SARI CRITICAL CARE TRAINING

SEVERE ACUTE RESPIRATORY INFECTION (SARI)

TREATMENT FACILITY DESIGN

MODULE 1: OVERVIEW OF BASIC OPERATIONAL AND IPC PRINCIPLES IN COVID-19 CONTEXT

MARCH 2020

World Health Organization

HEALTH EMERGENCIES programme

Learning objectives

By the end of this lecture, you will be able to:

- Describe the public health objectives at all stages of the preparedness and response plan;
- Identify ventilation and exhausted air treatment as IPC measures within a COVID-19 context; and
- Explain the different modes of transmission and apply a rational use of PPE.

Modules

This lecture is organized in three different sections:

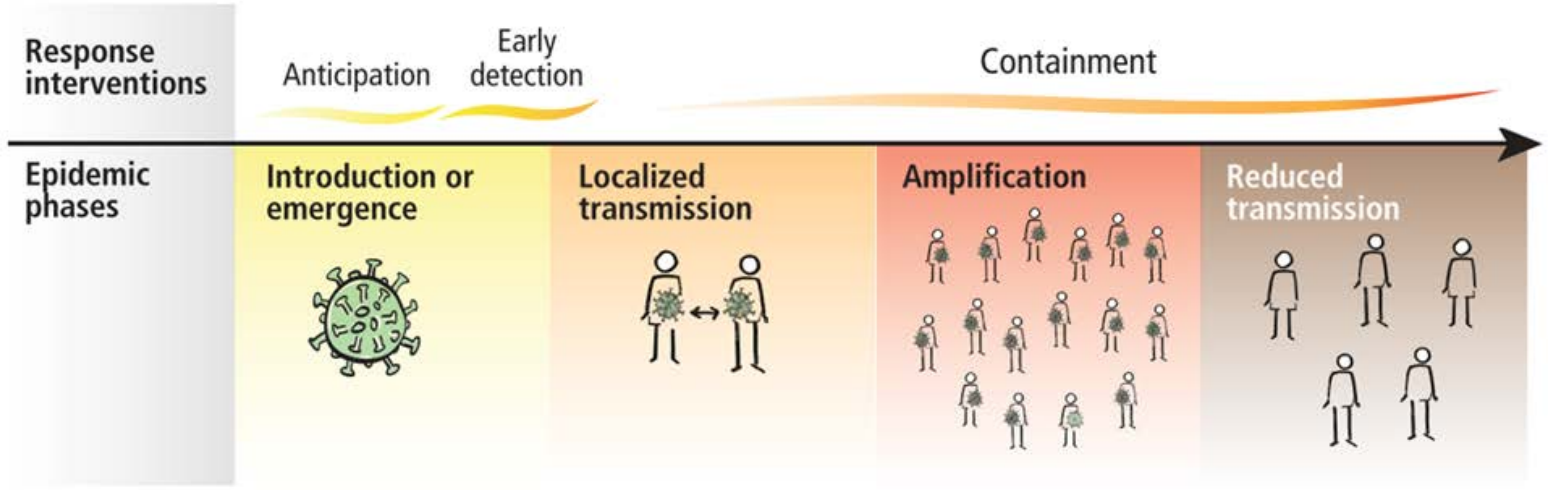
- 1A Public health objectives and strategic priorities by scenario
- 1B Ventilation and exhausted air treatment as IPC measures within a COVID-19 context
- 1C Modes of transmission and rational use of PPE.

Module: 1A

Module 1A

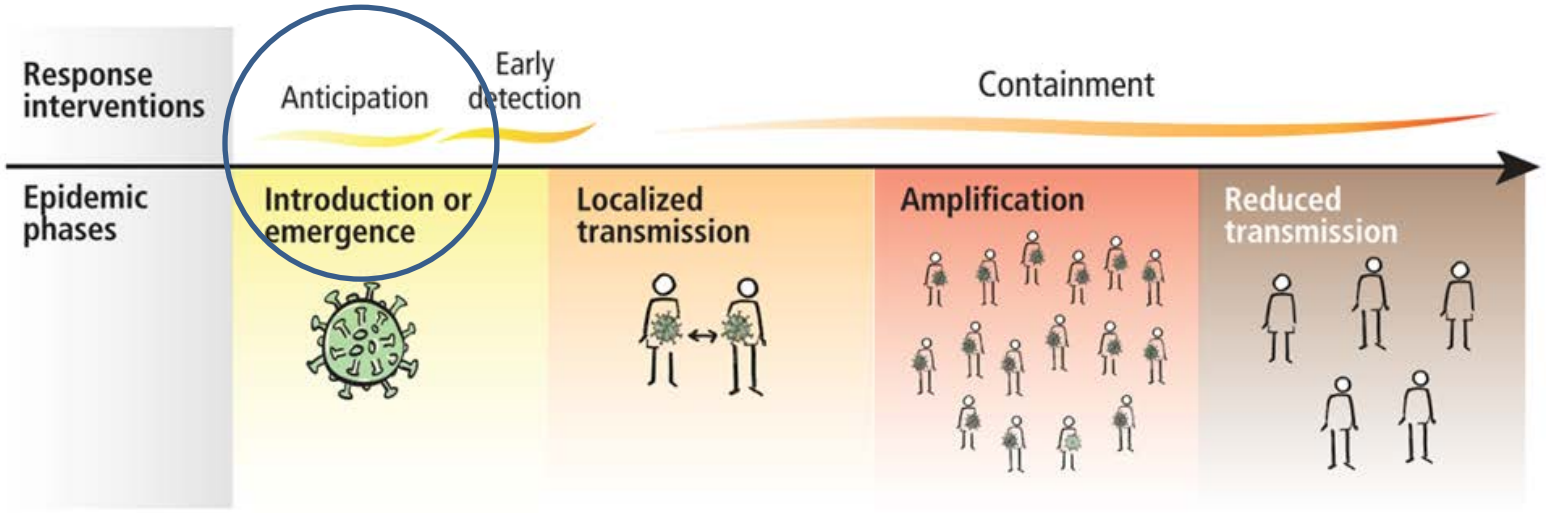
Public health objectives and strategic priorities by scenario

Epidemic phases



Four transmission scenarios are observed:

Epidemic phases



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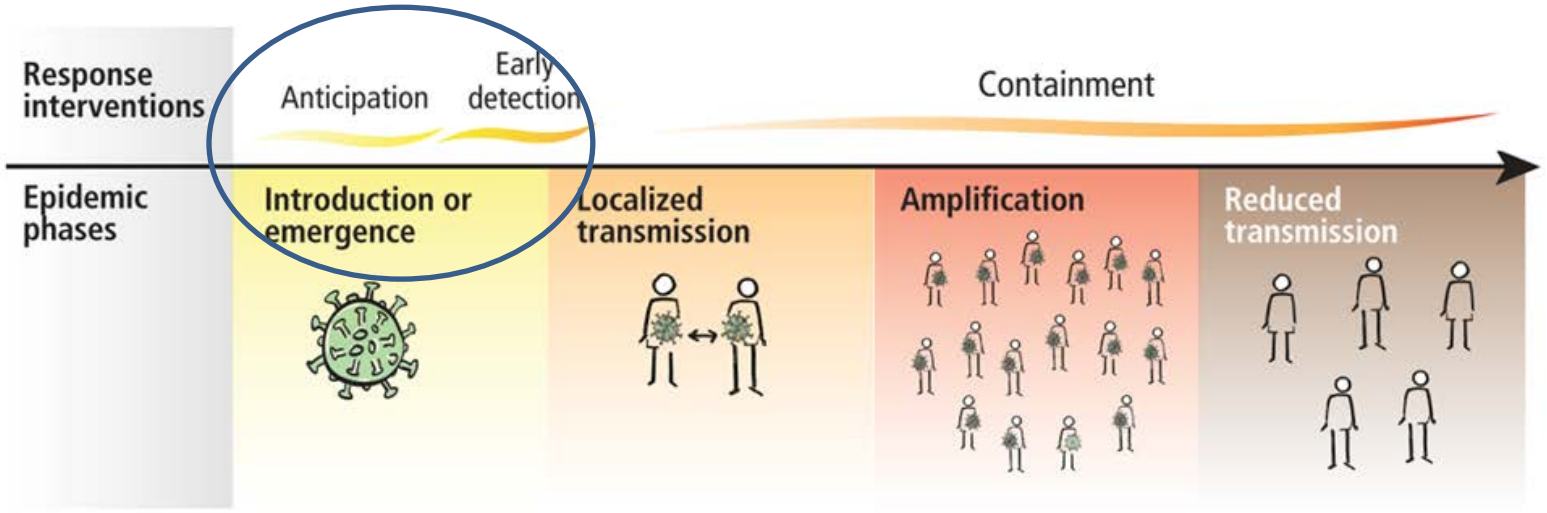

