4]. WHO guidance recommends administration of corticosteroid for severe COVID-19 patients who require supplemental oxygen.[5]

[4] RECOVERY, NEJM, 2020
[5] Corticosteroids for COVID-19. WHO, 2020

Recommendations for the use of corticosteroids

- Use either oral or intravenous corticosteroids for up to 7-10 days in patients with COVID-19 who are mechanically ventilated or those who require supplemental oxygen:
  - Dexamethasone 6mg once daily
  - Hydrocortisone 50mg every 8 hours or 100mg every 12 hours
  - Methylprednisolone 8mg every 6 hours or 16mg every 12hours
- Do not use corticosteroids in patients with COVID-19 who do not require supplemental oxygen.

Unknowns

- Safety and efficacy of corticosteroids is less clear among pregnant women and children. The United States NIH guidelines recommend dexamethasone for pregnant women with COVID-19 who are mechanically ventilated or those who require supplemental oxygen[6].
- Corticosteroids may be beneficial in pediatric patients with COVID-19 who are on mechanical ventilation, but use of corticosteroids in pediatric patients who require other forms of supplemental oxygen should be considered on a case-by-case basis.

Considerations

- Although duration of corticosteroid use is short, known potential adverse events of systemic steroid should be considered, including hyperglycemia, gastrointestinal ulcer and neuropsychiatric effect.

2. Antivirals

The international randomized control trial conducted by WHO revealed that remdesivir, hydroxychloroquine, lopinavir/ritonavir and interferon have little or no effect on 28-day mortality or the clinical course of hospitalized patients[7]. WHO recommends that potential therapeutic drugs not be administered as treatment or prophylaxis for COVID-19, outside of the context of clinical trials.

3. Antibiotics

Antimicrobial therapy should be assessed daily for de-escalation, with guidance from septic work-up (Sputum culture/ Blood culture/ Urine culture/ peripheral line microscopy and culture).

[6] COVID-19 Treatment Guidelines. NIH, 2020
[7] "Solidarity" clinical trial. WHO, 2020

Antibiotic use based on disease severity

Mild	No antibiotics
Moderate	Routine antibiotic use is discouraged unless there is a clinical suspicion of bacterial infection If bacterial pneumonia is clinically suspected • **Amoxicillin** 500mg orally TDS for 5 days If with comorbidities consider combination therapy • **Augmentin** (amoxicillin/clavulanate 500mg/125mg) 625mg orally TDS for 5 days + **Azithromycin** 500mg on the first day then 250mg daily for 4 days.[8]
Severe/Critical	Use empiric antimicrobials to treat all likely pathogens, based on clinical judgment, patient host factors and local epidemiology **Antibiotics should be used as soon as possible (within 1 hour of initial assessment if possible),** ideally with blood cultures obtained first. Community Acquired Pneumonia (within 48 hours of hospital admission) • **Ceftriaxone** 2g IV QD + **Azithromycin** 500mg oral on day one, then 250mg oral daily for four days. Hospital Acquired Pneumonia (after 48 hours of hospital admission) • **Ceftriaxone** 2 g IV QD + **Ciprofloxacin** 400mg IV BD consider adding **Gentamicin** 5-7mg/kg IV per day[9]

Oxygen supplementation

As supportive therapy is still the mainstay of COVID-19 management, oxygen therapy is important treatment for severe patients. See Annex 5: Oxygen titration flowchart for:

- Indication of supplementary oxygen
- Targets of SpO_2
- Oxygen delivery devices
- Flow chart for oxygen titration
- Checklist to troubleshoot warning signs

[8] Alternative for Augmentin use Amoxicillin. Alternative for Azithromycin use clarithromycin 500mg orally BD for 5 days or Doxycycline 100mg orally BD for 5 days.
[9] Dosing considerations with renal impairment

Prevention of complications

1. Thromboembolism	Patients with COVID-19 are at increased risk of thromboembolism including DVTs and pulmonary embolism.[10] **All hospitalized patients (adults and adolescent) should have prevention measures:** ● Antiembolism stockings for all hospitalized patients if available ● Encourage patients to move as much as possible ● Minimise the duration of mechanical ventilation and hospitalization ● Give prophylactic dose enoxaparin to all hospitalized adult and adolescent patients unless there is a contraindication (e.g. active bleeding, severe uncontrolled hypertension with systolic > 180 mmHg, active peptic ulceration, clotting abnormalities, severe liver disease). ● Dose according to weight **< 100kg : enoxaparin 40mg s/c once daily** **> 100kg : enoxaparin 80mg s/c once daily** ● If enoxaparin is not available, use subcutaneous unfractionated heparin 5000 units twice daily.
2. Catheter-related blood stream infection	Ensure sterile insertion of catheter and remove catheter if no longer needed.
3. Stress ulcers and GI 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 GI bleeding include: ○ Mechanical ventilation for ≥ 48 hours ○ Coagulopathy ○ Renal replacement therapy ○ Liver disease ○ Multiple comorbidities ○ Higher organ failure score
4. Mental stress	● Good communication with the patient and the family ● Try to maintain privacy and dignity of the patient.

[10] Middeldorp *et al.* 2020

Management of critical cases in the ICU / intubation

Intubation is an aerosol generating procedure (AGP) that, in the context of a deteriorating patient with suspected or confirmed COVID-19, should be undertaken with caution. Anticipate the need, and appropriateness, for intubation where possible.

- Seek specialist advice as required in order to ensure the decision to escalate care is appropriate (i.e. if no ICU is available intubation is not considered).
- Only the most qualified staff are involved; these staff are skilled in performing the procedure whilst using airborne precautions.
- Where possible, intubate in a planned fashion rather than as an emergency.

When to intubate?

The decision whether a patient should be intubated – and the timing of intubation – depends on the hospital resources available, the clinical status of the patient and their wishes.

Healthcare facility preparation

- Sufficient trained staff for intubation/mechanical ventilation
- Sufficient equipment such as adequate numbers of respirators, closed circuit suction, circuit filters and a well-ventilated room
- IPC for AGPs is in place
- Adequate referral pathway after intubation (if the facility has enough staff, equipment, and skill for intubation but not confident in ICU management)

Indication for intubation/mechanical ventilation

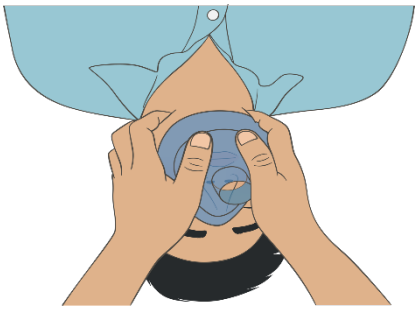
- Patients who are judged to have the potential to survive their illness.
- Patients/family members who agree to intubation
- Patients who are no longer able to maintain SpO_2 ≥90% with simple oxygen delivery devices

How to intubate safely

Intubation is an AGP with an increased risk of transmitting COVID-19. Staff need to wear an N95 mask and take extra precautions to decrease the infection risks. AGP should only be carried out in a room with adequate ventilation.

When hospitals are caring for many COVID-19 cases, it is recommended to have a dedicated 'intubation team' to perform all intubations.

1. Before intubation	**a. Staff protection** ● Full PPE including N95 mask, eye protection, gloves and long-sleeved gown. ● Minimise the number of staff present for the intubation – maximum of 3 for most situations ● Where possible, intubation should be carried out in a well-ventilated room. **b. Equipment required** ● Prepare the drugs and equipment and discuss the airway plan before putting on PPE and going to the patient ● Endotracheal tubes (have 2 sizes available) ● Bag-valve mask ventilator (Ambu bag) ● Laryngoscope (check light is working) ● Stylet or bougie ● Tape to secure tube ● Aqueous lubricant ● 10ml syringe ● Oropharyngeal airway (2 sizes) ● One heat and moisture exchange filter (HMEF) ● Suction machine and suction catheter ● Pillow or folded towel to help with patient positioning ● Will need 2 oxygen sources, one preconnected to the ventilator, the other to the reservoir mask then the Ambu. ● Ventilator tubing and closed-circuit suction device ● NG tube to insert post intubation
2. During intubation	**a. Non-technical skills** ● Allocate clear roles to the team ● Communicate the airway plan clearly ● Use 'closed loop' communication throughout ● All team members should check each other for potential contamination. **b. Technical aspects** ● Connect a viral / bacterial filter to an Ambu bag and then move it to the expiratory limb of the ventilator once the patient is intubated. ● Minimise aerosol generation by minimising bag-mask ventilation ● Connect an HMEF to the patient end of the ventilator tubing. ● Pre-oxygenate with 15L O_2 via a reservoir mask for at least 5 minutes beforehand ● Use a two person Ambu technique – one person to hold the mask, one to squeeze the bag ● 'Thumbs down' facemask grip to achieve a tight seal

	• Minimise patient coughing where possible • After intubation, only squeeze the Ambu bag after the cuff has been inflated.  **Thumb down grip** **c. Premedication for intubation** *Considerations* • Intubators can choose drugs that they are most comfortable and familiar with. • Try to minimise the apnoeic period and bag-valve mask ventilation. • Consider the use of succinylcholine to decrease the risk of the patient coughing during intubation and potentially increase the speed and ease of the intubation **if intubators have enough knowledge and experience to use it safely**. *Choice of medicines* • Sedative: pick ONE - midazolam (dormicum) 0.1 – 0.3 mg/kg - propofol 2.5 – 3.5 mg/kg - ketamine 1- 2mg/kg • Opiate: - Fentanyl 2 – 5 mcg/kg • Muscle relaxant at the intubator's discretion **(optional)**: - Succinylcholine (suxamethonium) 1.5 mg / kg (avoid if hyperkalaemia) • Noradrenaline infusion if patient haemodynamically unstable
3. After intubation	• Avoid unnecessary circuit disconnection • All reusable equipment need to be carefully disinfected

Initial set-up of the ventilator

Make sure the circuit is clean, dry and properly assembled. For COVID-19 cases, a heated humidifier is preferred to a HMEF to humidify the circuit. A filter with bacterial / viral filtration capacity should be attached to the expiratory limb of the ventilator circuit. Make sure that there is closed circuit suction within the circuit.

Mode	• Volume-controlled, synchronised intermittent mandatory ventilation with pressure support (VC-SIMV-PS)
Tidal volume (Vt)	• Measure the patient's height • Vt should be 4-8 ml/kg predicted body weight (See Annex 12: Tidal volume chart for calculation) • Enter Vt
Respiratory rate (RR)	• 16-20 bpm

FiO_2 and PEEP	• Titrate to maintain target SpO_2 according to patients' condition
	  ○ >90% without multiorgan failure or ARDS
	  ○ ≥94% for patients with multiorgan failure
	  ○ 88-95% for ARDS patients
	• Keep the FiO_2 as low as possible
	• PEEP should be 5-10 cmH_2O

Alarm settings	• 30 cmH_2O for high airway pressure (Paw) alarm • Turn on apnoea backup mode • The apnoea time should be 15-20 seconds.
Pressure support	• Start at 8 cmH_2O and titrate • Spontaneous breaths should be 4-8 ml/kg.
Inspiration: expiration ratio (I:E ratio)	• Start at 1:2

Managing hypoxia in the ventilated patient

If ventilated patients develop hypoxia, consider following interventions.

1. PEEP	• Higher levels (eg. 10-16 cmH_2O) can be challenged in severely hypoxic patients but HWs should be cautious as >10 cmH_2O may cause haemodynamic instability. • Avoid disconnecting the patient from the ventilator where possible, which results in loss of PEEP and atelectasis.
2. I:E ratio	• Try changing the I:E ratio to 1:1.
3.Prone ventilation	• Prone ventilation can help to improve oxygenation. • **Only safe to do this in centres where there are sufficient staff and training** • Patients should be placed face down by a team of five nurses and doctors for >12 hours per day, every day, until they improve.
4. Search for complications	HWs should consider complications such as: • ventilator associated pneumonia • pneumothorax • pulmonary thromboembolism Assess other vital signs and take physical examination carefully, and if such complications are suspected, consider further investigation including imaging studies.

Prevention of complications associated with mechanical ventilation

It is important to prevent common complications associated with mechanical ventilation. Liberate the patient from the ventilator as soon as possible to minimise complications. Use spontaneous breathing tests every day once the patient starts to improve to test if they are ready to come off the ventilator. Spontaneous breathing tests should last 30 minutes, in CPAP-PS mode, with PEEP = 5 and PS = 5.

Problem	Prevention measures
Ventilator-induced lung injury (VILI)	• Use lung protective ventilation with the ventilator settings described above
Ventilator-associated pneumonia	• Hand hygiene, especially before suctioning • Raise head of the bed to 30-45 degrees • Make sure the ET tube balloon is kept well inflated • Daily oral cleaning • Minimise the duration of mechanical ventilation • Use a closed suctioning system • Use a new ventilator circuit for each patient
Blocked ET tube	• Ensure good circuit humidification • Never give a patient non-humidified oxygen • Suction the patient when they have secretions
Bed sores	• Turn the patient **every 2 hours** while on the ventilator • Use a pressure-relieving mattress where available • Ask the family to bring in pillows and blankets to help prop the patient in the correct positions. • The most common areas for bedsores are the sacrum and buttocks, hips, and heels. Use gel pads to relieve pressure on affected areas or if they are not available use a glove filled with water. • Inspect the skin every day to check for ulcers • For patients who have been in bed for more than 72 hours, apply barrier cream to the sacrum.

Managing shock

Some patients with COVID-19 develop shock. One important cause of this is septic shock. If they are ventilated, PEEP and drug-induced hypotension are also possible. It can be difficult to distinguish septic shock from other causes, so suspect septic shock in all hypotensive patients who need noradrenaline to maintain a systolic BP > 90mmHg. They should be managed as septic shock until more information is available.

International WHO guidance defines septic shock as follows:

- 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. In the absence of a lactate measurement, use blood pressure (i.e. MAP) and clinical signs of perfusion to define shock.

- Children: Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] < 5th centile or > 2 SD below normal for age) or two or more of the following:
    - altered mental state
    - bradycardia or tachycardia (HR < 90 bpm or > 160 bpm in infants and HR < 70 bpm or > 150 bpm in children)
    - prolonged capillary refill (> 2 sec) or feeble pulses
    - tachypnoea
    - mottled or cold skin/petechial or purpuric rash
    - increased lactate
    - oliguria
    - hyperthermia or hypothermia

Management of shock

1) Try giving 250-500 ml IV saline for adults and 10-20 ml/kg for children and check for an improvement in heart rate, blood pressure, mental status, capillary refill time and urine output. Repeat as required but be cautious about giving too much fluid because this can make respiratory failure worse.
2) If the patient remains hypotensive despite IV fluid, start noradrenaline to keep systolic BP > 90 mmHg. If signs of poor perfusion and cardiac dysfunction persist despite achieving target BP with fluids and noradrenaline, consider an inotrope such as dobutamine.
3) Look for a source of infection: is there evidence of ventilator-associated pneumonia or an infected catheter?
4) If possible, take blood cultures in all patients with suspected septic shock, even if they have had blood cultures earlier in their admission.
5) Give antibiotics as soon as possible (see guidance on which antibiotic to choose). Review the ongoing need for antibiotics after 48 hours and continue for up to 7 days as required.
6) For patients with confirmed COVID-19, renal function and electrolytes should be repeated as clinically indicated to monitor for complications, such as acute liver injury, acute kidney injury, acute cardiac injury, or shock.

