

Covid-19 in Indonesia

Cahyarini Dwiatmo





Agenda

01

Current Situation in Indonesia

Number of cases, population impact

02

Engineering Control

Part of Hierarchy Control as a strategy to combat Covid-19

03

Implementation engineering control in Indonesia's building

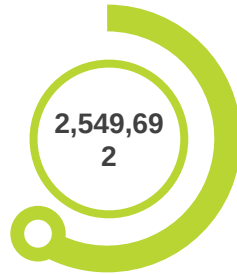
Air circulation, air change per hour, air dilution



Current Situation in Indonesia



Coronavirus Cases



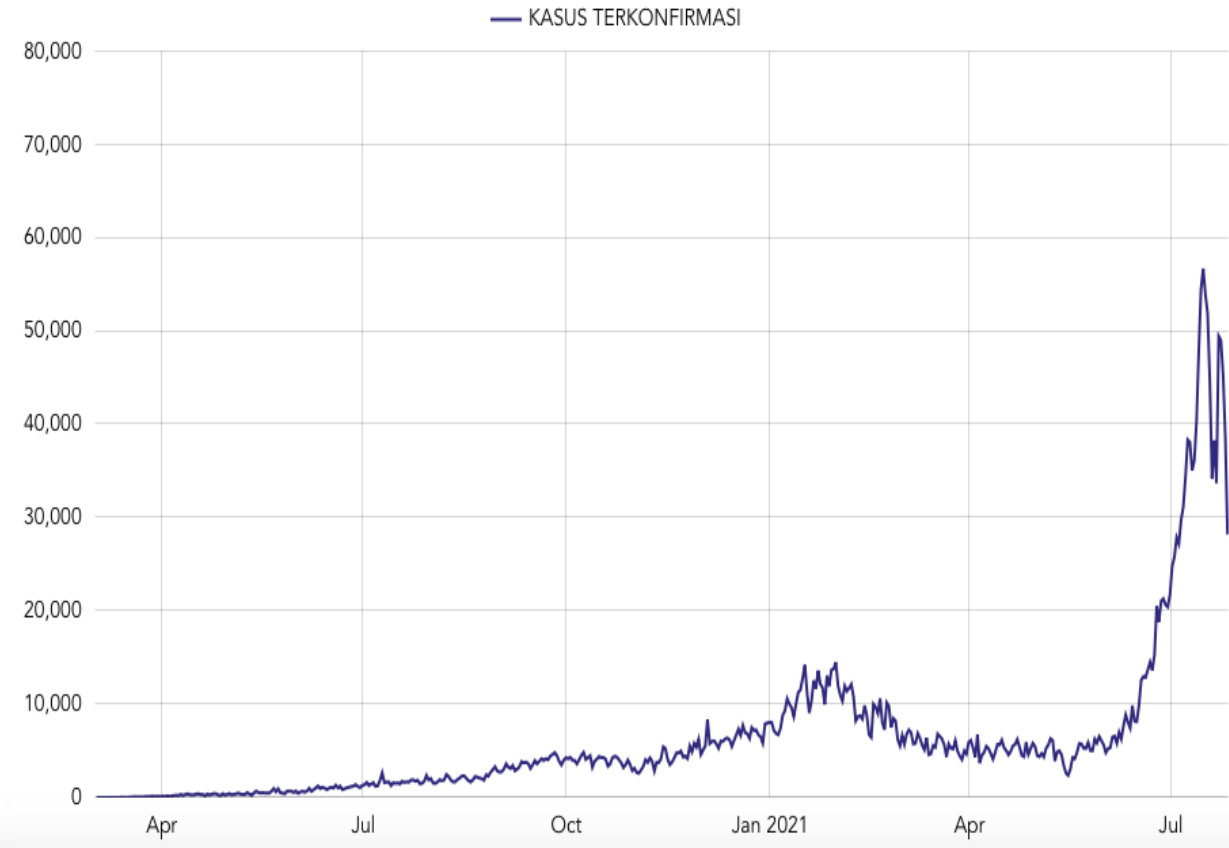
Deaths



Recovered

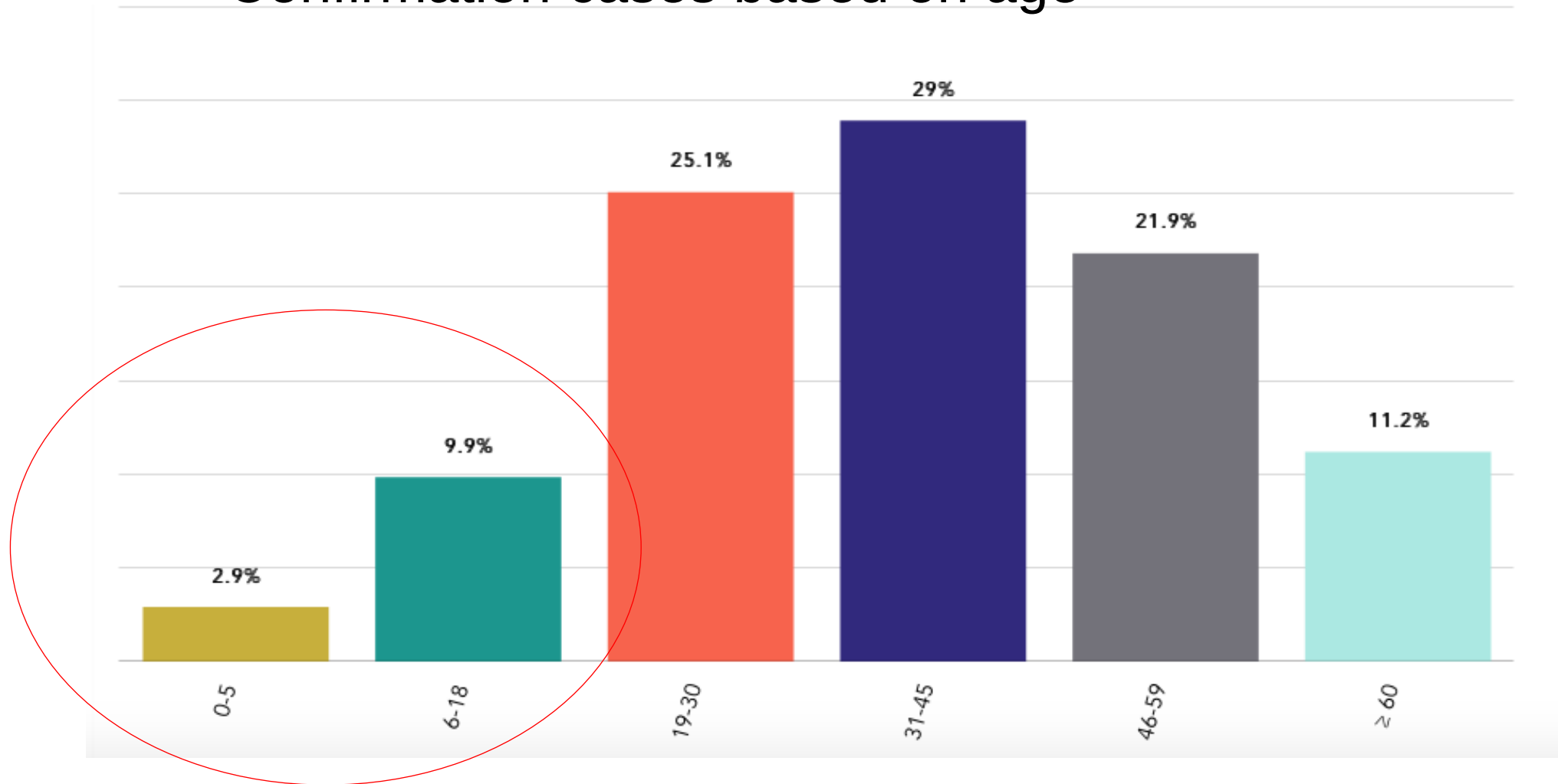
worldometer

Last updated: July 26, 2021, 14:45 GMT



Satuan Tugas Penanganan COVID-19 Indonesia, 2021

Confirmation cases based on age



Indonesia to Reopen Schools with Extra Cautions (Jakarta Globe, June 07, 2021)



indonesia hospital today



Indonesia prepared to add hospital room...
thejakartapost.com



INDONESIA More than a million COVID-19 ca...
asianews.it



Like a war zone': Doctors, hospitals plead fo...
thejakartapost.com



Indonesia faces oxygen crisis amid worsening Co...
bbc.com



Covid-19 cases surge to 1m in Indonesia, s...
straitstimes.com



Indonesia to ramp up testing, tracing ahead ...
thejakartapost.com



Fears for pregnant women, children as COV...
aljazeera.com



Indonesia Continues to Break Daily Case Records...
en.tempo.co



10 VARIAN CORONA

Variant of Concern (VoC)