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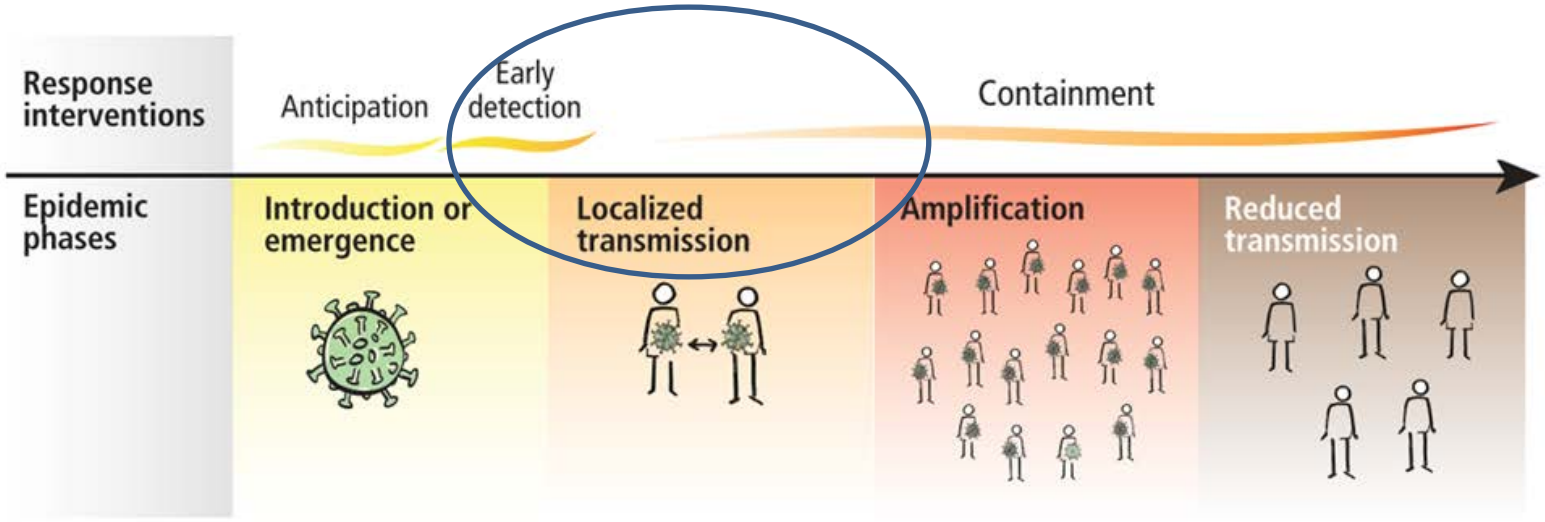
- Countries with no cases (no cases);
- Countries with one or more cases, imported or locally acquired (sporadic cases);

Epidemic phases



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- Countries with one or more cases, imported or locally acquired (sporadic cases);
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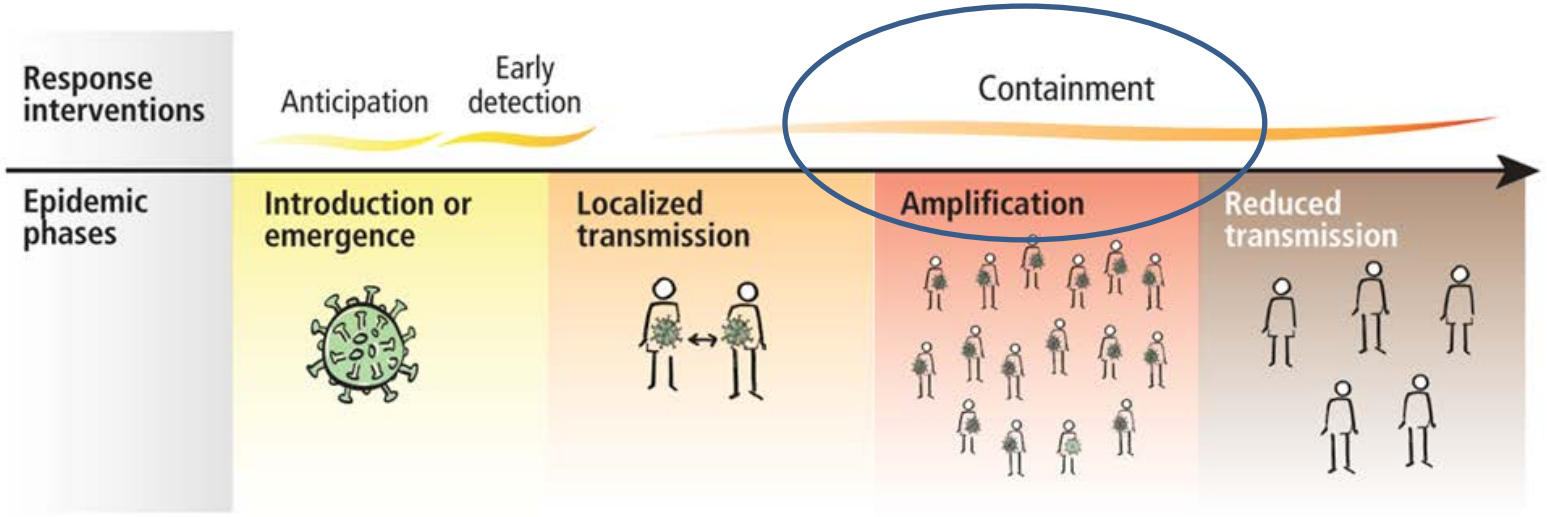
Epidemic phases and response interventions. Managing epidemics: Key facts about major deadly diseases. WHO, 2018

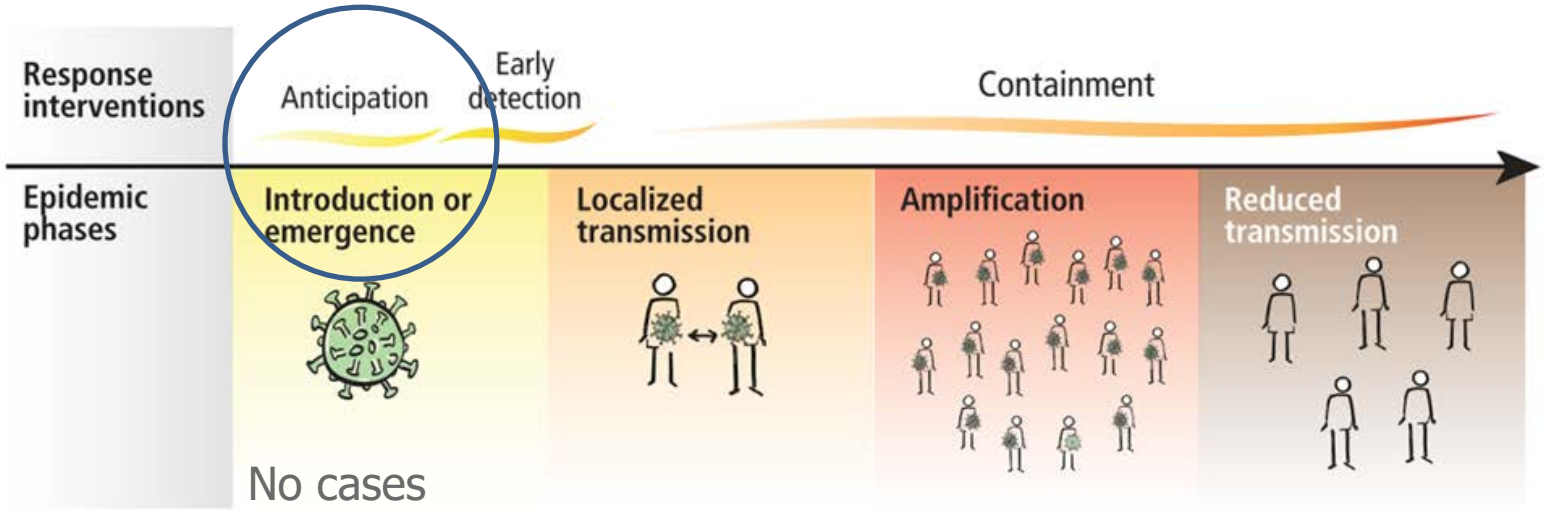
Epidemic phases



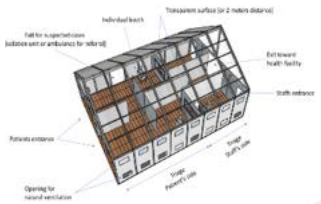
Four transmission scenarios are observed:

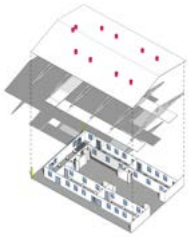
- Countries with no cases (no cases);
- Countries with one or more cases, imported or locally acquired (sporadic cases);
- Countries experiencing clusters of cases in time, geographic location, or common exposure (clusters of cases);
- Countries experiencing larger outbreaks of local transmission (community transmission).