Cardio-pulmonary resuscitation (CPR)

CPR is a procedure that may produce aerosols when performed. Healthcare facilities, especially hospitals, should review their approach to undertaking CPR in the ward / outpatient

environments, for patients with COVID-19 and in the context of widespread community transmission.

CPR: key considerations

- Identify as early as possible any patients at risk of further deterioration.
- Treating HWs should identify clear goals of care on admission to hospital (including whether CPR would be appropriate in the event of further deterioration). ***Seek specialist advice as required in order to ensure the decision to escalate care is appropriate.***
- PPE must be readily available to staff in areas where resuscitation is anticipated
- Donning PPE before performing CPR is essential for the safety of HW. It is accepted that donning PPE may cause a delay in commencing resuscitation.
- *Do not do mouth-to-mouth resuscitation*. Do not put your face close to listen for breaths. If there are no breaths visible or no signs of life commence compression resuscitation only.
- If the patient is already receiving oxygen via a face mask, leave the mask on during chest compressions (as this may limit aerosol spread)
- Restrict the number of staff and/or relatives in the room to the minimum. There should be no onlookers. This should be monitored and controlled by a staff member at the entrance of the room

Management of mental health issues

Acute confusion

Acute confusional state in COVID-19 may occur as a result of any of the following:

- Central nervous system is affected directly by COVID-19
- When the CNS inflammatory mediators are activated
- Due to the multiple organ failure
- Use of sedatives
- Prolonged mechanical ventilation
- Hypoxia
- Other underlying medical conditions

If acute confusion is present ensure to:

- Check oxygen saturation and ensure that the patient is getting oxygen
- Check Hydration-check the fluid intake and output and ensure that the patient is well hydrated

- Check temperature-if patient is febrile do a septic workup: full blood count, ESR, blood culture, Blood slide/RDT for Malaria, dengue test, urinalysis and culture and others as required
- Check liver function, Urea/Creatinine/Electrolytes, blood glucose
- Assess other vital signs: Blood Pressure, heart rate and respiratory rate
- If appropriate investigations have been done already check the results and if there is any abnormality identified, treat the appropriate condition accordingly.

Nursing management:

- Nurse in a quiet and calm room
- Ensure the patient is comfortable
- Encourage to rest and sleep
- Help re-orientate patient allowing them to read newspaper or listen to radio or talk to their family on phone, or by informing them of what time of the day it is
- Encourage to get up and sit down on chair during day time
- Avoid overstimulation or understimulation.

Psychotropic drug use in COVID-19

If a patient has psychotic features of hallucination, illusion, paranoia and agitation, aggression and psychotropic medications are required to use minimum effective doses of **haloperidol** 2mg daily. If haloperidol is contraindicated then short half-life benzodiazepines can be added; **lorazepam** 1-2mg oral daily. If lorazepam is not available then use **diazepam** 5mg oral daily to control anxiety, aggression and agitation. Note:

- Use the above medications with caution. Avoid Benzodiazepines (Lorazepam and Diazepam) use in patients with significant respiratory impairment.
- Ensure to monitor vital signs after giving the psychotropic medications

Management of other mental health concerns

- Provide basic mental health and psychosocial support should be provided to those persons with suspected or confirmed COVID -19 through problem detection and problem solving. This should be extended to their families and others in the community or health care providers if the need arises and to patients of the different age groups
- Persons discharged from hospital should be followed up through phones or face to face to ensure that they are mentally well.
- Stress management and brief psychological interventions should be considered for those experiencing symptoms of anxiety
- Those experiencing symptoms of depression should be given brief psychological interventions, problem-solving treatment and relaxation training.

Palliative care

Not all patients will survive COVID-19 and is it important that these patients receive high quality end-of-life care. The focus should be on alleviating a patient's symptoms and providing emotional and spiritual support for them and their families. Where possible, patients should be offered a choice between hospital or community-based care (either in home isolation if they meet the criteria to do it safely or in an isolation facility).

Hospital-based palliative care

- provide a single room where possible, or screens for privacy. Try to facilitate telephone contact with family and friends.
- For hospital-based care, the patient should be assessed every four hours to evaluate and treat their symptoms
- All patients should receive regular mouth care and repositioning.
- Cardiopulmonary resuscitation is considered to be an aerosol-generating procedure and so should be avoided unless everyone in the room is wearing the appropriate PPE including an N95 mask.

Pharmacological management of palliative care symptoms

Symptom	Suggested treatment
Breathlessness	ORAL MORPHINE (if able to swallow): 2.5mg–7.5mg PO, every 4 hours as required IV MORPHINE (if unable to swallow) 0.5mg–2.5mg IV, every 30 minutes as required. Alternatives if morphine not available: • IV FENTANYL 12.5 micrograms–25 micrograms IV, every 15 minutes as required. • IV MIDAZOLAM 0.5mg–1mg IV, every 30 minutes as required.
Pain	ORAL MORPHINE (if able to swallow): 2.5mg – 10mg PO, every 4 hours as required IV MORPHINE (if unable to swallow) 1mg – 3mg IV, every 2 hours as required.
Agitation	Midazolam 0.5 – 1mg IV, every 30 minutes as required.

Discontinuation of additional precautions, isolation and hospital discharge

It is important to continue additional precautions until a patient is no longer infectious. The recommended way to decide when a COVID-19 patient is no longer infectious is summarised in the following table.

Summary of criteria for discontinuation of additional precautions and isolation

How to determine discontinuation	● Ask **two questions** for **symptomatic** patients and **one question** for **asymptomatic** patients shown below. ● PCR-based criteria is **NOT RECOMMENDED** since RT-PCR results can remain positive for those who are no longer infectious.
Guidance after discontinuation	● Patients can be discharged home or transferred to the normal ward. ● Standard precaution is required if they are transferred to the normal ward. ● Patients can resume normal activities including returning to work.
Symptomatic patients	**1. Have 10 days passed since the patient started to have symptoms of COVID-19?** **2. Have at least 3 days passed since the patient stopped having fevers and respiratory symptoms?** ● If the answer to BOTH questions is YES, then the patient no longer requires isolation. ● If the answer to either question is NO, continue isolation. *For example* ● if a patient had symptoms for two days, then the patient could be released from isolation after **10 days + 3 = 13 days** from date of symptom onset ● if a patient with symptoms for **14 days**, the patient can be discharged **(14 + 3 =) 17 days** after date of symptom onset; ● if a patient with symptoms for **30 days**, the patient can be discharged **(30+3=) 33 days** after symptom onset).
Asymptomatic patients	**1. Have 10 days passed after the positive test for COVID-19?** ● If the answer is YES, then the patient no longer requires isolation.

4. Special considerations for specific populations

Pregnant women

Pregnant and recently pregnant women with COVID-19 might be at higher risk of admission to an intensive care unit. Risk factors for severe COVID-19 in pregnancy include increasing maternal age, high body mass index and pre-existing comorbidities (diabetes and chronic hypertension).[11] There has also been evidence of infection in the third trimester causing premature rupture of membrane, fetal distress and preterm birth. However, existing evidence has not identified major risks of complications in babies born to mothers with COVID-19.

Considerations for pregnant women with suspected or confirmed COVID-19

- Pregnant women with suspected or confirmed COVID-19 infection should be treated with care and therapies as described above for non-pregnant adults with regular reviews by the obstetric team, if such care is available.
- We recommend all pregnant women with a history of contact with a person with confirmed COVID-19 be carefully monitored, considering asymptomatic transmission of COVID-19 may be possible.
- Pregnant women with suspected or confirmed mild COVID-19 may not require acute care in hospital, unless there is concern for rapid deterioration or an inability to promptly return to hospital. It is recommended that she be isolated to contain virus transmission.This can be done at a hospital, isolation facilities or at home, according to established COVID-19 care pathways.
- Where possible, there should be regular consultations with the obstetric, paediatric, and intensive care teams (depending on the condition of the mother and her pre-existing medical conditions)
- Delayed umbilical cord clamping (not earlier than 1 minute after birth) is recommended for improved maternal and infant health and nutrition outcomes. The risk of transmission of COVID-19 through blood is likely to be minimal. There is no evidence that delaying cord clamping increases the possibility of viral transmission from the mother to the newborn. The proven benefits of a 1–3 minute delay, at least, in clamping the cord outweigh the theoretical, and unproven, harms.
- Induction of labour and caesarean section should only be undertaken when medically justified, and based on maternal and fetal condition. COVID-19 positive status alone is not an indication for caesarean section.

Mothers, infants and breastfeeding practices

Relatively few cases have been reported of newborns confirmed with COVID-19; most cases reported were newborns with mild disease. A systematic review has revealed possible vertical

[11] Allotey *et al*, BMJ 2020

transmission in several cases of third-trimester maternal infection within 14 days of delivery, suggesting that congenital infection is possible but uncommon (< 3 to 4 percent of maternal infection).[12]

Mothers should not be separated from their infants unless the mother is too sick to care for her baby. If the mother is unable to care for the infant another competent family caregiver should be identified. Mothers and infants should be enabled to room-in together for skin-to-skin contact, including kangaroo mother care, especially immediately after birth and during establishment of breastfeeding. This is regardless of whether they or their infants have suspected or confirmed COVID-19 infection. Mothers should wear appropriate IPC when handling their infants.

Please note, there is a separate **COVID-19 guideline for Paediatric Health Care Workers**, available from: https://pngpaediatricsociety.org/

Guidance for breastfeeding for infants born to mothers with suspected or confirmed COVID-19

- Regardless of the mother's COVID-19 status, standard infant feeding guidance should be adhered to.
- This means that breastfeeding should be initiated within 1 hour of birth and exclusive breastfeeding should continue for 6 months.
- If a mother with COVID-19 is too unwell to breastfeed directly, mothers should be encouraged and supported to express milk, and safely provide the expressed breast milk to the infant.
- Every attempt should be made to initiate early breastfeeding. This may be relevant to mothers who give birth by caesarean section, mothers that require a procedure under anaesthesia, or those who haemodynamically unstable that precludes initiation of breastfeeding within the first hour after birth.

[12] Kotlyar *et al*, 2020

Steps for the mother to perform during childcare

- Perform frequent hand hygiene with soap and water or alcohol-based hand rub, especially before contact with her child.
- Perform respiratory hygiene: sneeze or cough into a tissue and immediately dispose of the tissue. Hands should immediately be washed with soap and water or alcohol-based hand rub.
- Clean and disinfect surfaces with which the mother has been in contact.
- Wear a medical mask until symptom resolution and criteria for release from isolation have been met.
- Additionally, breastfeeding mothers should be helped to clean her chest with soap and water if she has been coughing on it before breastfeeding. She does not need to wash her breasts prior to every breastfeed.
- While mothers are recommended to wear medical masks, if the mother does not have a medical mask, she should still be encouraged to continue breastfeeding as the benefits of breastfeeding outweigh the potential risks of transmission of the virus when breastfeeding while applying other IPC measures. **Babies do not require a mask.**
- Breastfeeding counselling, basic psychosocial support and practical feeding support should be provided to all pregnant women and mothers with infants and young children if either of them have suspected or confirmed COVID-19 infection.

Elderly patients

Older age has been reported as a risk factor for increased mortality in those affected by COVID-19. They are also more vulnerable to severe COVID-19.

Guidelines for screening of the elderly

- Older people should be screened for COVID-19 at the first point of access to the health system.They should be recognized promptly if they are suspected to have COVID-19 and treated appropriately according to established COVID-19 care pathways. This should occur in all settings where older people seek care; including but not limited to facility-based emergency units, primary care, prehospital care settings and long term care facilities.
- Older patients may present with atypical symptoms of COVID-19. Atypical symptoms include fatigue, reduced alertness, reduced mobility, diarrhoea, loss of appetite, delirium and absence of fever.
- It is advisable to review medication prescriptions in the elderly as they might be on multiple medications. This will also prevent medicine interactions and adverse events for those being treated with COVID-19.
- For older people with probable or suspected COVID-19, make sure their treatment takes into account a thorough understanding of the person's life, values, priorities, and preferences for their care. Where possible, involve caregivers and family members in decision-making and goal setting.
- Ensure multidisciplinary collaboration among community workers, physicians, nurses, pharmacists, physiotherapists,social workers, mental health providers and other health care professionals in the decision-making process to address multimorbidity and functional decline. This would include addressing malnutrition in the elderly, hearing and visual impairments, declined cognitive state, longer rehabilitation post COVID-19 infection, and chronic infections like TB.

Non-communicable diseases (NCD)

Pre-existing NCDs including cardiovascular disease, diabetes, chronic respiratory disease, hypertension and cancer, have been identified as independent risk factors for death.

It is recommended that when caring for patients with suspected and confirmed COVID-19 with underlying NCDs; to continue or modify previous medical therapy according to the patient's clinical condition.

Antihypertensive drugs should not routinely be stopped in patients with COVID-19, but therapy may need to be adjusted based on general considerations for patients with acute illness, with particular emphasis on maintaining normal blood pressure and renal function.

Metformin, a common anti-diabetic drug, is thought to offer cardiopulmonary protection in COVID-19.[13] Studies are still ongoing on its definitive role. Similarly, it has been suggested that antihypertensive drugs that exert their effect by inhibiting ACE or blocking the ACE 2 receptor may either aggravate or ameliorate the clinical course of patients with COVID-19. To date, there

[13] Malhotra *et al*. 2020

are no studies that can substantiate this, and it is generally advised to continue these medications unless there are other reasons to stop these. (e.g. hyperkalaemia, hypotension or acute deterioration in renal function).

Tuberculosis (TB) and COVID-19

Papua New Guinea (PNG) is included in the top thirty countries globally with the highest burden of TB, MDR-TB and TB/HIV. The estimated incidence of TB was 37,000 (30,000 – 45,000) patients with a rate of 432 per 100,000 population in 2018,[14] which is one of the highest globally and in the Western Pacific Region. In 2018, the number of new and relapse TB cases notified was 27 887, and the estimated treatment coverage was 75%. TB is a leading cause of death in PNG.

TB and COVID-19 are both infectious diseases that primarily attack the lungs. As the COVID-19 pandemic advances, more people including TB patients will be exposed to COVID-19. A positive result for COVID-19 infection **does not exclude** the possibility of concomitant TB, particularly in high TB burden settings like PNG.

Transmission of TB and COVID-19

Tuberculosis transmits through **airborne transmission** while COVID-19 is predominantly spread through **respiratory droplets and contact transmission.** Aerosol transmission is possible in specific circumstances and settings in which procedures that generate aerosols are performed.

Symptoms of TB and COVID-19

While fever and cough in COVID-19 have a rapid onset with an incubation period of mostly 5 - 6 days and up to 14 days after exposure, the clinical manifestations of TB typically develop over a much longer period of two weeks and above after exposure. The coughing in TB is usually productive cough with sputum and even blood-stained, while in uncomplicated COVID-19, the cough is usually dry at presentation. When shortness of breath occurs in COVID-19 it develops soon after onset; in TB this usually happens at a much later stage or as a long-term sequelae, often accompanied with weight loss and night sweats.

If after the first weeks of the COVID-19 the illness progresses to symptoms of haemoptysis, persistent fevers, night sweats or weight loss, it is important to consider the possibility of TB in a patient with COVID-19.

Diagnosis of TB and COVID-19

The diagnostic methods for TB and COVID-19 are quite distinct. A careful history of exposure to both COVID-19 and TB, past episodes of TB in the patient, and information about contacts are important steps in diagnosis.

[14] WHO 2019

In order to prevent poor treatment outcomes, including death, early diagnosis of both TB and COVID-19 is important. Older age and certain comorbidities like diabetes mellitus and chronic obstructive pulmonary disease (COPD) increase the likelihood of severe COVID-19 and the necessity for intensive care and mechanical ventilation. These risk factors are also poor prognostic factors in TB.

TB patients who have lung damage from past TB sequelae or COPD may suffer from more severe illness if they are infected with COVID-19. If both TB and COVID-19 are clinically suspected, patients should receive tests for both diseases even if the clinical picture is atypical. More evidence on how COVID-19 impacts on TB outcomes of people with other risk factors such as malnutrition, renal failure and liver disease are awaited.

Treatment of TB and COVID-19

In most cases, TB treatment is not different in people with or without COVID-19 infection. TB preventive treatment, treatment of drug-susceptible and drug-resistant TB should continue uninterrupted as it is important to safeguard the patient's health. Experience in joint management of both COVID-19 infection and TB remains limited.

Comparison of clinical characteristics and management between TB and COVID-19

	COVID-19	Tuberculosis
Route of transmission	• Mainly contact and droplet	• Airborne
Disease progression	• Acute with incubation period of mostly 5-6 days up to 14 days	• Sub-acute, usually over several months
Symptoms	• Fever • Respiratory symptoms including dry cough and shortness of breath • Fatigue • Myalgias	• Fever • Productive cough • Weight loss • Fatigue • Night sweat • Chest pain
Chest X ray finding	• May be normal in early stage • Consolidation and ground glass opacities with typically bilateral, peripheral and lower lung-zone distributions	• Often normal • Hilar adenopathy • Pleural effusions • Pulmonary infiltrates
Specimen sample and diagnostic tests	• Oropharyngeal / nasopharyngeal swab. Sputum or endotracheal aspirate or bronchoalveolar lavage may be used in patients with severe respiratory disease. • PCR test including Xpert	• Sputum , lymph node aspirate, cerebrospinal fluid (CSF), or nasopharyngeal aspirate in children • PCR test including use of Xpert MTB/RIF • Sputum culture
Treatment	• Supportive therapy • Anti virals, dexamethasone and anti-coagulant therapy for inpatients with severe and critical disease	• Anti-tuberculosis treatment
Required precautions	• Standard precaution • Contact precaution • Droplet precaution	• Standard precaution • Airborne precaution
Type of PPE	N95 mask, eye protection, gown and gloves	N95 mask, eye protection, gown and gloves

Eye clinical standards and COVID-19

Eye care professionals should take the following actions in managing eye patients during the pandemic. Communication must be maintained with the PNG NCC COVID-19 Committees should be set up by the respective PHA Hospital in response to the COVID-19 pandemic.

On arrival
All patients seeking eye care would have been screened prior to entry into the health facility. ● Case definition **not met** and **urgent care**: Examination in the eye clinic may resume. Staff are to wear gloves and surgical masks and examine the patient through a slit-lamp shield at the eye clinic. ● Case definition **met:** maintain isolation of patient and await further instructions. If eye condition is urgent, patient may be assessed and treated by the ophthalmology team at the COVID-19 assessment area or isolation area wearing appropriate PPE. ● **All other non-urgent cases are not allowed** No patient should be allowed into the eye clinic unless the eye condition is severe and sight threatening.
During consultation
If the case is a COVID-19 suspect (PUI) or a documented confirmed COVID-19 case needing **urgent eye care,** eye care workers must wear PPE including face shield and slit lamp shield, in line with standard IPC. Use a surgical mask if a N95 mask is unavailable. A **N95 mask must be worn** if a patient undergoes an AGP. If COVID-19 is suspected and considered possible when an eye examination is already in progress (and patient has not been screened), do the following: ● Assess a suitable and safe point to bring the consultation to a close, withdraw from the room, close the door and wash your hands thoroughly with soap and water or alcohol-based hand rub. ● Contact PHA Hospital COVID-19 Response Team immediately. The clinicians will assess the case and advise on the next steps: ○ Case definition **not met**: Routine care in the eye clinic may be resumed with precautions (as above) ○ Case definition **met**: Maintain isolation in the COVID-19 assessment area pending transfer to defined destination.

Sight threatening and urgent eye conditions

Eye condition	Comments
Red painful eye (conjunctivitis,acute angle closure glaucoma, uveitis,endophthalmitis, acute dacrocystitis)	COVID-19 can cause conjunctivitis! So take travel history and observe standard droplet precaution for every patient especially with a fever or cough
Sudden loss of vision	Watch out for CRAO,CRVO,vitreous haemorrhage, CNV
Cataract with pain (high IOP)	Phacomorphic or phacolytic glaucoma
Trauma or injury to the eye	Including foreign bodies to eye
Proliferative diabetic retinopathy	
Rapidly increasing eyelid mass	Eyelid cancer like squamous cell carcinoma or basal cell carcinoma
Proptosis	With decreased vision or positive RAPD or prevents the eyelids from close properly
Bilateral cataract in children	Can cause amblyopia if not treated on time
Eye screening for newborns or premature babies	

Disposal, cleaning and decontamination of the eye clinic

After a suspected or confirmed case has been seen in the eye clinic:

- The room or isolation area where the patient was placed should not be used
- The room door should remain shut, area cordoned off, with windows opened and the air conditioning switched off, until it has been cleaned with detergent and disinfectant.
- If a suspected case spent time in a communal area – for example, a waiting area or toilet facilities, then these areas should be cleaned with detergent and disinfectant as soon as practicably possible.
- The usual PPE equipment disposal protocols apply when cleaning and disinfecting.
- Remove and discard PPE as clinical waste.

5. Infection Prevention and Control (IPC)

Refer to the updated "**National Guidelines on Infection Prevention and Control for COVID-19**" for detailed information.

IPC is extremely important, particularly in the context of COVID-19 as it is a highly transmissible virus. Keeping healthcare workers safe is paramount. Alcohol-based hand rub, soap and paper towels should be readily available throughout the hospital for the use of staff, patients and other visitors.

Standard precautions

Standard precautions represent the minimum infection prevention measures that apply to all patients. Standard precautions are used at all times on all patients and are designed to protect and prevent the spread of infection amongst patients and healthcare workers.

Standard precautions are

- Hand and respiratory hygiene
- The use of appropriate PPE according to risk assessment
- Safe injection practices
- Safe waste management
- Environmental cleaning and sterilization of patient-care equipment.

Hand hygiene

HWs' hands play a crucial role in the transmission of the virus. Regular hand-hygiene is one of the most effective actions HW's can take to reduce the spread of COVID-19. Hand hygiene includes either cleansing hands with an alcohol-based hand rub (ABHR) or with soap and running water.

HWs should apply the WHO **5 moments of 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.

Hand hygiene tips

- **ABHR**s are preferred if hands are **not visibly soiled**; All surfaces of the hands should be rubbed with ABHR for 20-30 seconds. Allow to dry well before touching a patient or surfaces.
- **Wash hands with soap and water** when they are **visibly soiled**; Once hands are wet all surfaces are washed thoroughly with soap for at least 30 seconds, then rinsed and dried thoroughly with a towel.
- **Soap** is particularly effective at inactivating an enveloped virus like COVID-19 due to its oily surface. The surface is dissolved by soap thereby killing the virus. The mechanical action of handwashing is also effective at removing the virus.

For further information, see National IPC guidelines for COVID-19

Respiratory hygiene

Respiratory hygiene and cough etiquette

Measures to contain respiratory secretions

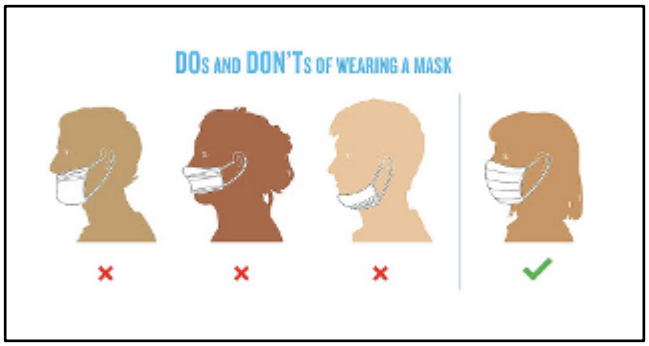
- Cover your mouth and nose with a tissue when coughing or sneezing.
- If you don't have a tissue, cough or sneeze into your elbow.
- Throw the tissue away immediately after use and perform hand hygiene (i.e.: ABHR or hand washing with soap and water).
- Perform hand hygiene after any contact with respiratory secretions (such as wiping a child's running nose or sneezing)
- Offer a surgical face mask to patients with suspected COVID-19 infection while they are in waiting / public areas or in cohort rooms.

Use of masks

- Medical masks are essential PPE when engaging with patients with suspected, probable or confirmed COVID-19.
- Respirator masks (such as N95) should be used in settings where procedures generating aerosols are performed and must be fitted to ensure the right size is worn

How to wear a mask

- Clean your hands before you put your mask on, as well as before and after you take it off.
- Make sure it covers both your nose, mouth and chin.
- Avoid touching the mask while wearing it.
- Remove the mask by untying it from behind, not touching the front of the mask.
- Replace masks as soon as they become damp with a new clean, dry mask.
- Avoid reusing single-use masks.
- Perform a mask seal check, prior to use, each time a respirator mask is applied.



For further information see the **National IPC guidelines for COVID-19**

Use of Personal protective equipment (PPE)

Rational, correct, and consistent use of PPE helps to reduce the spread of pathogens.

The type of PPE used when caring for COVID-19 suspected or confirmed patients will vary according to the setting, type of personnel, and activity.

In the context of COVID-19, a risk assessment is undertaken at triage, on assessment and throughout the patient's care, based on the presence of symptoms or pathological confirmation. Based on this, a decision of PPE should be made and clearly communicated. See Annex 7. Appropriate Use of PPE

How to put on and remove PPE

PPE is safe and effective when used correctly. PPE is "**donned**" (i.e. put on) before entering a room / zone and **"doffed"** (i.e.: removed) when leaving.

For visual guidance on how to put on and remove PPE

- When **all items are required** see: Annex 8: How to put on and remove PPE
- For **aerosol generating procedures** see: Annex 9: How to put on and remove PPE for aerosol generating procedures

Avoiding self-contamination and the spread of microorganisms whilst wearing PPE

- Avoid touching hair, neck or face
- Limit surfaces touched
- Change gloves when torn or physically contaminated
- Try to '**bundle cares**' where possible, i.e. plan ahead and do whatever is needed in "bundles" of care rather than entering and re-entering the space over and over.

Additional precautions for suspected or confirmed COVID-19 cases

Additional precautions or transmission-based precautions are used when standard precautions alone are insufficient to interrupt the transmission of a pathogen. Additional precautions include **contact precautions, droplet precautions and airborne precautions**, which are designed to limit transmission of certain organisms and clinical conditions.

Principles of contact and droplet precautions

- **Contact Precautions** protect individuals by minimising the COVID-19 transmission risk from:
    - direct physical contact with the patient
    - indirect contact from shared patient care equipment or from contaminated environmental surfaces.
    - Contact precautions include using a medical mask, full length gown with long sleeves and gloves
- **Droplet Precautions** protect the individual's nose, mouth and eyes mucosa from droplets produced by the patient's coughing and sneezing. Droplet precautions include eye protection (face shield or goggles, medical mask, full length gown with long sleeves and gloves.

The combination of contact and droplet precautions (**in addition to standard precautions**) must be in place while caring for, or in contact with a suspected OR confirmed COVID-19 case.

Airborne precautions and aerosol generating procedures (AGP)

Healthcare workers performing **AGP** should also apply airborne precautions:

Principles of airborne precautions

- Airborne precautions protect HWs' respiratory tract from very small and unseen airborne droplets that become suspended in the air.
- Airborne transmission may occur via small-particle aerosols containing germs that remain infective over time and distance.
- During AGPs, these small and unseen airborne droplets become aerosolised.
- A correctly fitted respirator mask protects the wearer against these aerosolised droplets.

Examples of AGP's

- Intubation and extubation
- Cardiopulmonary resuscitation
- Manual ventilation (using a bag-valve-mask system prior to intubation)
- Bronchoscopy
- Tracheostomy care (all cares including suctioning associated with tracheostomy)
- Sputum induction (using nebulised aerosol hypertonic saline)
- Autopsy

It remains unclear whether aerosols generated by nebulizer therapy or high-flow oxygen delivery are infectious, as data on this is still limited. However, to protect HWs, airborne precaution is recommended for such procedures.

Airborne precautions include eye protection (face shield or goggles), N95 mask, full length gown with long sleeves and gloves. See Annex 7. Appropriate Use of PPE

IPC measures for the screening, assessment and isolation areas

Screening area
• There should only be one entrance to the health facility • The person stationed at the screening site can be non-clinical, e.g. a security guard or cleaner but needs to be trained in infection prevention and control measures. • They should wear a medical mask and maintain at least 1.5 metre distance from other people • They need to perform hand hygiene frequently. • The screening station should be equipped with a hand sanitizer, thermometer and extra medical masks to give to people who are not wearing a mask with a cough or other positive symptoms • There should be information on hand and respiratory hygiene as well as common COVID-19 symptoms
Assessment area
• The assessment area must be staffed by clinicians. • Clinicians in this area should wear gloves, long sleeved gown and medical mask. • Clinicians must also wear a respirator mask (e.g. N95) and face shield when taking a swab.
Isolation area
• Each health facility should have an area where they can isolate patients who are suspected or confirmed of having COVID. • If someone requires hospitalization, where possible they should be admitted to a single room while awaiting the results of their COVID-19 test. • If a single room is not available, cohort patients with suspected COVID-19 in the same room with at least 1.5 metre distance. • Ensure there is adequate ventilation in the room. • Oxygen should be ready to give if needed (oxygen cylinder, regulator, nasal cannula, reservoir oxygen masks, pulse oximeter). • The isolation area must be staffed by clinicians. • The clinicians in this area should wear gloves, long sleeved gown and medical mask. • Clinicians must also wear an N95 mask and face shield when performing AGPs.

Visitor access

Ideally no visitors should be permitted in areas with suspected and confirmed COVID cases. There may be times (such as for pastoral care in critical illness or the parent of an unwell child) where it may be appropriate to allow a family to see their relative. If this is the case visitor access should be limited to no more than one dedicated visitor. This visitor should only be allowed if they

are not in a vulnerable group (such as the elderly or immune-compromised) and have been shown how to wear PPE.