Epidemic phases and response interventions

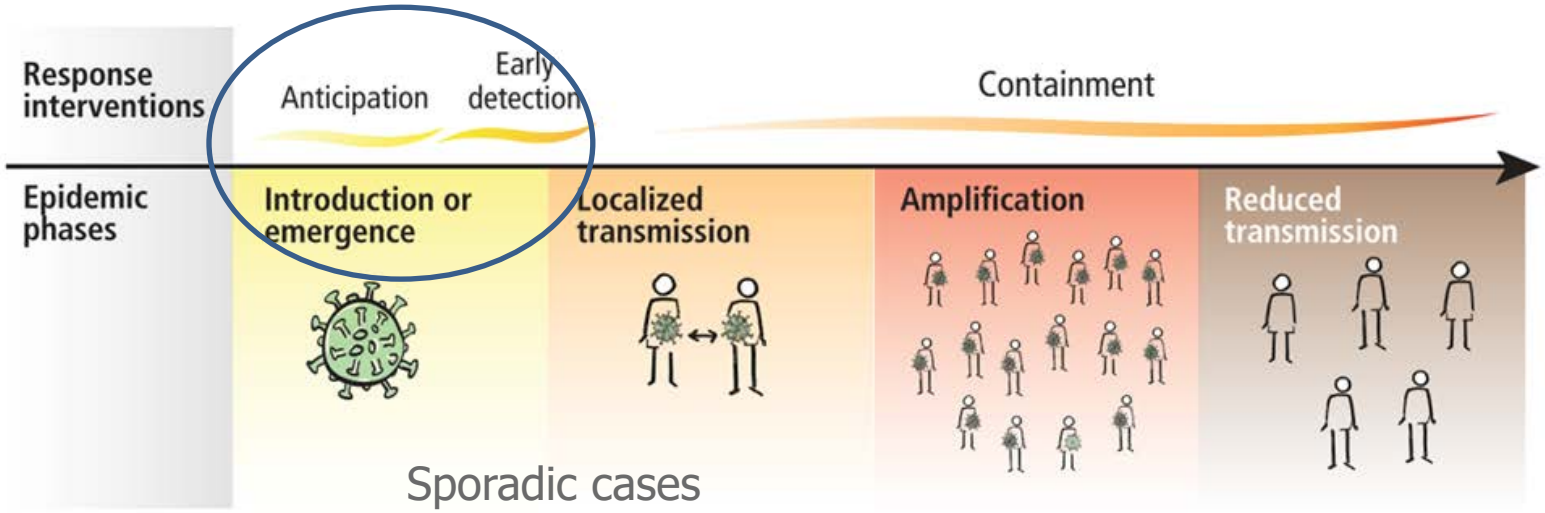


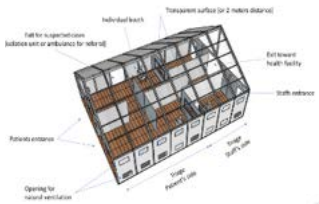
1. Set up screening and triage.
2. Set up COVID-19 designated wards in health facilities.

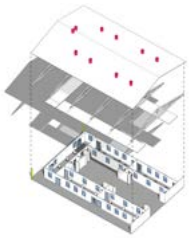




Epidemic phases and response interventions







1. Set up screening and triage.
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3. COVID-19 designated treatment area.

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Epidemic phases and response interventions. Managing epidemics: Key facts about major deadly diseases. WHO, 2018

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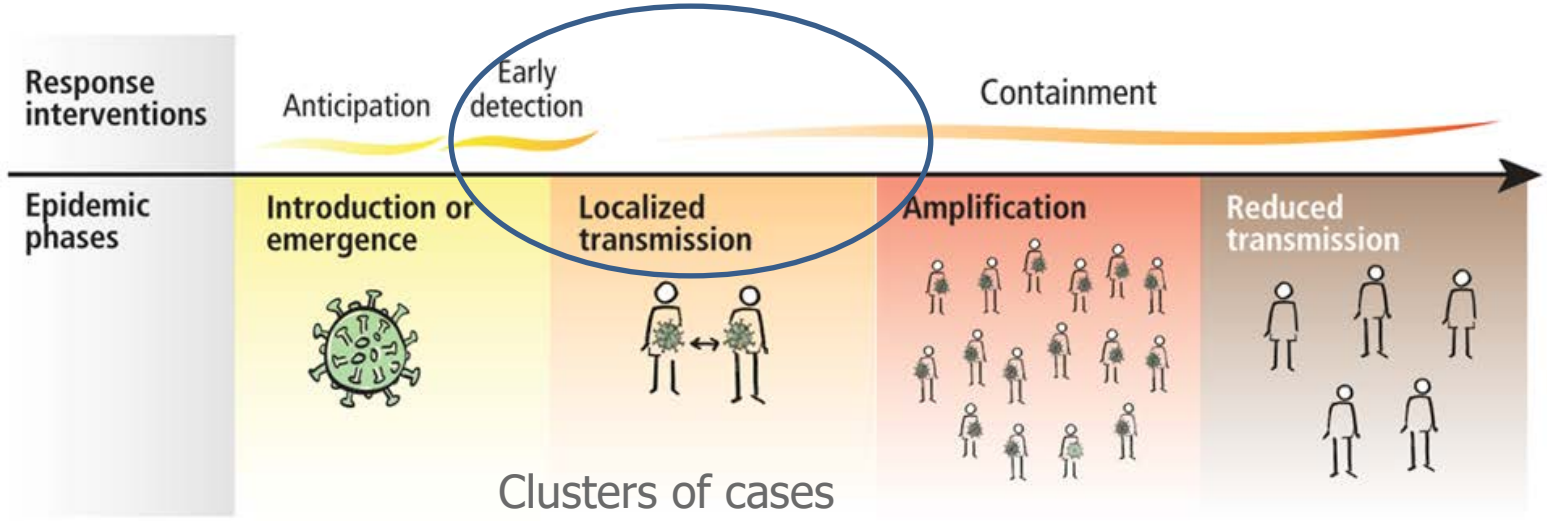
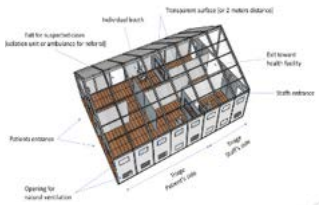
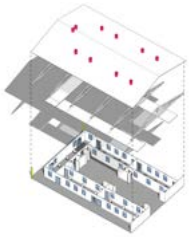
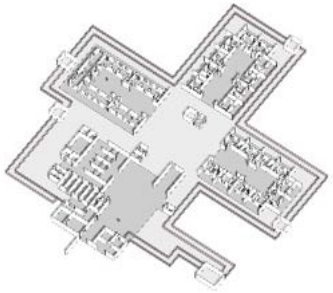
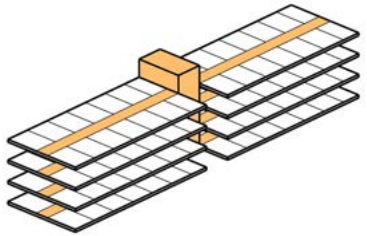
Epidemic phases and response interventions