Health Worker IPC Management

See **National IPC for COVID-19 guidelines** for more information

Key points

- Health workers (HW) include physicians, nurses, allied health workers (x-ray, laboratory staff, physiotherapists etc.), and administrative and support staff, such as cleaning and laundry personnel, admission/reception clerks, patient transporters and catering staff.
- HW in contact with and/or who care for COVID-19 patients are at a higher risk of infection than the general population.[15]

Mitigating and reducing the risk of HW infection

- Appropriate PPE use, hand hygiene best practices, implementation of universal masking policies in health care facilities, and adequate IPC training and education
- A system for managing **exposures** based on risk assessment should be in place to promote and support HW's reporting of occupational and non-occupational exposures to or symptoms of COVID-19.
- A system for managing **suspected infections**, including measures for HW who test positive for COVID-19 and those who are infected should be in place.
- Clear **criteria for returning to work** should be established according to the WHO principles for discontinuing isolation for COVID-19.

[15] WHO

Health-worker exposure risk and advised action

Exposure type	Advice
Lower risk exposure in the workplace: ● Provided direct care to COVID -19 patient while wearing required PPE and following IPC precautions ● Present during an AGP on a patient with COVID-19 while wearing required PPE and following IPC precautions ● Exposure to a colleague who is a suspect or COVID-19 positive case at work while wearing a mask.	**No symptoms (asymptomatic)** ● May continue to work following IPC measures. ● Reinforce IPC measures. ● Self-monitor for symptoms for 14 days and report immediately if any symptoms develop. ● If positive, identify contacts and follow up according to contact tracing procedures. ● Test for COVID-19, if resources are available.
	Symptomatic ● Staff member to self-isolate. ● Test for COVID-19 ● If positive, identify contacts and follow up according to contact tracing procedures. See guidance below for return to work.
Higher risk exposure in the workplace: ● Provided direct care to COVID-19 patient with no or inappropriate PPE, or a breach in PPE integrity or other IPC precautions not followed ● Present during an AGP without or inappropriate PPE, breach in PPE integrity, or other IPC precautions not followed ● Exposure (>15 min face-face contact, < 1m) to a colleague who is identified as positive for COVID-19 with no masks (e.g. in a break room, while eating etc.), ● Exposure to splash or spray of body fluids/blood and/or a puncture/sharp injury.	**No symptoms (asymptomatic)** ● Staff to quarantine for 14 days after last exposure. ● Staff to remain off work for 14 days from last exposure. ● Test for COVID-19 ● If positive, identify contacts and follow up according to contact tracing procedures. ● Monitor daily for symptoms and notify necessary authorities
	Symptomatic ● Staff member to self-isolate. ● Test for COVID-19 ● If positive, identify contacts and follow up according to contact tracing procedures ● See the guidance below for return to work.
Non-occupational exposure ● e.g. contact with a confirmed case who is a family or community member without proper precaution	**Asymptomatic** ● Quarantine for 14 days after the exposure. ● Test for COVID-19. If positive, identify contacts and follow up according to contact tracing procedures. ● Monitor daily for symptoms and notify necessary authorities
	Symptomatic ● Staff member to isolate. ● Test for COVID-19. ● If positive, identify contacts and follow up according to contact tracing procedures. ● See the guidance below for return to work.

Measures for health-workers positive for COVID-19

Health worker status	IPC Measures
Health worker tests COVID-19 positive (with or without symptoms)	• Isolate in a health-care facility, designated setting (e.g. health-care facility, nontraditional facility), or at home as appropriate and according to clinical condition for a minimum of 10 days plus 3 days without symptoms
Health worker is symptomatic but tests negative for COVID-19	• Follow guidance for diagnostic testing for COVID-19 • Consult with the appropriate authority on whether to return to work and consider if additional testing is required for alternate diagnoses according to local guidance • Any HW permitted to return to work should be advised of symptoms to monitor and follow infection control guidance as described above, including the use of appropriate PPE.

Return to work should be decided on a case by case basis in collaboration with the IPC focal point and should include the HW's own preferences.

Conditions for determining whether a HW can return safely to work

- Their unit (dedicated to COVID-19 patients, ICU or long-term care versus, direct patient care, or non patient-facing care)
- Clinical conditions (e.g. immunocompromised) of the patients for whom the health worker may provide care
- Facility IPC measures and use of universal masking as per WHO Advice on the use of masks in the context of COVID-19 guidance
- The HW's general health, and severity of previous illness with COVID-19

See the **National IPC for COVID-19 guidelines** for more information on Management of HW infection.

6. Considerations for routine health services

Health systems are being challenged by increasing demand for care of people with COVID-19, compounded by fear, stigma, misinformation and limitations on movement that disrupt the delivery of health care for all conditions. When health systems are overwhelmed and people fail to access needed care, both direct mortality from an outbreak and indirect mortality from preventable and treatable conditions increase dramatically. Maintaining population trust in the capacity of the

health system to safely meet essential needs and to control infection risk in health facilities is key to ensuring appropriate care-seeking behaviour and adherence to public health advice.

Immunization

Disruptions in immunization services, even for a brief period, result in increased numbers of susceptible individuals and an increased risk of outbreaks of vaccine-preventable diseases (VPDs) (e.g. measles, polio, diphtheria, pertussis, meningococcal disease, typhoid, cholera, influenza and yellow fever), leading to excess morbidity and mortality.

Because of the high morbidity and mortality associated with VPD outbreaks, WHO recommends that countries continue routine immunization services wherever feasible. Many countries have already temporarily postponed preventive or outbreak response mass vaccination campaigns.

Recommended programme adaptations include improving microplanning, providing training and building capacity. It will be important to closely monitor vaccine stocks and initiate forecasting of required vaccines and related supplies for catch-up vaccination and other immunization activities.

The polio programme continuity guide provides specific guidance.[16]

Countries are strongly advised to maintain their VPD surveillance and their monitoring of adverse events following immunization, and to closely monitor any disruption to immunization activities in order to intensify efforts to track and vaccinate missed individuals at the earliest opportunity.

Countries must frequently reassess decisions to adapt immunization services and resume full services as soon as is safely possible, while monitoring vaccine stocks, related supplies and catch-up needs. Any policies that might limit catch-up efforts (e.g. restrictions on age or target group), and when immunization takes place, should be reviewed and considered for revision.

Catch-up vaccination schedules should be linked to the national immunization schedule, include clear directives on the minimum intervals permissible between doses and be widely disseminated. Community engagement plans should be developed to help ensure that the concerns of health workers and the population are addressed and that communities are encouraged and feel safe to seek vaccination services.

Review of vaccination status, with referral for any needed vaccines, should be part of every health facility visit. For more details, see WHO interim guidance on immunization services during the COVID-19 pandemic and frequently asked questions.[17]

[16] Ref: Interim guidance for the poliomyelitis (polio) surveillance network in the context of coronavirus disease. WHO, 2020
[17] WHO, 2020

Suggested modifications in programme activities for immunization

Programme activities	Modifications for safe delivery of services	Transition towards restoration of activities*
Routine immunizations: ● fixed services ● outreach ● services ● mobile clinics	Maintain routine immunization but modify sessions to eliminate risk of infection transmission as follows: ● Train staff on IPC and delivery protocols. ● Provide facilities with adequate IPC equipment, including for waste management. ● Plan several small sessions per day at different times to limit contact. ● Limit the duration of stay in the health facility. ● Modify session locations to ensure separation of immunization services from treatment areas, and proactively inform communities about this strategy while reinforcing the value of vaccination. ● Establish a screening process before allowing entry to the vaccination area. ● For outreach and mobile services, proactively engage with communities to identify open sites that allow physical distancing.	Resume comprehensive services as soon as supply chains are ensured, sufficient health workers are trained in IPC, and revised operating procedures are in place to accommodate physical distancing. Catch-up activities should not wait for the lifting of restrictions and should proceed even when other immunization activities are suspended. Consider resuming immunization services based on the COVID-19 situation at the subnational level. Consider periodic intensification of routine immunization services to ensure rapid catch up for children and adolescents.
Mass vaccination Campaigns ● Preventive ● Outbreak response	Undertake a systematic decision-making process to assess the risks and benefits of implementing mass vaccination campaigns (both preventive and outbreak response) with the active engagement of local oversight bodies, such as national immunization technical advisory groups. Modifications could include using physical distancing measures, measures to avoid oral dropper contamination, and context-suitable adaptations to enable caregivers to administer vaccines to children under vaccinator supervision.	Monitor for increases in VPDs to identify the need for campaigns and ensure readiness: ● adopt microplans to account for all missed cohorts; ● confirm adequate stocks of vaccines and related supplies; ● ensure that health workers are trained in new IPC and physical distancing measures. Consider mass vaccination campaigns that integrate multiple antigens or the delivery of other health interventions.

VPD surveillance (including for polio, measles, and other priority VPDs)	Maintain minimum recommended VPD surveillance and risk assessment activities. To minimize the exposure of personnel and communities to COVID-19 consider (a) delaying in-person training and meetings or conducting them remotely if feasible and (b) discouraging community-based surveillance for polio. Establish protocols for joint implementation of VPD and COVID-19 surveillance, and upgrade data and laboratory systems as needed to support this expanded portfolio of work. Maintain case detection and reporting, and specimen collection, modifying where there are transport disruptions to ensure specimens are stored under proper conditions until delivered to the laboratory.	Restore when full resumption of VPD surveillance is possible. Adjust for evolving VPD epidemiology.
Poliovirus containment	Inventories of supplies for vaccination against polio types 1 and 3 should be conducted and reported through the coordinators of the national authorities of containment or the national certification committee to regional certification committees, when possible. National authorities of containment should continue their dialogue with, and oversight of, their poliovirus-essential facilities to progress the containment certification progress. Exchanges should continue among national authorities of containment, the Containment Working Group of the Global Commission for the Certification of the Eradication of Poliomyelitis and the Containment Advisory Group.	

Maternal and newborn health

Reductions in access to and utilization of essential maternal and newborn health (MNH) services during epidemics translate into important increases in the number of women and newborns who suffer complications or die during pregnancy, childbirth and the postnatal period. WHO recommends that all essential elements of antenatal care (ANC) and postnatal care (PNC) are maintained and that women and newborns have access to skilled care at all times, including referral for the management of complications and for auxiliary services, such as laboratory, blood banks and timely and safe transport to health facilities.

Risks for mothers and newborns of adverse outcomes associated with unattended childbirth outweigh the potential risks of COVID-19 transmission at health facilities. Essential commodities and supplies should be in stock and available for ANC, childbirth and PNC services, including newborn care.

Mothers with suspected or confirmed COVID-19 should be encouraged to initiate and continue skin-to-skin contact and breastfeeding with appropriate precautions.

Suggested modifications in programme activities for maternal and newborn health

Programme activities	Modifications for safe delivery of services	Transition towards restoration of activities
Delivery of eight ANC contacts according to national guidelines	Where comprehensive facility-based services are disrupted: ● prioritize ANC contacts for low-risk pregnant women during the third trimester and for all pregnant women who are assessed as high risk, including women with comorbidities, who are underweight or overweight, adolescent girls, women at risk of common maternal mental health conditions, or other vulnerable groups; ● ensure that birth preparedness and complications readiness plans are adapted to take into account changes to services. Offer 2–3 months of recommended micronutrient supplements and ITNs. Whenever possible, book ANC visits to reduce overcrowding and plan to provide all relevant care in a single visit. Prioritize risk assessments for conditions known to be increased in the COVID-19 context, including tobacco, alcohol and other substance use; common mental health conditions (e.g. anxiety, depression); and gender-based violence.	Ensure targeted outreach strategies are implemented where coverage and careseeking have declined. Plan for catch up of missed ANC contacts, including delivery of tetanus toxoid–containing vaccines, and HIV and syphilis testing. Establish mechanisms for ensuring continued early delivery of missed contacts or content. Plan for catch-up of incomplete home-based records.
Skilled care during labour, childbirth, and the immediate postnatal period in a health facility for a minimum of 24 hours after birth	Maintain maternity waiting homes where they exist, ensuring that appropriate IPC guidance is followed. Ensure birth companions are appropriately screened for COVID-19 infection. Ensure safe transport to care for mothers and newborns. Prioritize support for initiation of skin-to-skin contact and early and exclusive breastfeeding.	

	A caesarean section should be performed based solely on obstetric indications, independent of the COVID-19 transmission scenario and the COVID-19 status of the mother.	
Delivery of four PNC contacts according to national guidelines	Where comprehensive facility-based services are disrupted: ● prioritize PNC contacts with women and newborns during the first week after birth, including PNC contact within the first 24 hours after birth in the case of a home birth; ● prioritize follow up of high-risk women and newborns. Where feasible, use digital health platforms for counselling and screening, including for danger signs. Where in-person visits are necessary, provide all relevant care in a single visit. Offer 2–3 months of recommended micronutrient supplements, ITNs and contraceptives. Consider offering long-acting reversible contraception. Ensure that complication readiness plans are adapted to take into account changes to services.	Ensure targeted outreach strategies are implemented where coverage and care seeking have declined. Plan for catch up of missed PNC contacts or essential elements, including administration of vitamin K and birth dose immunizations for newborns Plan for catch-up of incomplete home-based records.
Management of preterm and LBW newborns	Limit the number of caregivers providing KMC support to one or two trained in IPC with PPE. Develop strategies to enable support to continue KMC in the home. Consider early discharge with follow up of stable preterm or LBW newborns receiving KMC.	

Tuberculosis

A recent modelling estimate suggests that if the COVID-19 pandemic led to a reduction of 25% in expected TB detection for 3 months – a realistic possibility given the levels of disruption in TB services being observed in multiple countries – a 13% increase in TB deaths would be expected, bringing the levels of TB mortality back to those of 5 years ago. Between 2020 and 2025, an additional 1.4 million TB deaths could be registered as a consequence of the COVID-19 pandemic.

In areas with TB transmission, clinicians should always consider whether people presenting with cough, fever, or difficulty in breathing warrant testing for both COVID-19 and TB. Home-based treatment should be facilitated for all people with TB, including providing all-oral treatments for

multidrug-resistant TB and extensively drug-resistant TB. Drug-resistant TB patients on injectables should receive treatment closer to their residence.

Appropriate planning and monitoring are essential to ensure that the procurement and supply of TB medicines and diagnostics are not interrupted.

Suggested modifications in programme activities for tuberculosis

Programme activities	Modifications for safe delivery of services	Transition towards restoration of activities
Prevention	Leverage established TB contact tracing mechanisms for COVID-19 contact tracing. Provide adequate stocks of medications for TB preventive treatment to households in order to minimize facility encounters.	Monitor volume of recruitment for TB preventive treatment and number and yield of TB contact investigations done. Catch up on any contact investigations and TB preventive treatment activities that were suspended.
Diagnosis	Maintain current molecular diagnostic services for TB and do not move equipment from currently designated TB laboratories to respond to the demand for COVID-19 testing. In areas with TB transmission, test for both COVID-19 and TB whenever clinically indicated. ● Special precautions are needed when collecting and transporting sputum samples as well as when samples are received and unpacked in the laboratory. ● Collect sputum in an open, well-ventilated space, away from others and preferably outside in a cough spot or sputum booth. ● Encourage sputum collection at home and give specific instructions as detailed in the previous point.	Monitor requests for TB tests or number of laboratory-confirmed TB cases (or TB notifications) to assess disruptions to TB services during the emergency measures and the competitive use of diagnostic platforms for COVID-19 testing. Maintain universal biosafety precautions; restart sputum collection at facilities.
Treatment and care	Provide adequate stocks of TB medicines to all patients to take home and where possible through treatment supporters to ensure treatment adherence while limiting treatment centre visits. Make alternative arrangements such as outreach activities to reduce visits for TB follow up.	Monitor the use of digital technologies that encourage adherence. Catch up on any TB treatment and care activities that were suspended (e.g. seeing people on waiting list for

	Use innovative communication technologies such as SMS and/ or video-observed therapy to maintain treatment support.	treatment for drug-resistant TB).

HIV

Among people living with HIV, those with low CD4 cell counts and high viral load and those not taking antiretroviral therapy (ART) have a generally increased risk of infections and related complications. While it is unknown if the immunosuppression associated with HIV infection increases the risk of COVID-19 disease or concomitant bacterial infections occurring during ventilation of patients with acute respiratory disorders, given the pandemic context it is prudent to take additional precautions for people with advanced or poorly controlled HIV infection.

Providing early testing, implementing preventive measures, including harm reduction, and ensuring continuity of ART are essential to maintain an effective HIV response during the COVID-19 pandemic.

To limit the potential for disruptions to the supply of ART and other essential medications, WHO recommends dispensing for up to 6 months.

As soon as movement restrictions are relaxed, catch-up campaigns should be considered to improve coverage of testing, prevention and treatment interventions.

TB–HIV coinfection

Provide adequate stocks of TB medicines to all patients to take home to ensure treatment completion without having to visit treatment centres unnecessarily to collect medicines. Use electronic health and mobile health platforms for adherence support. Implement catch-up campaigns for initiation of TB preventive treatment if delayed or missed.

Malaria

Malaria is a rapidly evolving, life-threatening febrile illness with symptoms that overlap with COVID-19. Making simple modifications to current delivery processes will allow malaria prevention to be delivered with minimal risk to health workers and the community. Early diagnosis and treatment are critical to prevent mild cases of malaria from progressing to severe illness or death. Public health messaging will need to be adapted to ensure that people do not delay seeking care for febrile illness.

To minimize the risk of COVID-19 transmission, appropriate PPE should be used for health workers conducting malaria rapid diagnostic tests (RDTs) on people with confirmed or suspected COVID-19. The lack of PPE or RDTs should not delay treatment. In such circumstances and in areas with malaria transmission, people with fever should be treated presumptively for malaria.

For more details, see WHO interim guidance on Tailoring malaria interventions in the COVID-19 response.[18]

Suggested modifications in programme activities for malaria

Programme activities	Modifications for safe delivery of services	Transition towards restoration of activities*
Diagnosis	In areas with malaria transmission, malaria diagnostic testing will be indicated in most people being evaluated for COVID-19. To ensure safety: ● conduct testing for people with suspected or confirmed COVID-19 in a designated area away from other patients. Tests could be done early in the patient flow such that results are available by the time the health worker evaluates the patient; ● for a person with suspected COVID-19, use appropriate PPE to test for COVID-19 and malaria. If PPE is not available, presumptively treat with the recommended antimalarial and arrange for confirmatory malaria testing when possible; ● in all cases, follow local protocols for isolating people with suspected or confirmed COVID-19. Modify to presumptive treatment of fever with ACTs where there are RDT stockouts due to supply chain disruptions and where there is a lack of capacity to perform RDTs. As a temporary measure, decisions can be made about which groups should receive presumptive treatment. These will include people at high risk of severe disease and death (including children younger than 5 years and pregnant women). Decisions should be made about how to use available supplies of RDTs and ACTs to safely manage other suspected malarial and nonmalarial illnesses. Under such circumstances, the priority is to obtain RDTs and relevant PPE.	Pretreatment parasitological testing should be reinstated as soon as RDTs and appropriate PPE are available. Presumptive treatment should be kept to a minimum because this approach will rapidly deplete stocks of ACTs, at which point there will be no treatment for malaria and a markedly increased risk of severe disease and death.
Ensuring prompt access to care and treatment	Modify public health messaging to ensure that people do not delay seeking care for illnesses that could be malaria. Consider increasing support for community-based treatment of fever and malaria to reduce the malaria burden on health facilities and improve access to care in rural and isolated communities.	Emphasize the importance of seeking prompt diagnosis and care for fever in areas of malaria risk. Where appropriate, maintain adaptations that

[18] WHO, 2020

	Where confirmation of parasitological diagnosis is not possible, initiate presumptive treatment for malaria based on symptoms.	have successfully expanded community-based malaria diagnosis treatment activities.
Surveillance	Prioritize the collection of basic minimum data (e.g. number tested; number positive, by parasite species and severity; age; and COVID-19 status, if available) through the health management information system to ensure critical malaria operational planning is maintained (e.g. commodity forecasting). Where possible and indicated, test for malaria and COVID-19 simultaneously.	Return to collecting the full complement of data that facilitates national and subnational planning.

Noncommunicable diseases

COVID-19 can negatively impact NCD outcomes for adults and children through several pathways including the higher susceptibility to COVID-19 infection and higher case fatality rates among people with NCDs. The COVID-19 pandemic provides an opportunity to promote tobacco cessation, which will also benefit the prevention and control of chronic respiratory diseases and other NCDs.

General management of chronic NCDs

Increase awareness of patients with NCDs about their heightened susceptibility to COVID-19 and ways to reduce the risk of transmission and recognize COVID-19 symptoms; this activity should also include information regarding the implications for self-management of NCDs.

- ensure patients with chronic NCDs are aware of when and how to access healthcare services for regular monitoring or urgent care for acute exacerbations or deterioration.
- create self-management plans, and support self-monitoring of disease, if appropriate, that is backed up by health care workers using alternative delivery mechanisms, if needed.
- increase home supplies of medication and stocks of monitoring devices.
- modify routine clinical reviews (e.g. frequency, means of delivery), as appropriate

Management of chronic respiratory diseases such as asthma and chronic obstructive pulmonary disease

In addition to modifying the management of chronic NCDs in general:

- increase patient education to include differentiating symptoms of COVID-19 from the usual cough or symptoms;

- direct patients to online resources for support or training in correct inhaler technique and virtual consultations to reinforce patient awareness and avoidance of triggers for acute episodes to minimize risk of hospital admission;
- if appropriate, ensure patients with asthma have rescue packs (i.e. a short course of steroids) to manage acute exacerbations at home with support, according to self-management plan agreed with clinician

Management of diabetes

In addition to modifying the management of chronic NCDs in general:

- modify the management of severe hypoglycaemia in people with insulin treated diabetes by supplying family with glucagon injection, and educate them about using it at home;
- provide people with type 1 diabetes with urine ketone self-monitoring strips, and ensure phone contact is established with a provider.

Management of CVDs (secondary prevention, including cardiac rehabilitation, for those with existing CVD)

In addition to modifying the management of chronic NCDs in general:

- develop individually tailored health promotion programmes, modifying them to be delivered through mass media campaigns, telephone, SMS text or online resources, as feasible
- extend treatment plans that are likely to expire during movement restrictions
- emphasize the importance of early detection of ischaemic heart disease and stroke and of continued care-seeking for signs of NCD emergencies
- ensure there is proactive follow up and outreach to patients, particularly those avoiding
- visits to health facilities

Specialist care of cancer

- Prioritize timely initiation of cancer treatment for cancers in which delays impact outcomes.
- Because cancer patients with advanced disease who are diagnosed with COVID-19 are at a higher relative risk for a poorer outcome, adaptations to treatment plans may be required.

- Prioritize the treatment of cancers for which the benefits of early initiation of therapy outweigh the risks of initiating therapy in the pandemic context, taking into account exposure risks and the extent to which the patient is immunocompromised. Tailor and modify to individual circumstances and service context:
    - treatment sequence (such as the use of chemotherapy or radiotherapy before surgery)
    - treatment regimens (such as the duration of therapy for patients in deep remission) and/or
- treatment plan (such as candidates for allogenic hematopoietic stem cell transplantation).

For people with cancer who are diagnosed with COVID-19, consider immediately changing their cancer treatment plans, including potentially suspending immunosuppressive therapies.

Renal dialysis

- Facilitate travel to haemodialysis centres and explore possibility of decreasing the frequency of haemodialysis, from three to two times per week, in patients who can tolerate such a regimen
- This will reduce the risk of infection or mitigate a shortage of dialysis supplies, or both.

Surge capacity for healthcare workers

Surge capacity refers to the ability to manage a sudden influx of patients. All health facilities should be aware of their surge capacity. Things to consider include:

- Plan ahead to mitigate the potential shortage of HWs due to the increased number of HWs who may be infected with COVID-19 or quarantined.
- Consider reducing, stopping or postponing non-essential services, such as non-urgent elective surgeries and reducing outpatient visits by prescribing medications for longer term or use of telemedicine.
- Consider expediting licensing for near-graduates and foreign medical graduates who are not practicing. Consider relicensing retired HCWs and those who are not currently in direct clinical roles.
- HCWs who are either pregnant, aged 60 years and above, or who have underlying medical conditions that place them at greater risk of severe complications from COVID-19 should be considered to be re-deployed, wherever possible, to clinical areas and duties that have reduced exposure to patients with suspected or confirmed COVID-19.

References & Appendices

General

- **Clinical Management of COVID-19. Interim guidance.** World Health Organization. 27 May 2020. Available from: https://www.who.int/publications/i/item/clinical-management-of-covid-19
- **COVID-19 guideline for Paediatric Health Care Workers**, available from: https://pngpaediatricsociety.org/

Pathogen and Clinical Features

- **Clinical characteristics of children and young people admitted with COVID-19 in United Kingdom: prospective multicentre observational cohort study**. Swann et al. BMJ, 2020
- **Multisystem inflammatory syndrome in children and adolescents with COVID-19.** COVID-19: Clinical care Scientific Brief. 15 May 2020. Available from: https://www.who.int/publications/i/item/multisystem-inflammatory-syndrome-in-children-and-adolescents-with-covid-19

Case definition, Screening, Diagnosis and Notification

- **COVID-19 Surveillance Standard Operating Procedures**. Papua New Guinea Department of Health. Version 3. 19 October 2020
- **WHO COVID-19 case definition**. Updated in Public health surveillance for COVID-19, published 7 August 2020. Available from: https://www.who.int/publications/i/item/WHO-2019-nCoV-Surveillance_Case_Definition-2020.1
- Surveillance Standard Operating Procedures for COVID 19 response in Papua New Guinea: **COVID-19 SAMPLE COLLECTION SOP** (COVID-19 Surveillance SOP Version 5, 22 October 2020).
- World Health Organization. Global Influenza Programme. Available from: https://www.who.int/teams/global-influenza-programme/surveillance-and-monitoring

Severity Classification and Management

- **Dexamethasone in Hospitalized Patients with Covid-19 – Preliminary Report**. N Engl J Med. 2020 Jul 17
- **Corticosteroids for COVID-19**. World Health Organization. 2 September 2020. https://www.who.int/publications/i/item/WHO-2019-nCoV-Corticosteroids-2020.1
- **Coronavirus Disease 2019 (COVID-19) Treatment Guidelines**. National Institute of Health. 3 November 2020. https://www.covid19treatmentguidelines.nih.gov/
- **"Solidarity" clinical trial for COVID-19 treatments**. WHO. 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments
- **Incidence of venous thromboembolism in hospitalized patients with COVID-19**.

Middeldorp S. et al. J Thromb Haemost. 2020; 18: 1995-2002.

- **Mechanical Ventilation in Adult Patients with Acute Respiratory Distress Syndrome.** An Official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine Clinical Practice Guideline. Available from: https://pubmed.ncbi.nlm.nih.gov/28459336/
- **Predicted body weight Calculator.** NHLBI ARDS Network. Available from http://www.ardsnet.org/index.shtml
- **Ventilatory support of patients with sepsis or septic shock in resource-limited settings**. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4751193/
- **The Confusion Assessment Method (CAM)**. Inouye, Van Dyck, Allessi,Balkin et al,1990
- **Clarifying Confusion: The Confusion Assessment Method: A new method for detection of Delirium**. Inouye SK; Van Dyck CH, Alessi CA,Balkin S, Siegal AP& Horwitz R. *Annals of Internal Medicine.* 1990
- **COVID-19 : what do we know about ICU delirium during SARS-CoV2 Pandemic?** Koftis K, Robertson SW, Wilson JE,Pun BT, Ely EW, Jezowska I, Jezierska M & Dabrowski W. Anaesthesiol IntensiveTher : 52,2: 132-138. 2020
- **Therapeutic Guidelines : Psychotropic Version 4.** Therapeutic Guideline Ltd (2000),Therapeutical Guideline Ltd,Level 2 ,55 Fleming Road,North Melbourne, Victoria, Australia

Special considerations for specific populations

- **Vertical transmission of coronavirus disease 2019: a systematic review and meta-analysis**. Kotlyar AM, Grechukhina O, Chen A, et al. Am J Obstet Gynecol 2020.
- **Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis**. Allotey J, Stallings E, Bonet M, et al. BMJ. 2020;370:m3320. Published 2020 Sep 1. doi:10.1136/bmj.m3320
- **Perspective. ACE-2, Metformin and COVID-19**. Malhotra A, Hepokoski M, McCowen KC and Shyy JY-J. iScience 23. September 25, 2020
- **National Tuberculosis Management Protocol.** National Department of Health, Papua New Guinea. 2017 edition
- **Tuberculosis and COVID-19: Considerations for tuberculosis care**. World Health Organization. WHO Information note. 12 May 2020. Available from: https://www.who.int/docs/default-source/documents/tuberculosis/infonote-tb-covid-19.pdf
- **WHO guidelines on tuberculosis infection prevention and control, 2019 update**. World Health Organization. Available from: https://www.who.int/tb/publications/2019/guidelines-tuberculosis-infection-prevention-2019/en/
- **Alert: Important Coronavirus for Ophthalmologists**. American Academy of Ophthalmology Updates. Available from: www.aao.org
- **COVID-19 Guidelines**. ANZICS, Australian and New Zealand Intensive Care Society, 2020

- **COVID-19 Triage Guidelines**. Royal Australia New Zealand College of Ophthalmology RANZCO. www.ranzco.edu
- **Ophthalmic Practice Guidelines in the Context of COVID-19**. All India Ophthalmology Society. www,aios.org