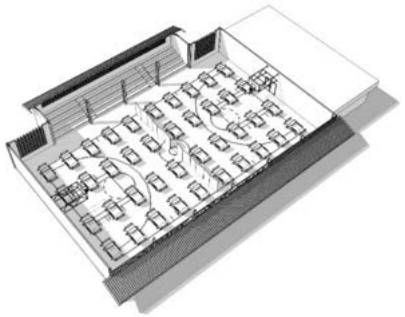






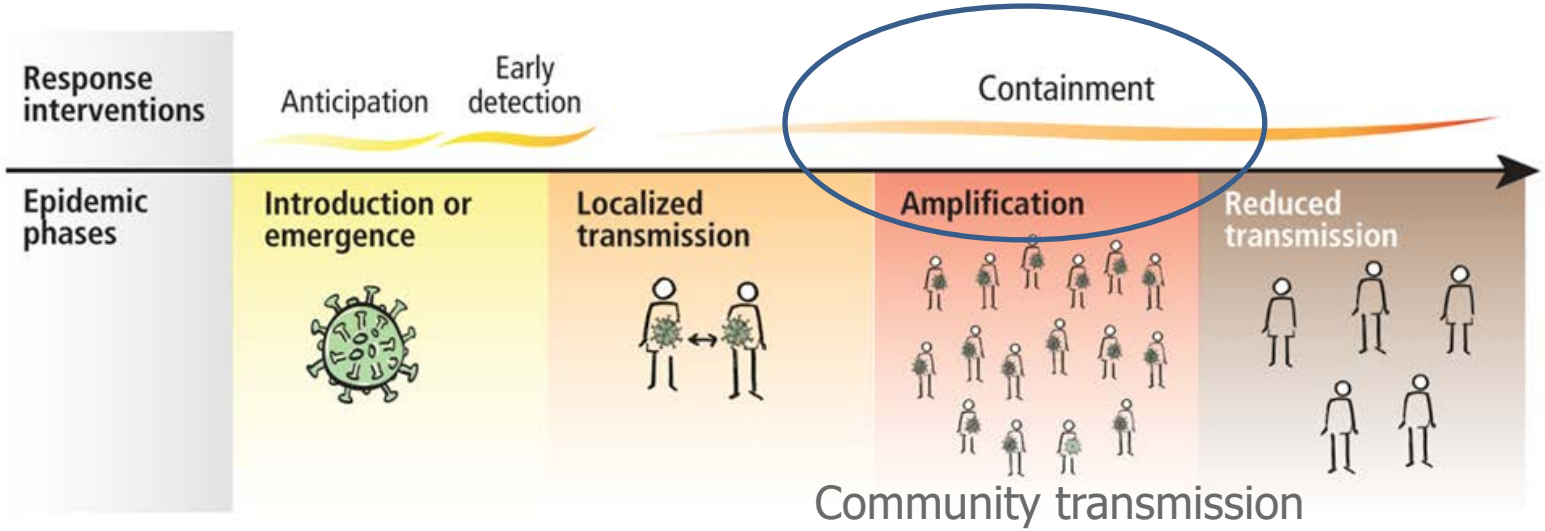




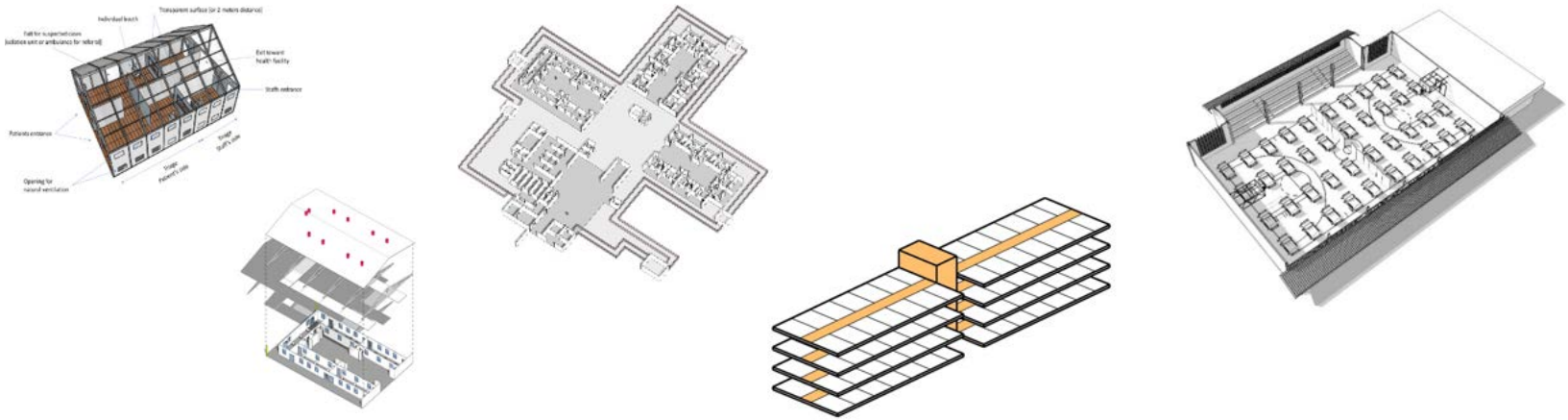


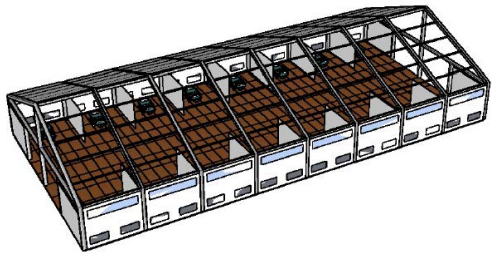
1. Set up screening and triage.
2. Set up COVID-19 designated wards in health facilities.
3. COVID-19 designated treatment area.
4. Repurpose existing buildings.
5. Community facilities.

Epidemic phases and response interventions



1. Set up screening and triage.
2. Set up COVID-19 designated wards in health facilities.
3. COVID-19 designated treatment area.
4. Repurpose existing buildings.
5. Community facilities.
6. New COVID-19 facilities.

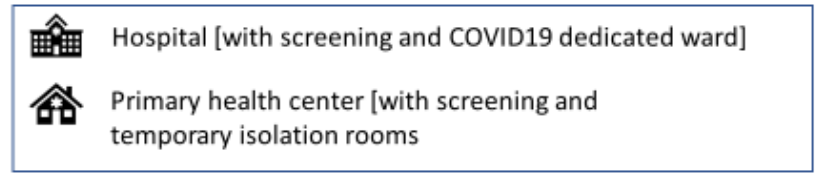




Referral pathway

According to specific epidemiological scenario:

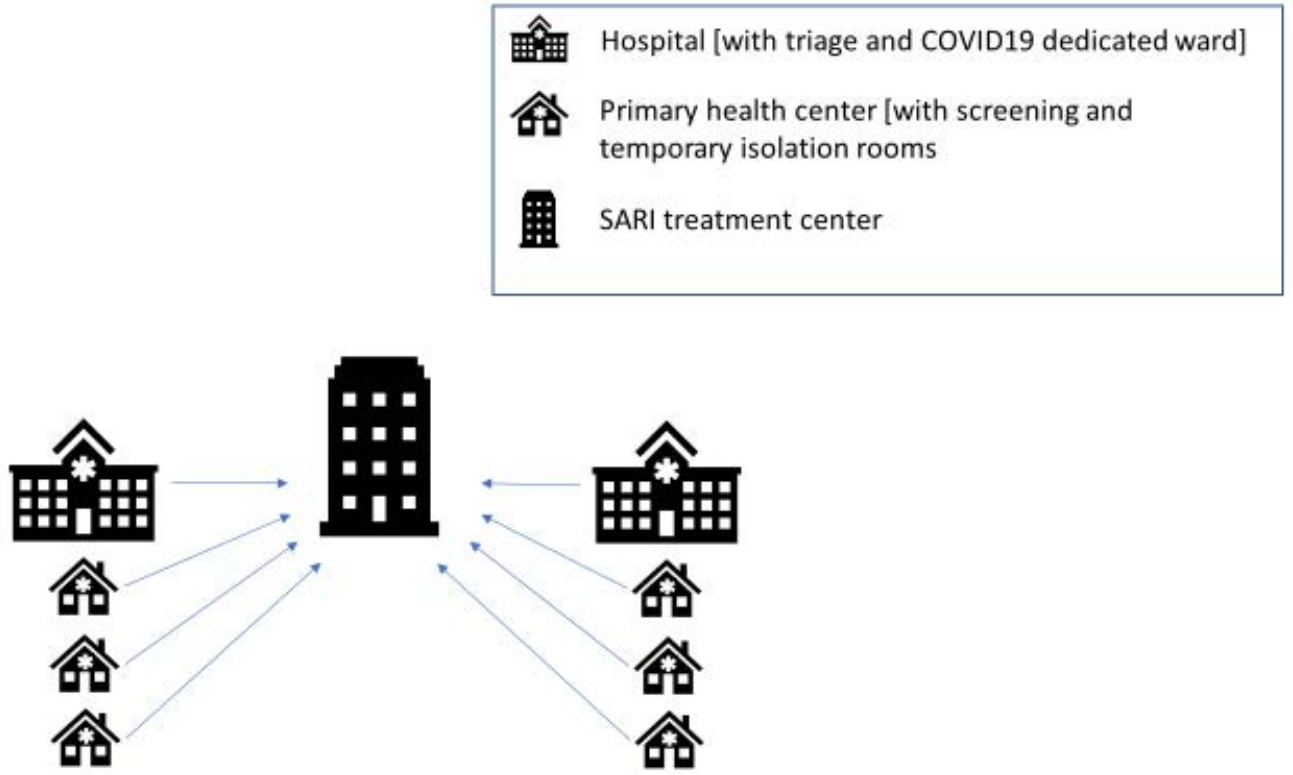
- Sporadic cases [introduction];
- Cluster: discrete groups of cases with epi-link [localized transmission];



Referral pathway

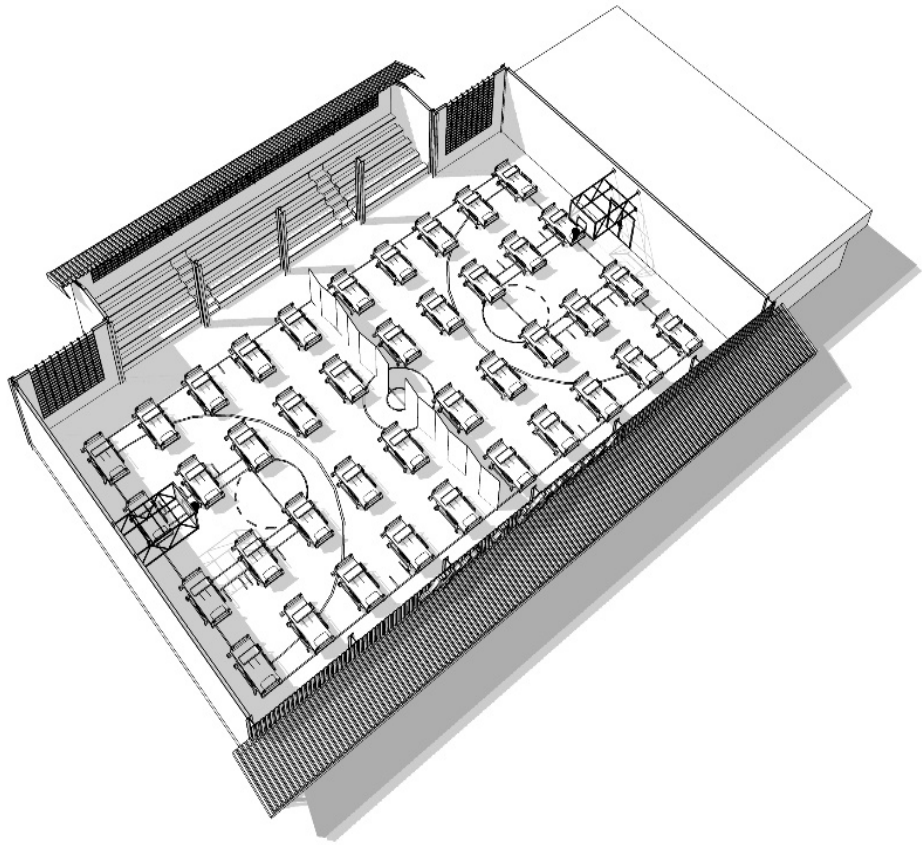
According to specific epidemiological scenario:

- Community transmission: areas experiencing outbreaks with local transmission, many without identifiable epidemiological link [amplification].



Community facilities

Where health facilities can no longer manage patients with mild or moderate disease, isolate patients who are not at high risk for severe disease (< 60 years of age, no co-morbid diseases) either in community facilities (e.g. stadium, gymnasium, hotel or tent) with access to rapid health advice (i.e. via adjacent dedicated COVID-19 health post, telemedicine) or at home according to WHO guidance.



Surge capacity

Surge capacity entails:

- human resource management, especially staffing;
- supplies, equipment, logistics and resupply mechanisms;
- specific expertise for critical areas of care; and
- overall management of hospital resources, such as expanding space and premises.

Planning for surge capacity should allow for progressive scale-up of activities over several stages, with clearly defined activation thresholds for each stage.

Surge capacity – from severity to cohorting

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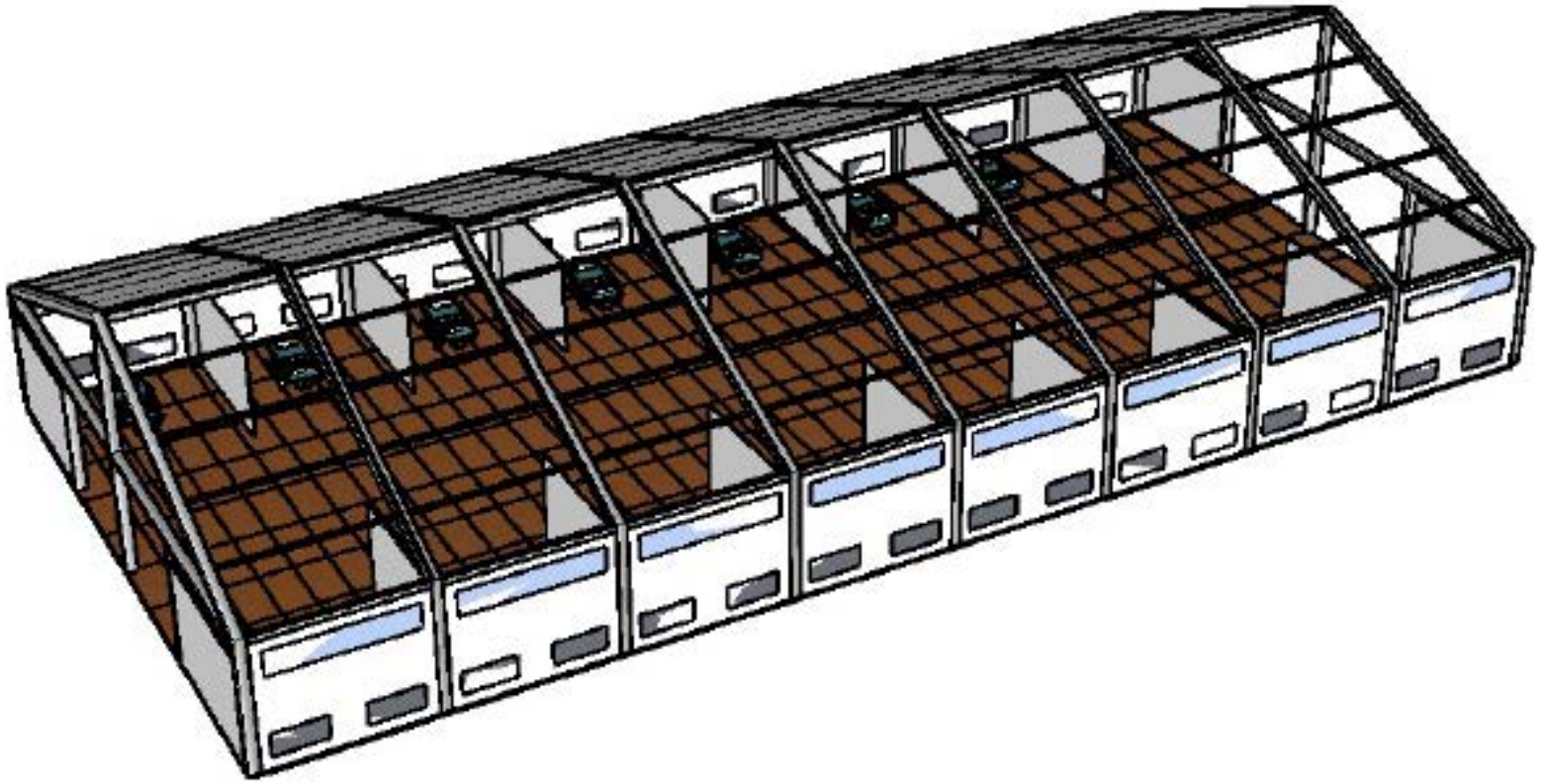
Surge capacity:

If needed, big facilities can be used to set up cohorted wards for severe and critical patients.



Module: 1B

Module 1B

Ventilation and exhausted air treatment as IPC measures within a COVID-19 context

Ventilation

The purpose of ventilation is to provide healthy air for breathing by both diluting the pollutants originating in the building and removing the pollutants from it.

Building ventilation has three basic elements:

- ✓ Ventilation rate — the amount of outdoor air that is provided into the space, and the quality of the outdoor air;
- ✓ Airflow direction — the overall airflow direction in a building, which should be from clean zones to dirty zones; and
- ✓ Air distribution or airflow pattern — the external air should be delivered to each part of the space in an efficient manner and the airborne pollutants generated in each part of the space should also be removed in an efficient manner.

Atkinson, J., Chartier, Y., Pessoa-silva, C. L., Jensen, P. & Li, Y. Natural Ventilation for Infection Control in Health-Care Settings Edited by : *WHO Publ.* (2009).

Ventilation

There are three methods that may be used to ventilate a building:

Natural ventilation

Natural forces (e.g. winds) drive outdoor air through the building openings such as windows, doors, solar chimneys, wind towers and trickle ventilators.

Mechanical ventilation

Mechanical fans drive mechanical ventilation. Fans can either be installed directly in windows or walls, or installed in air ducts for supplying air into, or exhausting air from, a room.

Hybrid ventilation

Hybrid (mixed-mode) ventilation relies on natural driving forces to provide the desired (design) flow rate. It uses mechanical ventilation when the natural ventilation flow rate is too low.

Atkinson, J., Chartier, Y., Pessoa-silva, C. L., Jensen, P. & Li, Y. Natural Ventilation for Infection Control in Health-Care Settings Edited by : *WHO Publ.* (2009).

Ventilation

The decision whether to use mechanical or natural ventilation for infection control should be based on needs, the availability of the resources and the cost of the system to provide the best control to counteract the risks.

Area or service	Proposed ventilation system	Proposed exhausted air treatment
Staff area	Natural ventilation	Dilution
Triage	Natural ventilation	Dilution
Waiting room	Natural ventilation	Dilution
Sampling room	Natural ventilation	Dilution
	Hybrid ventilation	HEPA filter
Mild and Moderate cases ward	Natural ventilation	Dilution
Severe and critical cases ward	Hybrid ventilation	Dilution
	Mechanical ventilation	HEPA filter
Waste zone	Natural ventilation	Dilution
Morgue	Natural ventilation	Dilution

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Atkinson, J., Chartier, Y., Pessoa-silva, C. L., Jensen, P. & Li, Y. Natural Ventilation for Infection Control in Health-Care Settings Edited by : *WHO Publ.* (2009).