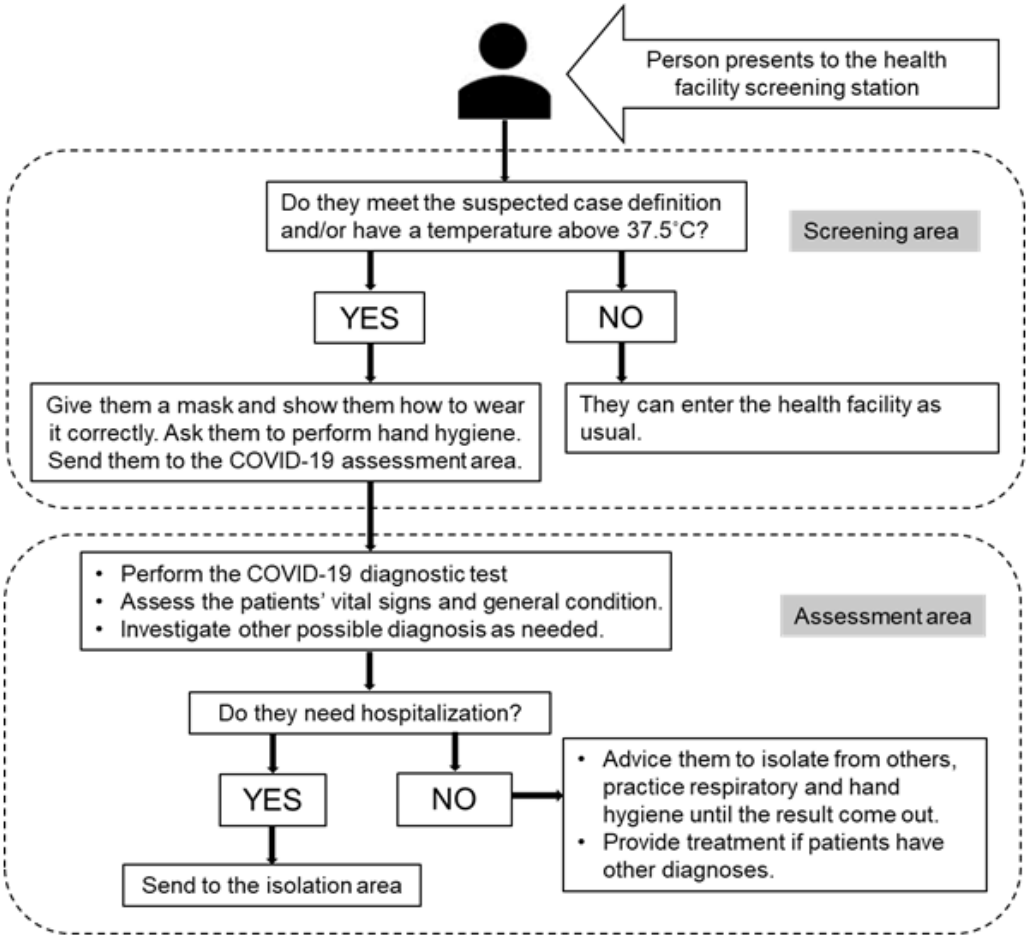
Infection Prevention and Control

- **National Guidelines on Infection Prevention and Control in the context of COVID-19 in Healthcare Settings**. National Department of Health, Papua New Guinea. July 2020
- **Prevention, identification and management of health worker infection in the context of COVID-19: interim guidance**.World Health Organization. 30 October 2020

Considerations for routine health services

- **Maintaining essential health services: operational guidance for the COVID-19 context**. World Health Organization. 1 June 2020. https://www.who.int/publications/i/item/covid-19-operational-guidance-for-maintaining-essential-health-services-during-an-outbreak
- **Guiding principles for immunization activities during the COVID-19 pandemic: interim guidance Interim guidance**. World Health Organization. 26 March 2020. Available from: https://www.who.int/publications/i/item/guiding-principles-for-immunization-activities-during-the-covid-19-pandemic-interim-guidance
- **Interim guidance for the poliomyelitis (polio) surveillance network in the context of coronavirus disease (COVID-19)**. World Health Organization. 4 June 2020. Available from: https://www.who.int/publications/i/item/WHO-POLIO-20.04
- **Tailoring malaria interventions in the COVID-19 response.** World Health Organization. 9 April 2020. Available from: https://www.who.int/publications/m/item/tailoring-malaria-interventions-in-the-covid-19-response
- **National Tuberculosis Management Protocol**. National Department of Health, Papua New Guinea. 2017 edition
- **Tuberculosis and COVID-19: Considerations for tuberculosis care.** World Health Organization. WHO Information note. 12 May 2020. Available from: https://www.who.int/docs/default-source/documents/tuberculosis/infonote-tb-covid-19.pdf
- **WHO guidelines on tuberculosis infection prevention and control, 2019 update**. World Health Organization. Available from: https://www.who.int/tb/publications/2019/guidelines-tuberculosis-infection-prevention-2019/en/
- **Type 2 diabetes in adults: management.** NICE guideline Published December 2015. Available from: https://www.nice.org.uk/guidance/ng28
- **Diabetes Clinical Practice Guidelines for Papua New Guinea**. July 2012. Papua New Guinea Department of Health

Annex 1: Health facility screening and assessment process



Suspected COVID-19 case

A person who meets the clinical **OR** epidemiological criteria:

Clinical criteria

a) Respiratory illness presenting with at least 1 or more of the following signs or symptoms:

- Fever (≥37.5°C or history of fever)
- Cough
- Shortness of breath
- Sore throat
- Loss of smell or taste

Epidemiological criteria

a) Close contact with a confirmed COVID-19 case in the 14 days prior to onset of symptoms

Probable COVID-19 case

a) A person meeting both clinical AND epidemiological criteria OR

b) Clinically suspected case for whom testing could not be performed for any reason OR

c) A **suspected case** for whom testing for COVID-19 is inconclusive by testing laboratory

Confirmed COVID-19 case

a) A person with laboratory confirmation (rt-PCR or GeneXpert) of COVID-19 infection, irrespective of clinical signs and symptoms.

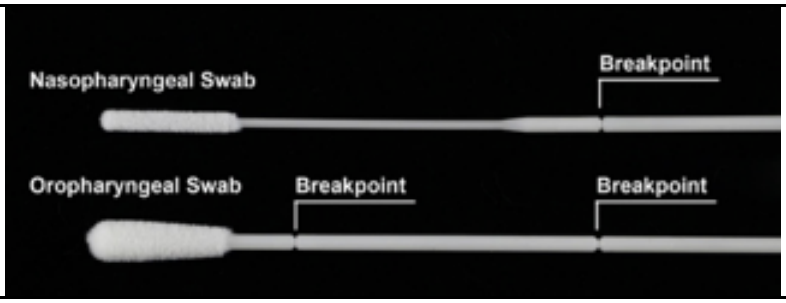
Annex 2: Procedure for sample collection

Equipment and materials required

1. Case Investigation Form (CIF) *(correctly filled out)*
2. Nasopharyngeal (NP) and Oropharyngeal (OP) flocked swab
3. Tube containing universal transport media (UTM) *(correctly labeled)*
4. Tongue depressor
5. Two biohazard bags for disposal of non-sharp materials
6. Tissue for patient to wipe nose before and after sample collection
7. Cooler box and ice packs
8. Ziploc plastic specimen bag
9. PPE & hand sanitizer/alcohol hand rub (minimum 60%)
10. Bleach (0.1%) solution for environmental cleaning

Comparison of nasopharyngeal (NP) and oropharyngeal (OP) swab

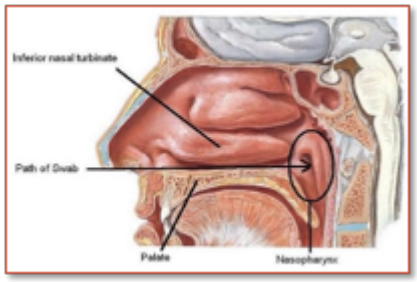
- OP swab has a thicker and less flexible shaft and a larger tip
- Do not use an OP swab to collect a NP sample. Using an OP swab to collect NP samples may result in pain and discomfort, difficulty reaching the nasopharynx and a sub-standard sample.
- **NP swab is the recommended method** to use due to limited contamination from food contamination and particles e.g. betel nut.
- OP is optional if nasopharyngeal cannot be collected as recommended



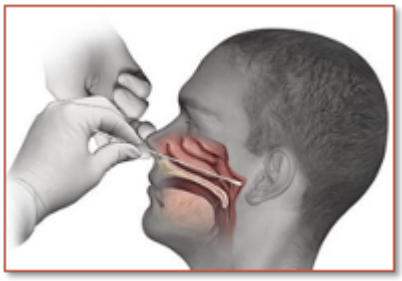
Steps for collection of Nasopharyngeal swab (NPS)

1. Put on (DON) PPE
2. Ask patient to blow nose with tissue
3. Open a sterile flocked swab at the plastic shaft
4. Ask the patient to tilt his/her head back. Estimate the distance from the patient's nose to the ear with your finger or the flock swab to measure how far the swab should be inserted
5. While patient head is tilted, gently insert the swab into the nostril and back (not upwards) to the nasopharyngeal until a slight resistance is met
6. Rotate swab 2-3 times and hold in place for 2-3 seconds

7. If resistance is felt, before reaching the initially estimated measured distance between the nose and the ears, remove and try the other nostril
8. Slowly withdraw the swab and without touching it



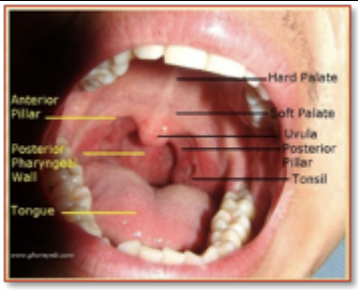
Anatomy of the nasopharynx



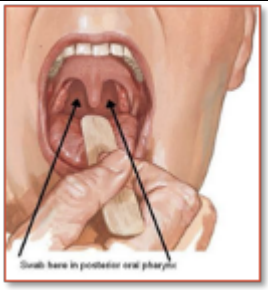
How to collect the NP swab

Steps for collection of Oropharyngeal swab (OPS)

1. Ask patient to rinse mouth prior to swab (particularly if patient has been chewing betel nut), this is to ensure food contaminants and particles are removed before sample is collected
2. Keeping the same pair of gloves on (if collecting the sample after the NPS), collect an OPS. Otherwise first step is to DON PPE
3. Open the OPS at the plastic shaft end
4. Ask the patient to tilt their head back and open the mouth wide
5. Hold the tongue down with a tongue depressor
6. Have the patient say ''aahh'' to elevate the Uvula
7. Swab each tonsil first, then the posterior pharynx
8. Avoid swabbing the soft palate, gums, teeth and tongue. NOTE: Do not touch the tongue with the swab tip as this can induce the gag reflex
9. The OPS can be placed into the same UTM tube as the NPS



Anatomy of the oropharynx



How to collect the OPS

Sample collection for infants (< 1 year) and children

Preferred sample

- Combined deep nasal and oropharyngeal

Equipment

- Use nasopharyngeal swab sticks for all children.
- If smaller infant swab sticks are available, use for children less than 1 year old. If not, use regular sized nasopharyngeal swab sticks

Contraindications to performing a swab

- Children at risk of upper airway obstruction (e.g. croup) who may become compromised further by the swab
- Bleeding disorders - a child with a low platelet count (e.g. <30 x 10^9/L) will need a transfusion or procedure to be deferred. Expert advice is recommended
- Recent facial trauma / fracture / surgery
- Mucositis

Potential complications

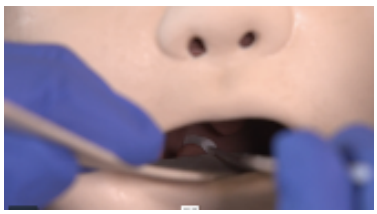
- Bleeding - there may be slight bleeding from the nose in some children

Steps

1. Prepare equipment
2. Explain to parent and child about procedure, sitting position during sampling and sensation when swab is inserted (tingly, eyes watering, possibility of mild nose bleed)
3. Arrange distraction techniques (toys etc.)
4. If child is cooperative, ask child to blow his/her nose and rinse mouth before procedure
5. Put on (DON) PPE
6. If the child is uncooperative, position the child/infant in a comfortable, secure position, preferably on a parent's lap - the parent should cross one arm across the child's body to hold the arms and place the other hand on the child's forehead.
7. First take an OP (oral cavity) swab. Then use the same swab stick to take a nasal sample from one nasal cavity.
8. OP swab sampling may be difficult or unsuccessful in younger children, especially infants. In this case, take samples/swabs from both nasal cavities with the same swab stick.
9. **Technique for OP swab:** Ask the child to say loud 'Ahhh'. Press tongue down lightly with tongue depressor. Insert swab and touch both tonsils and posterior pharynx (about 3 -5 seconds). Avoid touching the tongue.
10. **Technique for nasal swab:** Hold the swab with a pencil grip and insert horizontally (with child in sitting position) into one nostril parallel to the palate. Insert to the following depth or until resistance is met:
    - 1 cm if <2 years
    - 1.5 cm if 2-6 years
    - 2 cm if 6-12 years
    - 2-3 cm if >12 years

    Rotate the swab 5 times (5 seconds) against the nasal wall. Follow same method for the other nostril

How to position the child/infant



Technique for OPS

Technique for nasal swab

Post-mortem specimen collection from a patient who had respiratory illness before death

For a death in which the patient had respiratory illness and a specimen was not collected before death, collect the following post mortem specimen:

- Collect post-mortem NP or OP swab specimens for COVID-19 testing as soon as possible.
- Specimens can be collected up to 3 days after death as the virus may still be detected; however, sensitivity may be reduced with a longer post-mortem interval.