[1] For a safe dilution the air should be exhausted directly to the outside away from air-intake vents, persons, and animals

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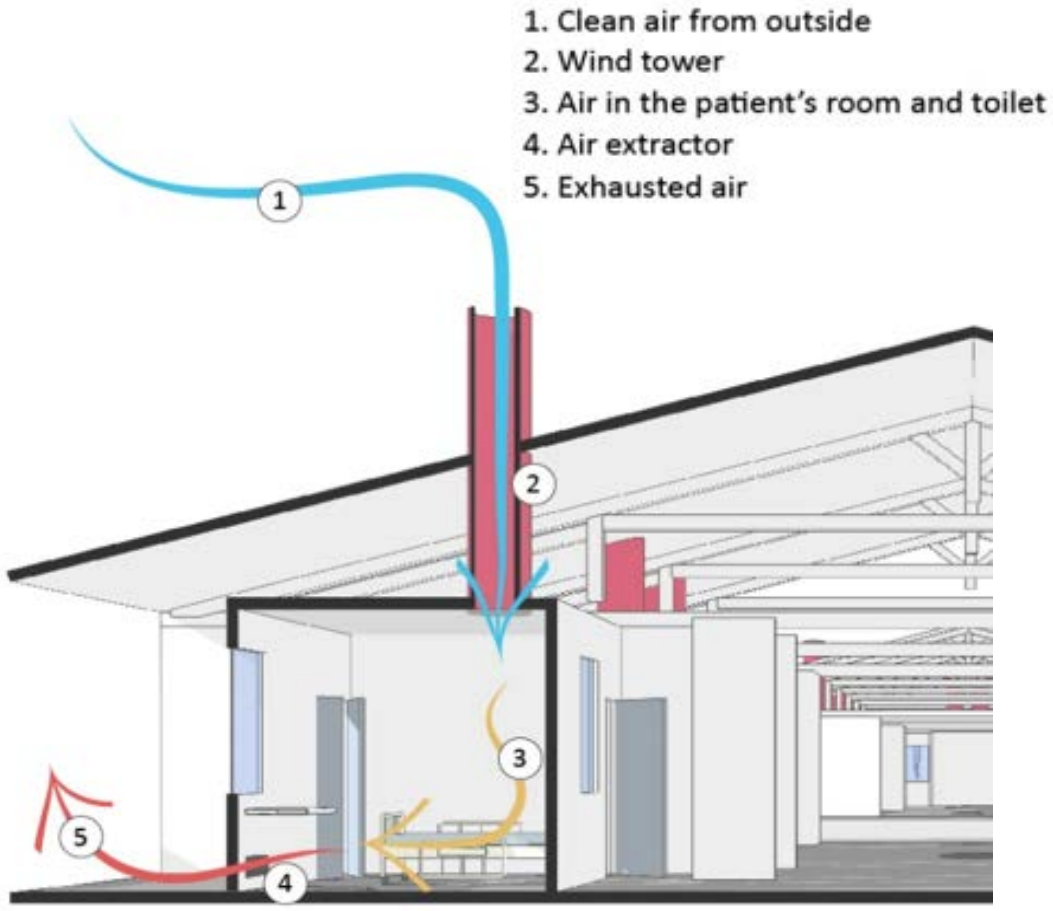
Ventilation – Hybrid ventilation

Top-down ventilation (fan-assisted stack plus a wind tower)

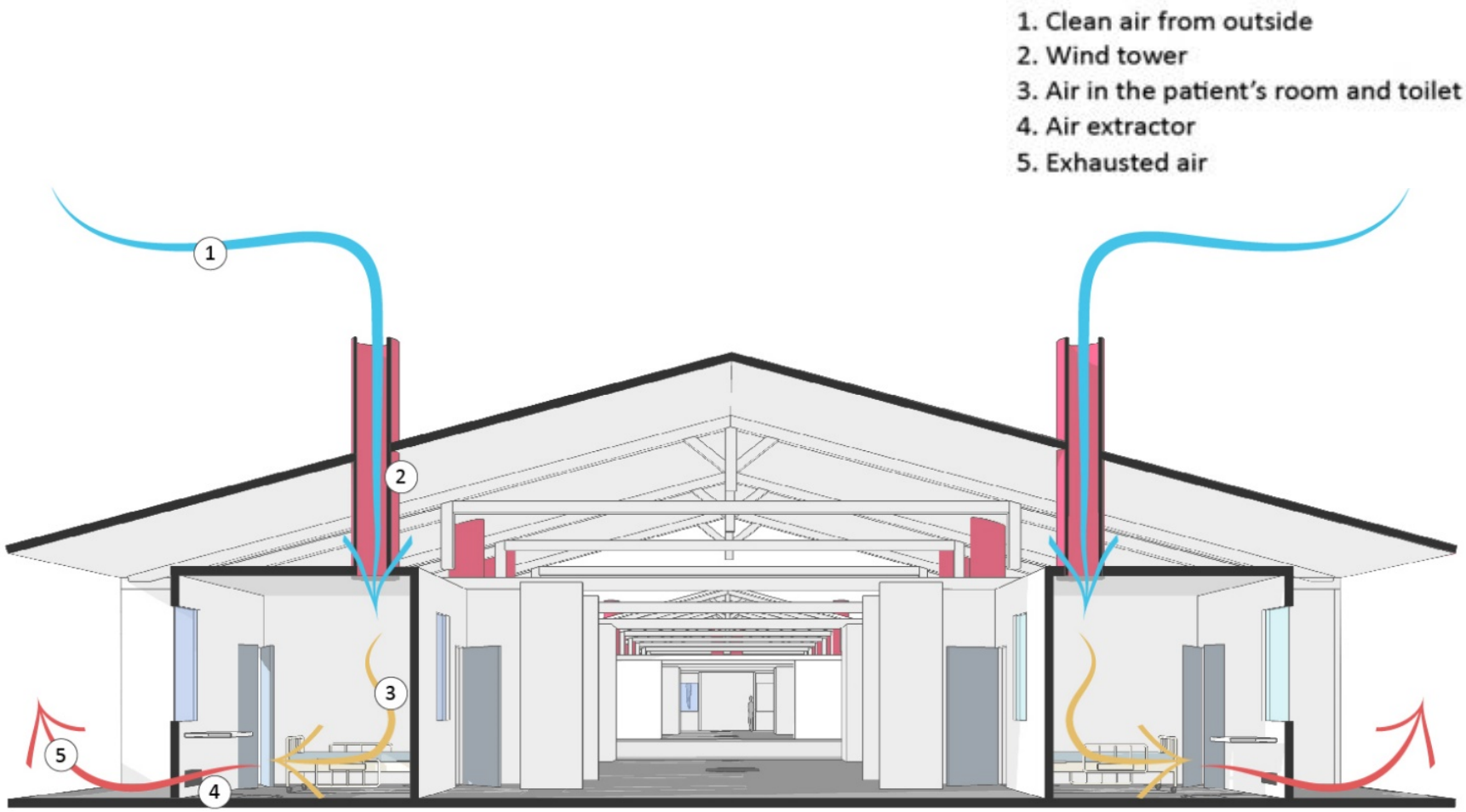
The air extractor will easily allow for control of the ventilation rate, meeting the ACH standard required and assuring a constant unidirectional top-down airflow.



How to install air extractor

In warm climate countries, due to temperature and pressure, the airflow will naturally move the opposite direction.

For the this reason, it is essential that air extractor is turned on whenever the room is occupied.



Exhausted air treatment

Air from the room can be exhausted directly to the outdoors where the droplet nuclei will be diluted in the outdoor air. It's essential to exhaust air away from air-intake vents, persons, and animals.

If for structural reasons dilution is not possible, exhausted air should passed through a special high efficiency particulate air (HEPA) filter that removes most (99.97%) of the droplet nuclei.

DILUTION IS THE RECOMMENDED SYSTEM

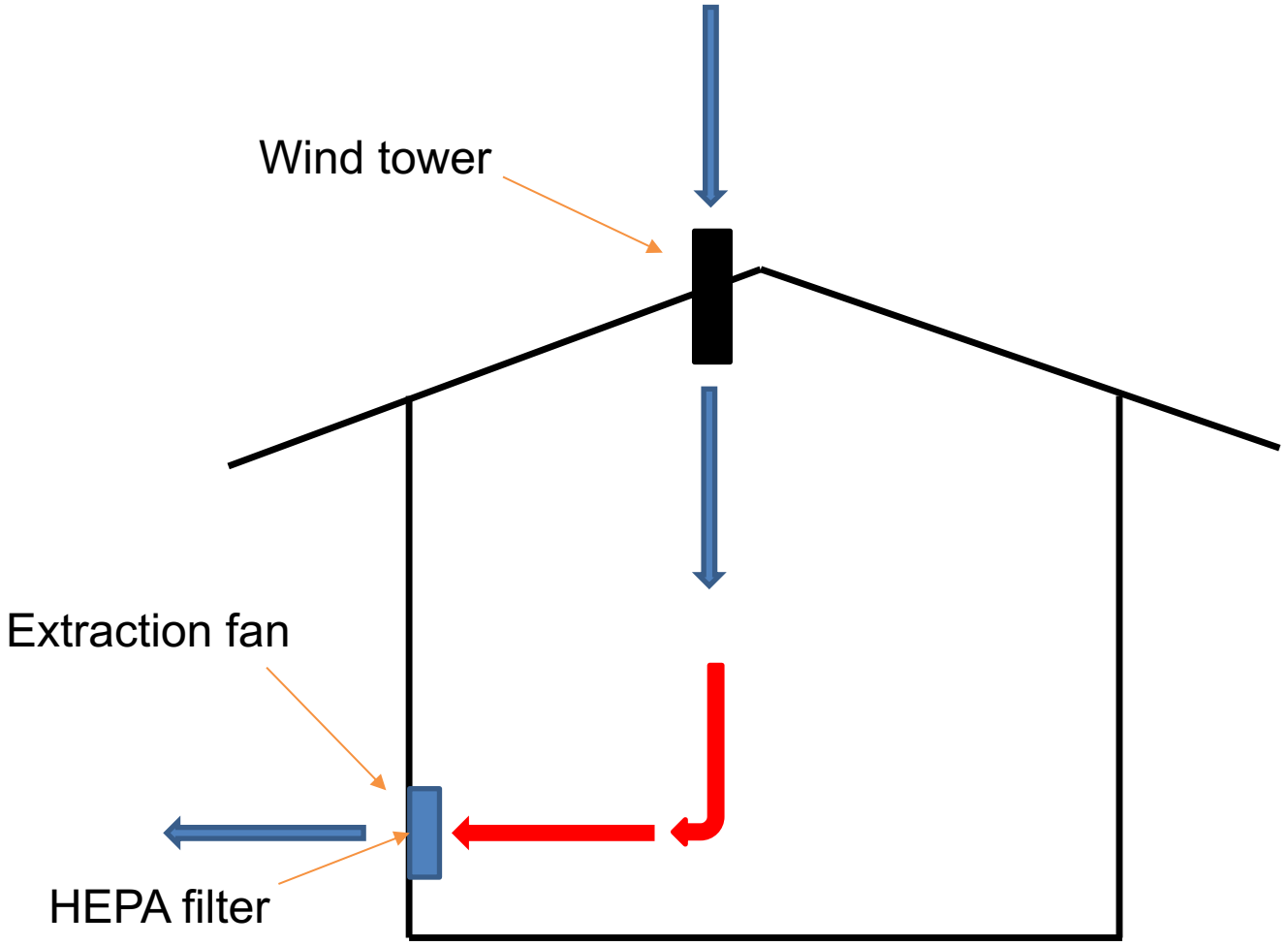
However, if not possible

HEPA FILTERS OR PORTABLE HEPA SYSTEMS ARE ADVISED

CDC. centre for Disease Control and Prevention. Chapter 7-Tuberculosis Infection Control. (2017).

Exhausted air treatment - HEPA

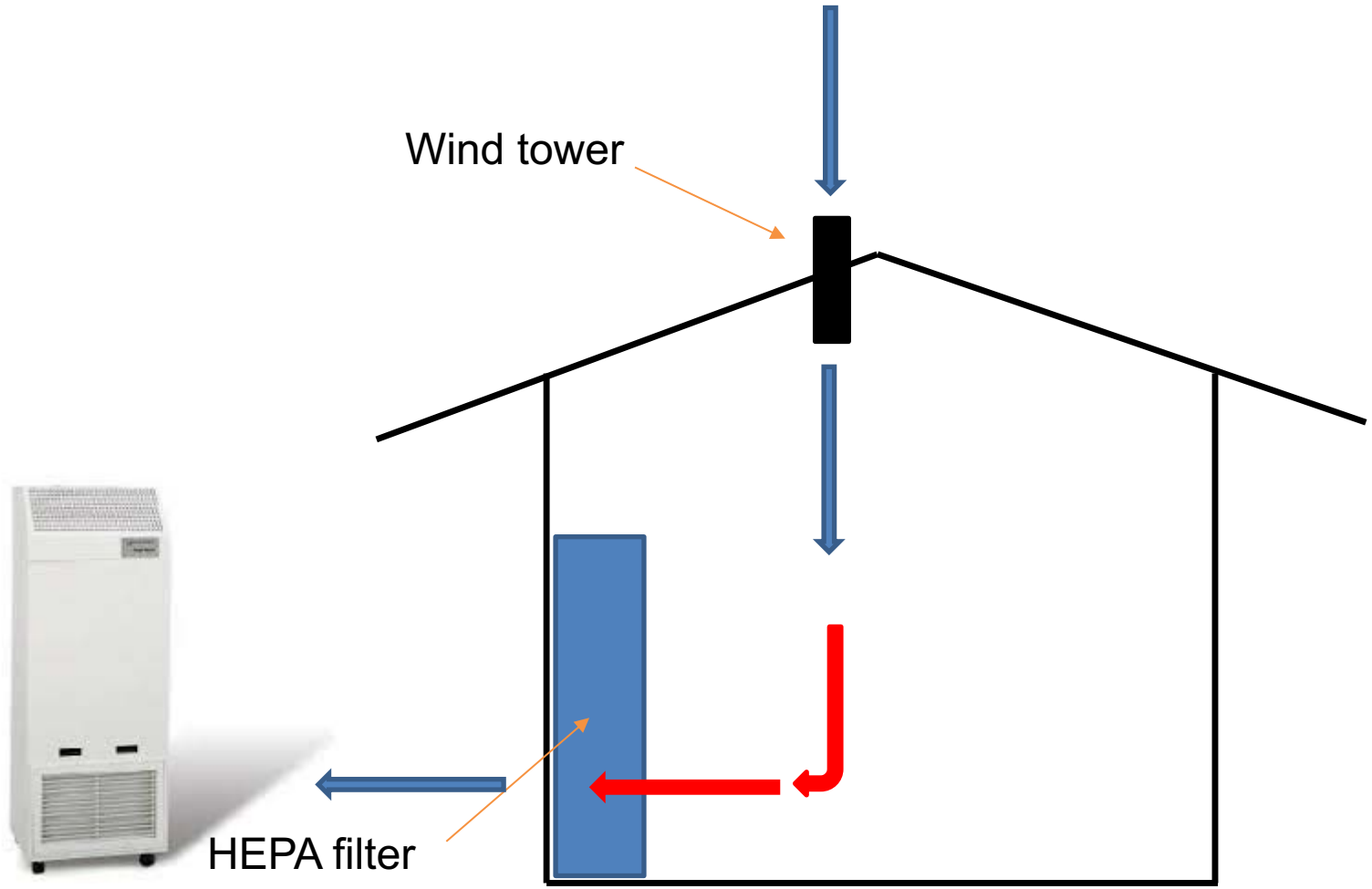
HEPA is a type of pleated mechanical air filter. It is an acronym for "high efficiency particulate air [filter]". This type of air filter can theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns (µm).



CDC. centre for Disease Control and Prevention. Chapter 7-Tuberculosis Infection Control. (2017).

Exhausted air treatment – portable HEPA

In order to simplify the installation, reducing the construction time and assuring proper air treatment, facilities may benefit from the use of a portable HEPA filter unit equipped with the proper fittings/ducting to exhaust air from a selected room to create the required ventilation flow rate and exhausted air treatment as well.

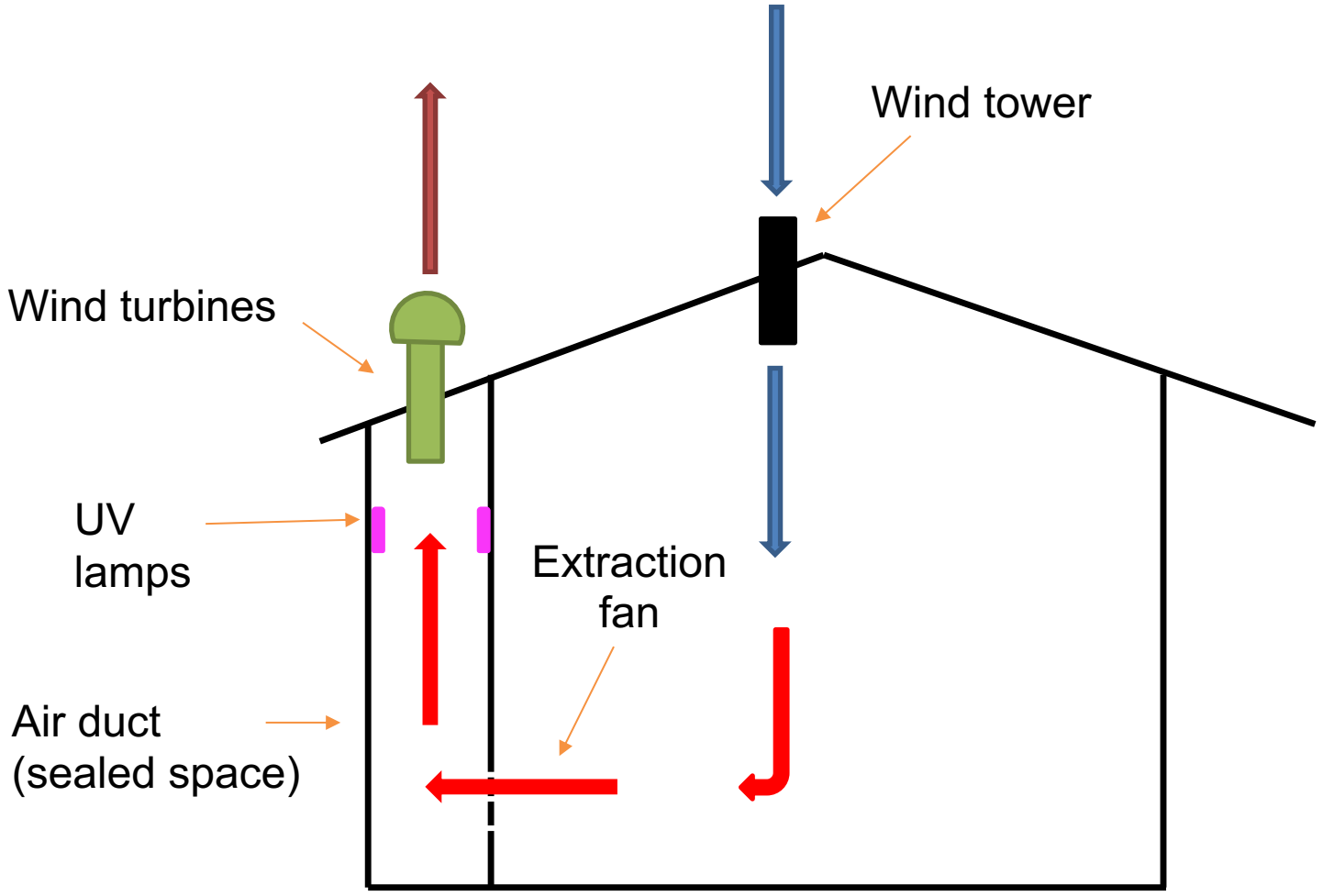


CDC. centre for Disease Control and Prevention. Chapter 7-Tuberculosis Infection Control. (2017).