Procedure after taking the swab

- Place the swab into the UTM tube and break off the shaft at the break point line
- Tightly close the tube
- Ensure patient information (patient's full name and date of birth) on the UTM matches with the information on the CIF. This will ensure no samples are mismatched or unmatched during sorting of samples at the laboratory
- Pack **UTM into the ziplock biohazard bag** and place **CIF in the side pouch** (do not place the CIF inside the Ziploc bag containing specimen, this is to avoid risk of contamination)
- Take off (DOFF) PPE
- Wash hands with soap and water or alcohol hand rub

Transport, package and storage of specimen

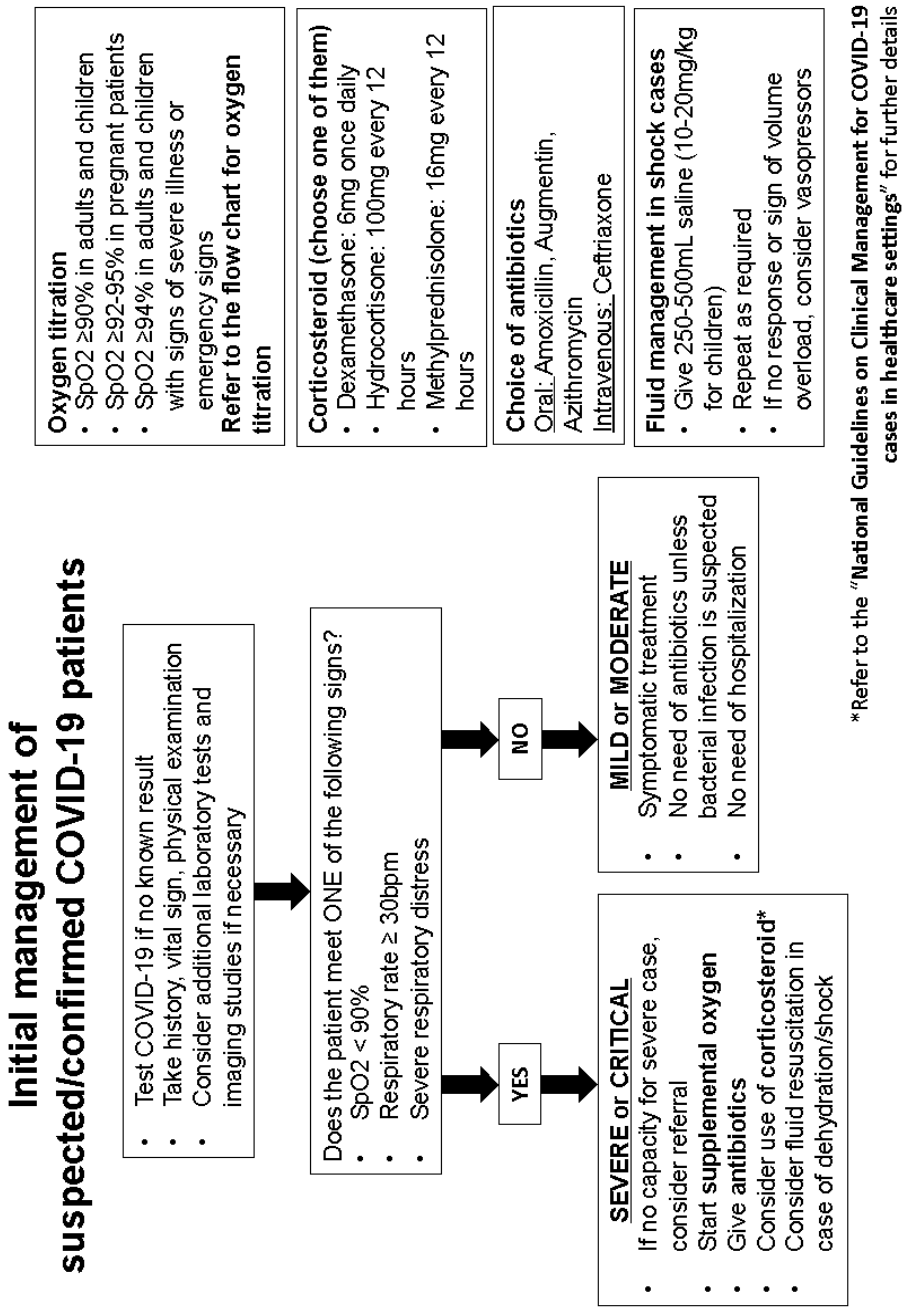
- Transport specimen to the lab in an esky (portable cooler or ice box) on ice as soon as possible (within 4 hours of collection). If there will be a delay in transportation, store the specimen at a temperature of 2-8°C
- Specimen must be shipped to CPHL or IMR within 24 hours of collection if possible or maximum can be within 48 hours. Specimen can be shipped via TNT Courier Company using WHO account or via road if possible
- Ensure all shipments are placed in a cooler box with ice packs to keep the specimen at 2-8°C during transportation.
- Have a certified shipper of dangerous goods inspect to assist you with packaging and shipment of specimen. Triple packaging of shipment is highly recommended at all times (see the **Sample collection Standard Operating Procedure** for list of certified shippers in each province).

Annex 3: COVID-19 disease severity assessment for adults and children

Severity	Clinical Syndromes	SpO_2	Respiratory rate
Mild	• Any symptoms (as table below) • Without evidence of pneumonia	≥90%	Normal
Moderate	<u>Adolescent or adult</u> • Clinical signs of pneumonia (cough, dyspnea, fast breathing) • Without signs of severe disease	≥90%	< 30
	<u>Child</u> • Clinical signs of pneumonia (cough or difficulty breathing + tachypnea and/or chest indrawing) • Without signs of severe disease	≥90%	< 2months: ≥ 60 2-11 months: ≥ 50 1-5 years: ≥ 40
Severe	<u>Adolescent or adult:</u> Pneumonia with following clinical manifestations • SpO_2 < 90% • Respiratory rate ≥ 30bpm • Severe respiratory distress	<90%	≥30
	<u>Child</u> Pneumonia with following clinical manifestations • Central cyanosis • SpO_2 < 90% • Fast breathing • Grunting • Severe chest indrawing • General danger sign (inability to breastfeed or drink, lethargy, unconsciousness, or convulsions) While the diagnosis is made on clinical grounds; chest imaging may identify or exclude some pulmonary complications.	<90%	< 2months: ≥ 60 2-11 months: ≥ 50 1-5 years: ≥ 40
Critical	• Severe disease requiring mechanical ventilation. • Severe disease with sepsis or septic shock.		
Common symptoms	**Less common symptoms**	**Common symptoms in children**	

• Fever • Cough • Fatigue • Anorexia • Shortness of breath • Myalgias	• Sore throat • Nasal congestion • Headache • Diarrhoea • Nausea and vomiting • Loss of smell preceding the onset of respiratory symptoms • Loss of taste preceding the onset of respiratory symptoms	• Fever • Cough • Nausea and vomiting • Shortness of breath • Fatigue and malaise • Abdominal pain • Diarrhoea

Annex 4: Initial management of suspected/confirmed COVID-19 patients



Annex 5: Oxygen titration flowchart

Oxygen titration flowchart

Indication of supplementary oxygen

1. Patients with SpO2 <90%
2. Patients with both SpO2 < 94% and the following emergency signs

Emergency signs in adults	Emergency signs in children
• Severe respiratory distress • Obstructed or absent breathing • Coma (or seriously altered mental status) • Signs of shock	• Central cyanosis • Nasal flaring • Inability to drink or feed • Grunting with every breath • Depressed mental status

- Adult: start at 5 L/min nasal prongs
- Children: start at 0.5-1 L/min nasal prongs
- Assess response, titrate oxygen to SpO_2 target

If increasing respiratory distress/not to target

- Adult: increase to 6-10 L/min
- Children and infants: See oxygen devices
- Assess response

If increasing respiratory distress/not to target

- Adult: increase to 10-15 L/min
- Children and infants: See oxygen devices
- Checklist to troubleshoot warning signs
- Positioning, such as high supported sitting
- Call for help

If increasing respiratory distress/not to target

- Consider advanced oxygen therapy (NIV, HFNO) or invasive ventilation, if available.
- Start manual ventilation (bagging) with high flow oxygen, if appropriate.

Oxygen delivery devices

Adults
- Nasal prongs 1-6 L/min
- Face mask/Venturi mask 6-10 L/min
- Mask with reservoir 10-15 L/min

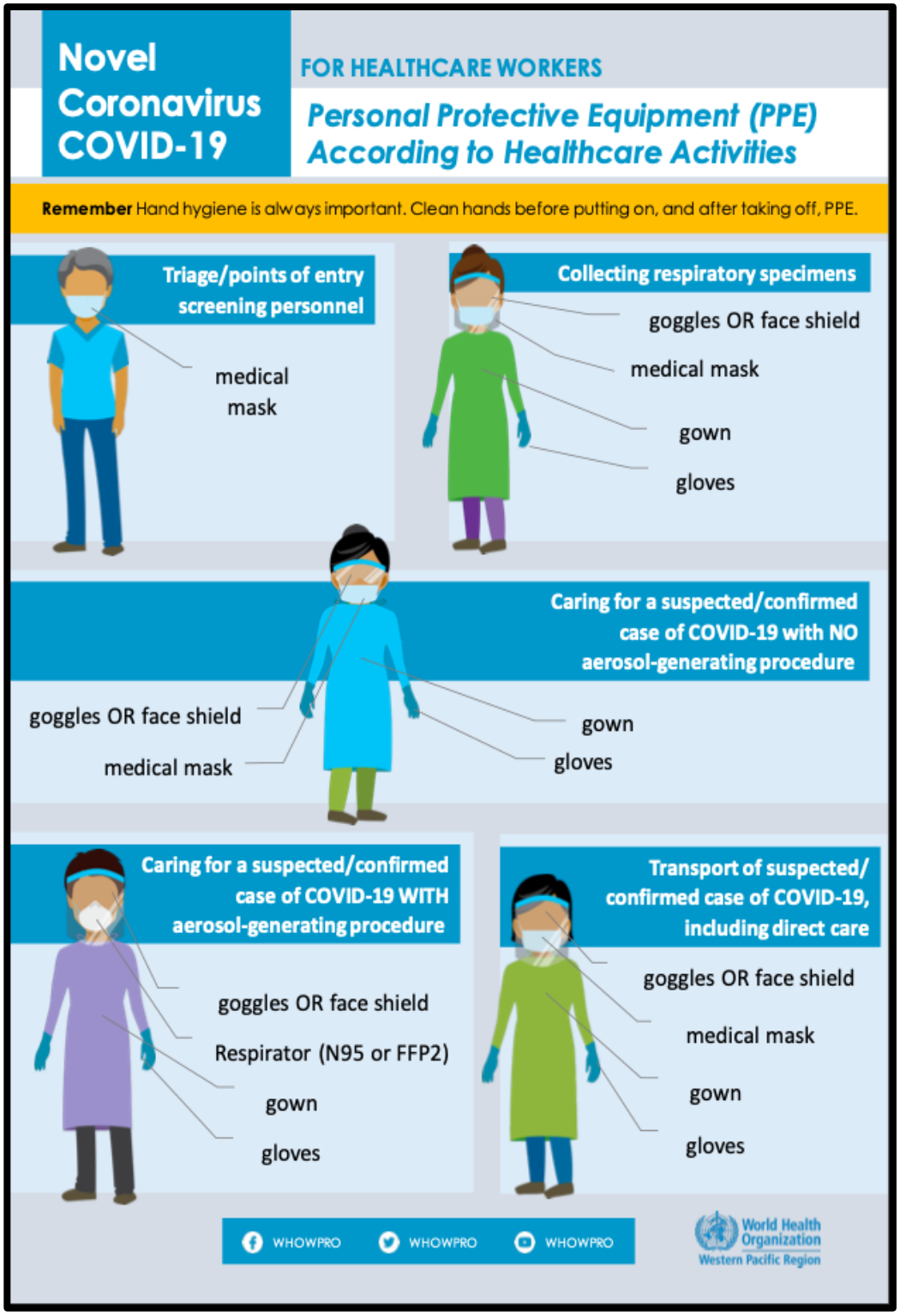
Children and Infants
- Nasal prongs 0.5-6 L/min
- Nasal catheter 0.5-1 L/min
- Nasopharyngeal catheter 0.5-1 L/min
- Head box, face mask 2-3 L/kg per min

Targets of SpO2
- SpO_2 ≥90% in adults and children
- SpO_2 ≥92-95% in pregnant patients
- SpO_2 ≥94% in adults and children with signs of severe illness or emergency signs

Checklist to troubleshoot warning signs:

- ☐ Repeat measurement (e.g. place pulse oximeter correctly; use another pulse oximeter, get an arterial blood gas if appropriate).
- ☐ Is the gas oxygen?
- ☐ Is the cylinder full or is the concentrator on?
- ☐ Check equipment (e.g. tube and masks).
- ☐ Are the flows correct for type of device? Is the reservoir bag full?
- ☐ Is the tubing kinked?
- ☐ Is there an alternate diagnosis? (e.g. heart failure).
- ☐ Ensure underlying etiology is being appropriately managed (e.g. antimicrobials given for pneumonia).

Annex 6: Summary of PPE use according to healthcare activity

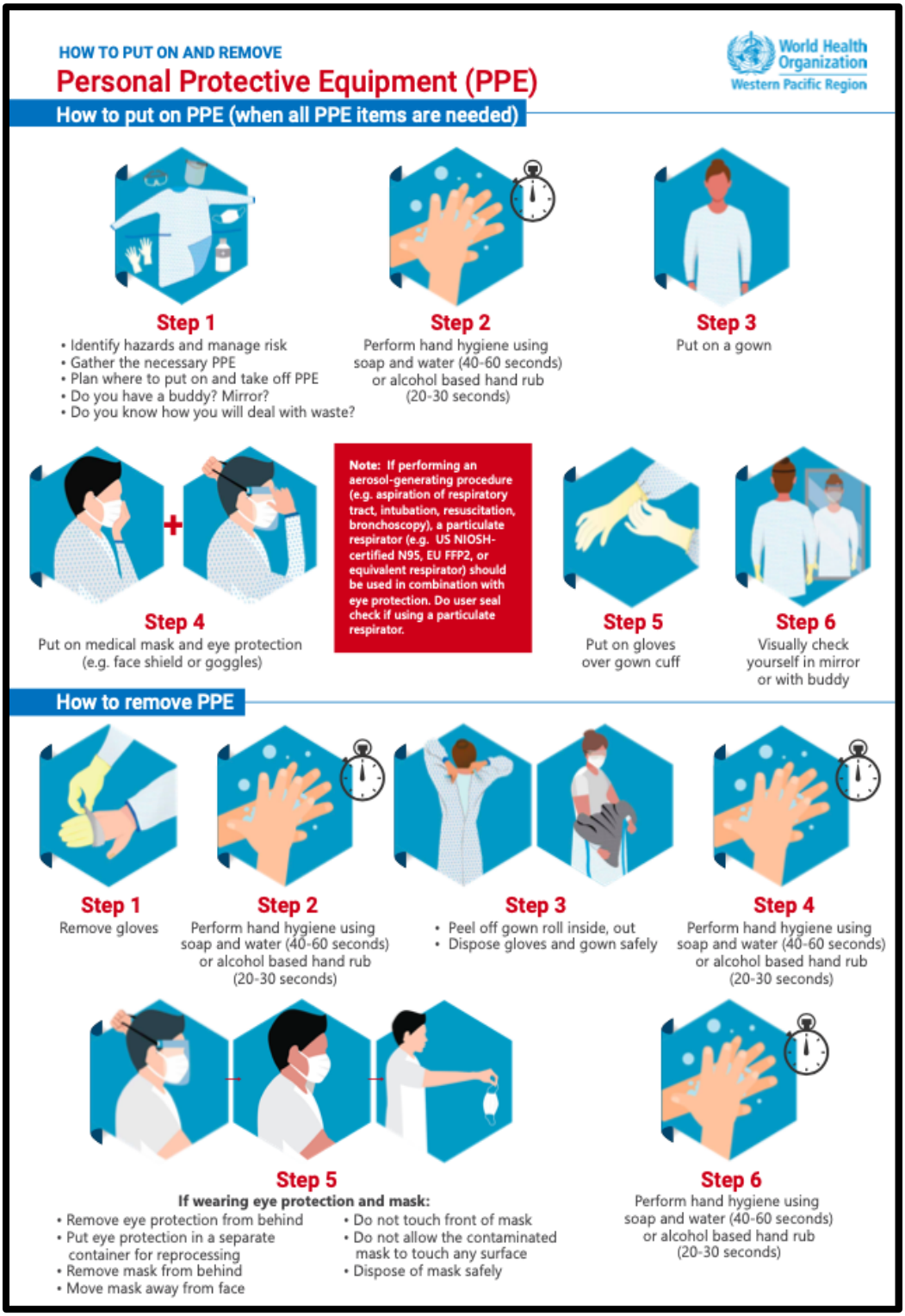


Annex 7. Appropriate Use of PPE

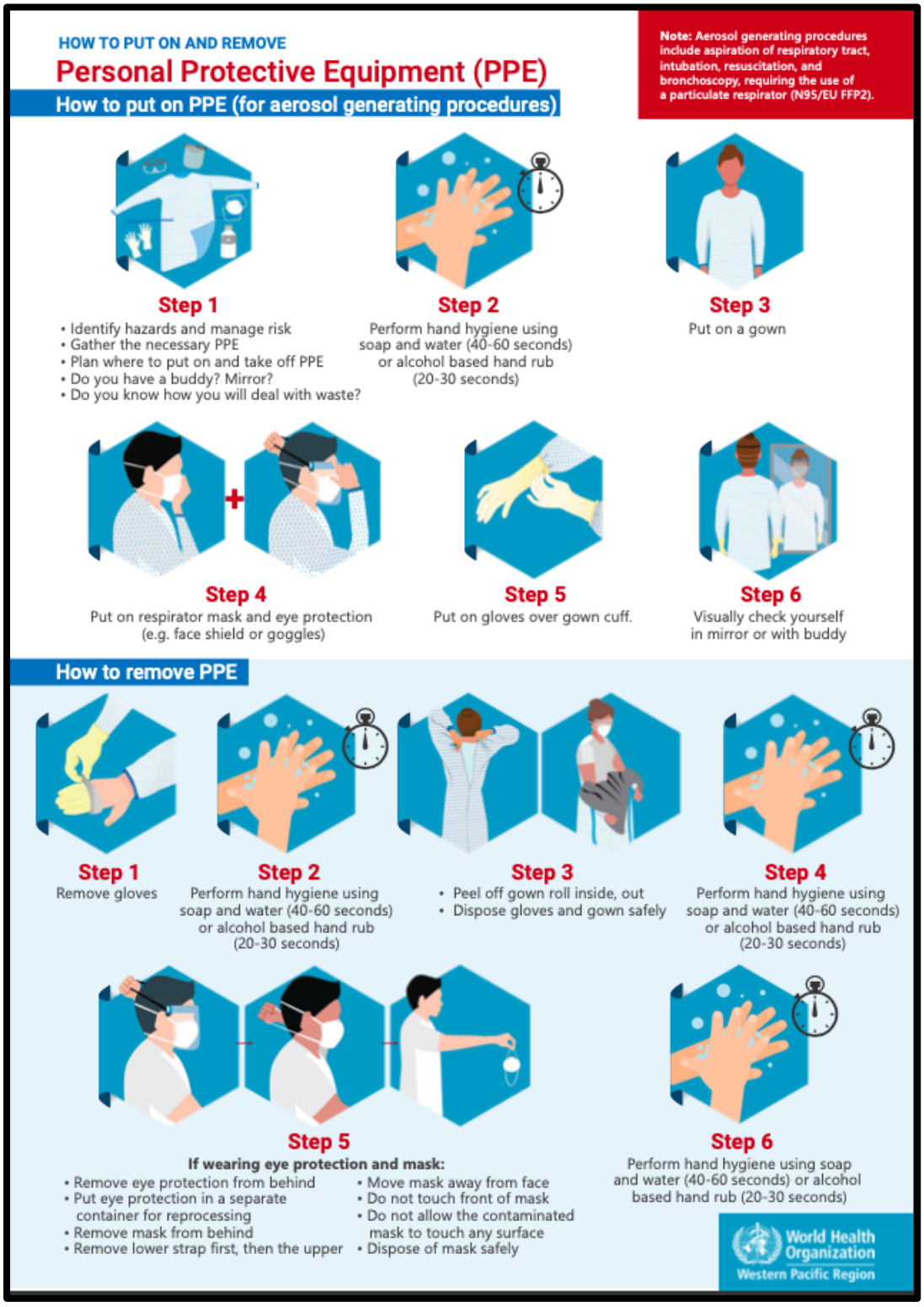
Setting	Who?	Activity	Kind of mask	Other protective measures
Healthcare facility				
Screening area	Any staff	Screening	Medical mask	Hand hygiene Eye protection (if available)
Assessment and triage area	Healthcare workers	Assessment and triage of patients suspected of COVID-19	Medical mask	Hand hygiene Gown Gloves Eye protection
Patient room / ward	Healthcare workers	Clinical care of suspected / confirmed COVID-19 patients not involving aerosol generating procedures	Medical mask	Hand hygiene Gown Gloves Eye protection
Intensive Care Unit or patient room / ward	Healthcare workers	Clinical care of suspected / confirmed COVID-19 patients involving aerosol generating procedures including: Endotracheal intubation, Bag-valve mask ventilation, Non-invasive ventilation, CPR Open suctioning	N95 respirator	Hand hygiene Gown Gloves Eye protection
Specimen collection area / patient room / ward	Healthcare worker	Collection of COVID-19 specimen	N95 respirator	Hand hygiene Gown Gloves Eye protection
COVID-19 areas	Cleaning staff, waste management	Cleaning of COVID-19 areas where no aerosol generating procedures are taking place	Medical mask	Hand hygiene Eye protection

	staff, healthcare staff			Impermeable gown or gown plus plastic apron Rubber gloves Rubber boots
COVID-19 areas	Cleaning staff, waste management staff, healthcare staff	Cleaning of COVID-19 areas where aerosol generating procedures are taking place including: Endotracheal intubation, Bag-valve mask ventilation, Non-invasive ventilation, CPR Open suctioning	N95 respirator	Hand hygiene Eye protection Impermeable gown or gown plus plastic apron Rubber gloves Rubber boots
During transport	Healthcare worker	Transport of a suspected / confirmed COVID-19 patient who is able to walk	Medical mask	At least 1m distance Eye protection Keep other people out of the way
Healthcare facility, During transport	Healthcare worker	Transport of a suspected / confirmed COVID-19 patient in a wheelchair or stretcher	Medical mask	Hand hygiene Gown Gloves Eye protection
Ambulance				
Ambulance with suspect / confirmed COVID patient	Healthcare worker or ambulance staff	Providing direct care to a patient in the ambulance / loading or unloading the patient	Medical mask	Hand hygiene Gown Gloves Eye protection
Ambulance with suspect / confirmed COVID patient	Cleaning staff or ambulance driver	Cleaning and disinfecting the vehicle after every use	Medical mask	Hand hygiene Impermeable gown or gown plus plastic apron Rubber gloves Rubber boots

Annex 8: How to put on and remove PPE



Annex 9: How to put on and remove PPE for aerosol generating procedures



Annex 10: Necessary equipment for hospital care of COVID-19 patients

Single use equipment for COVID-19

Consumables required for any patient with suspect / confirmed COVID-19 admitted to hospital

ALL PATIENTS	Comments
Soap	
Paper towels	
Alcohol gel	
Oxygen prongs, nasal	
Oxygen mask with reservoir bag	
Oxygen tube, extension	
Gloves	
Surgical masks	
Gowns	
Bio-hazard waste bag	
Bleach for cleaning	
IV giving set	
IV cannulas	
Syringes 5ml, 10ml	
Blood culture bottles	
Viral swabs	

Consumables required for any patient with suspected / confirmed COVID-19 on a mechanical ventilator

ICU	
Bag valve mask ventilator (some are reusable depending on make)	
Single use suction catheter	
Closed circuit suction	
Oropharyngeal airway	
N95 respirator	
Stylet OR Bougie*	
Endotracheal tube with cuff	
Heat and Moisture Exchange Filter (HMEF)	
Bacterial and viral filter	

Tape for ET tube	
NG tube	
Urine catheter	
Urine bag	
Tape to secure cannulas	
Anti-embolism stockings	
Aqua gel lubricant	
Bandages / arm ties for patient restraint	
Non-sterile gauze	
Sputum trap (to attach to closed circuit suction)	

Reusable equipment

Reusable items required for any patient with suspect / confirmed COVID-19 admitted to hospital

ALL hospitals	
Oxygen regulator	
1.1/8'' wrench to change oxygen regulator	
Pulse oximeter	
Commode / bucket for toilet	
Goggles	
Oxygen concentrator where available	
Blood pressure cuff (automatic)	
Sheets for bed	
Jug for toilet	

Reusable items required for any patient with confirmed COVID-19 on a mechanical ventilator

ICU	Comments
Oxygen hose adaptor for top of oxygen cylinder	Essential (one per ventilated patient)
Suction machine	Essential (minimum one per ventilated patient if in single room, minimum two per ward if patient in cohort)
Mechanical ventilator + spare parts	Essential (one per ventilated patient)
Laryngoscope + Mac 3 blade	Essential (minimum one per mechanical ventilator)
Reusable ventilator tubing and water trap	Essential (two per ventilator)
Electric syringe	Desirable (one per ventilated patient)
Pillow + pillowcase	Desirable (one per ventilated patient)
Portable X-ray machine	Desirable (one per hospital)

Annex 11: Necessary drugs for care of severe/critical adult COVID-19 patients

Medications and route of administration for severe and critical adult COVID-19 patients

Medication	Route of administration
Oxygen	Essential inhalation – via concentrator or cylinder
Morphine	Essential – PO / IV Oral liquid (10mg/5ml); Injection (10mg/mL); Tablet (30 mg)
Acetaminophen	Desirable – PO Elixir (120mg/5mL); Tablet (100 mg and 500 mg)
0.9% Sodium Chloride 1L	Desirable - IV
5% dextrose	Desirable - for reconstituting medications
Dexamethasone	Desirable IV, dexamethasone phosphate Inj, 4mg in 1mL
Ceftriaxone	Desirable - IV Ceftriaxone Inj., 1g
Benzyl Penicillin	Desirable - Inj., Benzyl Penicillin, 1 million IU, 600mg)
Amoxicillin	Desirable - Amoxicillin Inj., 500mg
Amoxicillin + Clavulanic Acid	Desirable - Amoxicillin 500mg + Clavulanic Acid, 125mg, Tab., 625mg
Either azithromycin or clarithromycin	
Azithromycin	Desirable - Azithromycin Tab., 500mg
Clarithromycin	Desirable - Clarithromycin Tab., 500 mg
Ciprofloxacin	Desirable - Ciprofloxacin Inj., 200mg/100mL
Either gentamicin or amikacin	
Gentamicin	Desirable - Gentamicin Inj., 80mg in 2mL
Amikacin	Desirable – IV Amikacin Injection, 250mg
Fentanyl	Essential – IV Fentanyl Citrate Injection, 50mcg/mL, 2mL
Midazolam	Essential – IV Midazolam Injection, 5mg/5mL
Propofol	Essential – Propofol Injection, 10mg.mL
Ketamine	Essential – IV Ketamine HCl Injection, 50mg/mL
Noradrenaline	Essential – IV Noradrenaline Inj, 4mg/4mL
Suxamethonium	Desirable – IV Suxamethonium Chloride, 5omg/mL
Senna	Desirable – PO / NG Docusate 50 mg + Senna 8.6 mg
Low molecular weight heparin (enoxaparin)	Desirable- s/c Enoxaparin Injection, 40mg/0.4mL

Annex 12: Tidal volume chart

HEIGHT	PBW	4 ml	5 ml	6 ml	7 ml	8 ml
4' 0" (48)	17.9	72	90	107	125	143
4' 1" (49)	20.2	81	101	121	141	162
4' 2" (50)	22.5	90	113	135	158	180
4' 3" (51)	24.8	99	124	149	174	198
4' 4" (52)	27.1	108	136	163	190	217
4' 5" (53)	29.4	118	147	176	206	235
4' 6" (54)	31.7	127	159	190	222	254
4' 7" (55)	34	136	170	204	238	272
4' 8" (56)	36.3	145	182	218	254	290
4' 9" (57)	38.6	154	193	232	270	309
4' 10" (58)	40.9	164	205	245	286	327
4' 11" (59)	43.2	173	216	259	302	346
5' 0" (60)	45.5	182	228	273	319	364
5' 1" (61)	47.8	191	239	287	335	382
5' 2" (62)	50.1	200	251	301	351	401
5' 3" (63)	52.4	210	262	314	367	419
5' 4" (64)	54.7	219	274	328	383	438
5' 5" (65)	57	228	285	342	399	456
5' 6" (66)	59.3	237	297	356	415	474
5' 7" (67)	61.6	246	308	370	431	493
5' 8" (68)	63.9	256	320	383	447	511
5' 9" (69)	66.2	265	331	397	463	530
5' 10" (70)	68.5	274	343	411	480	548
5' 11" (71)	70.8	283	354	425	496	566
6' 0" (72)	73.1	292	366	439	512	585
6' 1" (73)	75.4	302	377	452	528	603
6' 2" (74)	77.7	311	389	466	544	622
6' 3" (75)	80	320	400	480	560	640
6' 4" (76)	82.3	329	412	494	576	658
6' 5" (77)	84.6	338	423	508	592	677
6' 6" (78)	86.9	348	435	521	608	695
6' 7" (79)	89.2	357	446	535	624	714
6' 8" (80)	91.5	366	458	549	641	732
6' 9" (81)	93.8	375	469	563	657	750
6' 10" (82)	96.1	384	481	577	673	769
6' 11" (83)	98.4	394	492	590	689	787
7' 0" (84)	100.7	403	504	604	705	806

PBW and Tidal Volume for Females

HEIGHT	PBW	4 ml	5 ml	6 ml	7 ml	8 ml
4' 0" (48)	22.4	90	112	134	157	179
4' 1" (49)	24.7	99	124	148	173	198
4' 2" (50)	27	108	135	162	189	216
4' 3" (51)	29.3	117	147	176	205	234
4' 4" (52)	31.6	126	158	190	221	253
4' 5" (53)	33.9	136	170	203	237	271
4' 6" (54)	36.2	145	181	217	253	290
4' 7" (55)	38.5	154	193	231	270	308
4' 8" (56)	40.8	163	204	245	286	326
4' 9" (57)	43.1	172	216	259	302	345
4' 10" (58)	45.4	182	227	272	318	363
4' 11" (59)	47.7	191	239	286	334	382
5' 0" (60)	50	200	250	300	350	400
5' 1" (61)	52.3	209	262	314	366	418
5' 2" (62)	54.6	218	273	328	382	437
5' 3" (63)	56.9	228	285	341	398	455
5' 4" (64)	59.2	237	296	355	414	474
5' 5" (65)	61.5	246	308	369	431	492
5' 6" (66)	63.8	255	319	383	447	510
5' 7" (67)	66.1	264	331	397	463	529
5' 8" (68)	68.4	274	342	410	479	547
5' 9" (69)	70.7	283	354	424	495	566
5' 10" (70)	73	292	365	438	511	584
5' 11" (71)	75.3	301	377	452	527	602
6' 0" (72)	77.6	310	388	466	543	621
6' 1" (73)	79.9	320	400	479	559	639
6' 2" (74)	82.2	329	411	493	575	658
6' 3" (75)	84.5	338	423	507	592	676
6' 4" (76)	86.8	347	434	521	608	694
6' 5" (77)	89.1	356	446	535	624	713
6' 6" (78)	91.4	366	457	548	640	731
6' 7" (79)	93.7	375	469	562	656	750
6' 8" (80)	96	384	480	576	672	768
6' 9" (81)	98.3	393	492	590	688	786
6' 10" (82)	100.6	402	503	604	704	805
6' 11" (83)	102.9	412	515	617	720	823
7' 0" (84)	105.2	421	526	631	736	842

PBW and Tidal Volume for Males

Source: http://www.ardsnet.org/index.shtml