Exhausted air treatment - Ultraviolet Germicidal Irradiation (UVGI)

UVGI is electromagnetic radiation that can destroy the ability of microorganisms to reproduce by causing photochemical changes in nucleic acids.

UVGI is not recommended as stand-alone system but only as complementary to HEPA filtration in case of air recirculation.



Reed, N. G. The history of ultraviolet germicidal irradiation for air disinfection. Public Health Reports vol. 125 15–27 (2010).

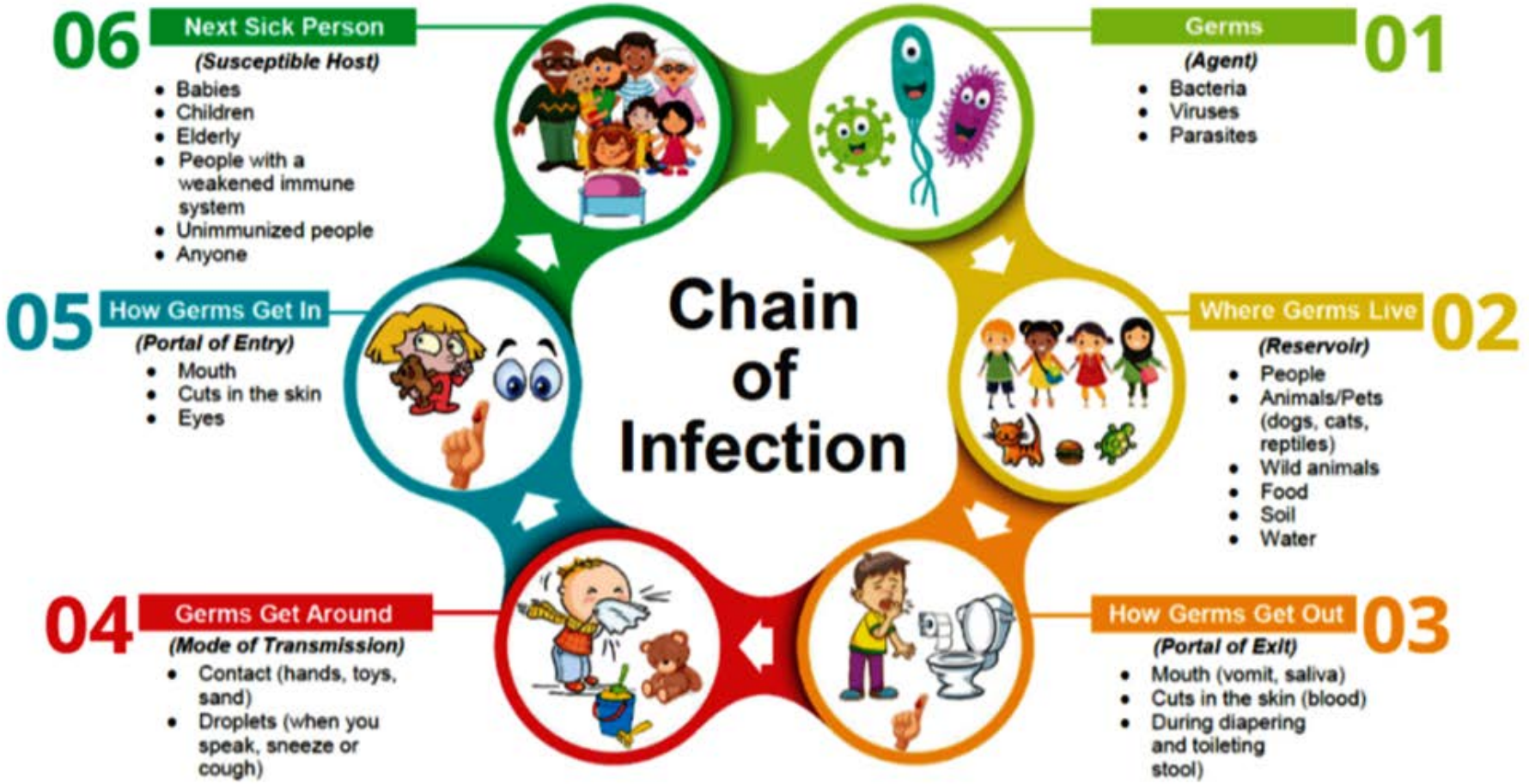
Module: 1C

Module 1C

Modes of transmission and rational use of PPE

Modes of transmission

For infection to spread, all links must be connected. IPC goal is to break a link in the chain to prevent the transfer of the pathogen.



http://ottawapublichealth.ca/en/professional.and.partners/chain.of.infection.aspx

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Modes of transmission

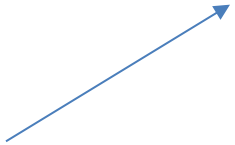
An infectious agent may be transmitted from its natural reservoir to a susceptible host in different ways. There are different classifications for modes of transmission.

In order to be able to assess the risk and rationalize the PPE, it's essential to understand the mode of transmission.

Contact	Direct contact	Direct Vertical Transmission	Mother to child
		Direct Horizontal Transmission	Direct physical transfer between one susceptible host and an infected/colonized person
	Indirect contact		Personal contact between a susceptible host and a contaminated intermediate object, usually inanimate
Airborne			By inhalation of infective small particles (< 5 µ) which once dispersed remain suspended in the air.
Droplet			By inhalation of infective large particles via close contact with an infected patient sneezing or coughing
Vector			Contact (e.g. stings, bites) with insects, arthropods and other parasites contaminated by excreta, secretions or blood from infected patients
Vehicle	Water borne		Transmission through contaminated water
	Food borne		Transmission through contaminated food

Modes of transmission

COVID-19



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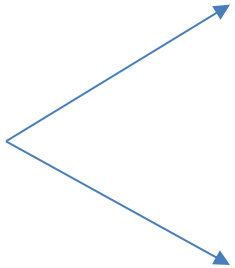

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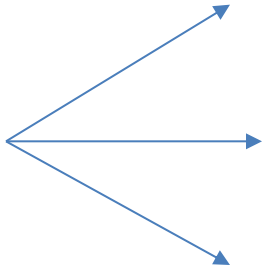
Modes of transmission

COVID-19



ONLY when performing aerosol-generating procedures, such as tracheal intubation, non-invasive ventilation, etc.

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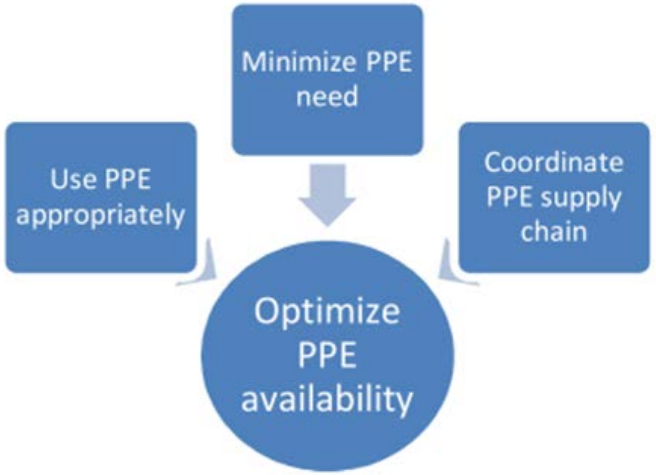
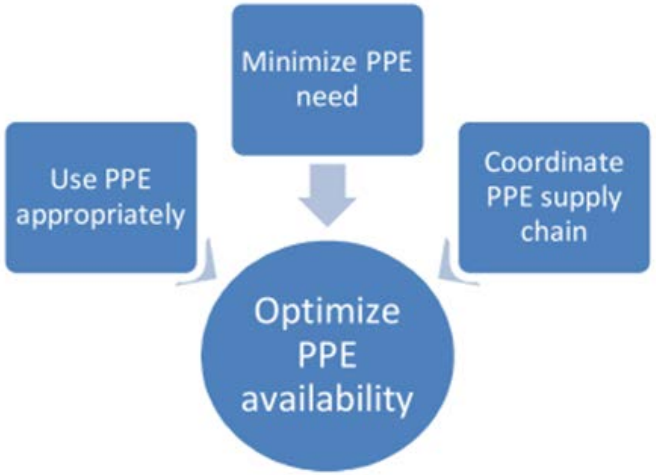
Rational use of PPE



- Use physical barriers to reduce exposure to the virus, such as glass or plastic windows. This approach can be implemented in areas of the healthcare setting where patients will first present, such as triage areas, the registration desk at the emergency department or at the pharmacy window where medication is collected.

Rational use of PPE



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

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Thank you

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