ALPHA/B117

Sebelumnya disebut Varian Inggris



BETA/B1351

Sebelumnya disebut Varian Afrika Selatan



GAMMA/P1

Sebelumnya disebut Varian Brazil



DELTA/B1617.2

Sebelumnya disebut Varian India

Variant of Interest (Vol)



**EPSILON/
B1427-B1429**

Pertama kali ditemukan di AS



AETA/P2

Pertama kali ditemukan di Brazil



THETA/P3

Pertama kali ditemukan di Filipina



IOTA/B1526

Pertama kali ditemukan di Amerika Serikat



ETA/B1525

Pertama kali ditemukan di beberapa negara, tidak spesifik



KAPPA/B1617.1

Pertama kali ditemukan di India dikanal sebagai "Varian India"



Waspada 3 Varian COVID-19 di Indonesia

POTENSI BAHAYA

Varian B117

Tingkatkan Risiko Kematian dibandingkan varian lain, tapi belum terbuktiengaruhi kemanjuran Vaksin Covid-19

Varian B1351

Turunkan Efikasi Vaksin & tingkatkan risiko keparahan penyakit

Varian B1617

Bermutasi Ganda: L452S & E484Q
L452S : Tingkatkan Transmisi Virus & kurangi kemanjuran antibodi
E484Q : Bantu Virus hindari sistem kekebalan tubuh



RSUP Persahabatan



rs_persahabatan



RSUP Persahabatan



rs_persahabatan

www.rsuppersahabatan.co.id

Problems in Indonesia

- Possitivity rate: high
- Health facilitiy & capacity: not enough
- Virus mutation
- Habit of Indonesian people
- Inadequate building in Indonesia makes disease transmission to occur easily





Correspondence

How can airborne transmission of COVID-19 indoors be minimised?



ARTICLE INFO

Handling Editor: Adrian Covaci

ABSTRACT

During the rapid rise in COVID-19 illnesses and deaths globally, and notwithstanding recommended precautions, questions are voiced about routes of transmission for this pandemic disease. Inhaling small airborne droplets is probable as a third route of infection, in addition to more widely recognized transmission via larger respiratory droplets and direct contact with infected people or contaminated surfaces. While uncertainties remain regarding the relative contributions of the different transmission pathways, we argue that existing evidence is sufficiently strong to warrant engineering controls targeting airborne transmission as part of an overall strategy to limit infection risk indoors. Appropriate building engineering controls include sufficient and effective ventilation, possibly enhanced by particle filtration and air disinfection, avoiding air recirculation and avoiding overcrowding. Often, such measures can be easily implemented and without much cost, but if only they are recognised as significant in contributing to infection control goals. We believe that the use of engineering controls in public buildings, including hospitals, shops, offices, schools, kindergartens, libraries, restaurants, cruise ships, elevators, conference rooms or public transport, in parallel with effective application of other controls (including isolation and quarantine, social distancing and hand hygiene), would be an additional important measure globally to reduce the likelihood of transmission and thereby protect healthcare workers, patients and the general public.

1. Recognising the potential for the airborne transmission of SARS-CoV-2

the 1–4 μm and $> 4 \mu\text{m}$ size ranges containing a range of viral loads (1.8–3.4 viral RNA copies per L of air) (Chia et al., 2020). The study from Nebraska, USA found that 63% of the air samples were positive



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Airborne transmission of SARS-CoV-2: The world should face the reality

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Bangunan Vertikal Tertutup
Tanpa Ventilasi & HVAC
kurang baik



Risiko Penularan

Dari Pasien ke Petugas
Dari Pasien ke Pasien
Dari Petugas ke Pasien atau antar
petugas

- **Tuberculosis, measles, chickenpox**

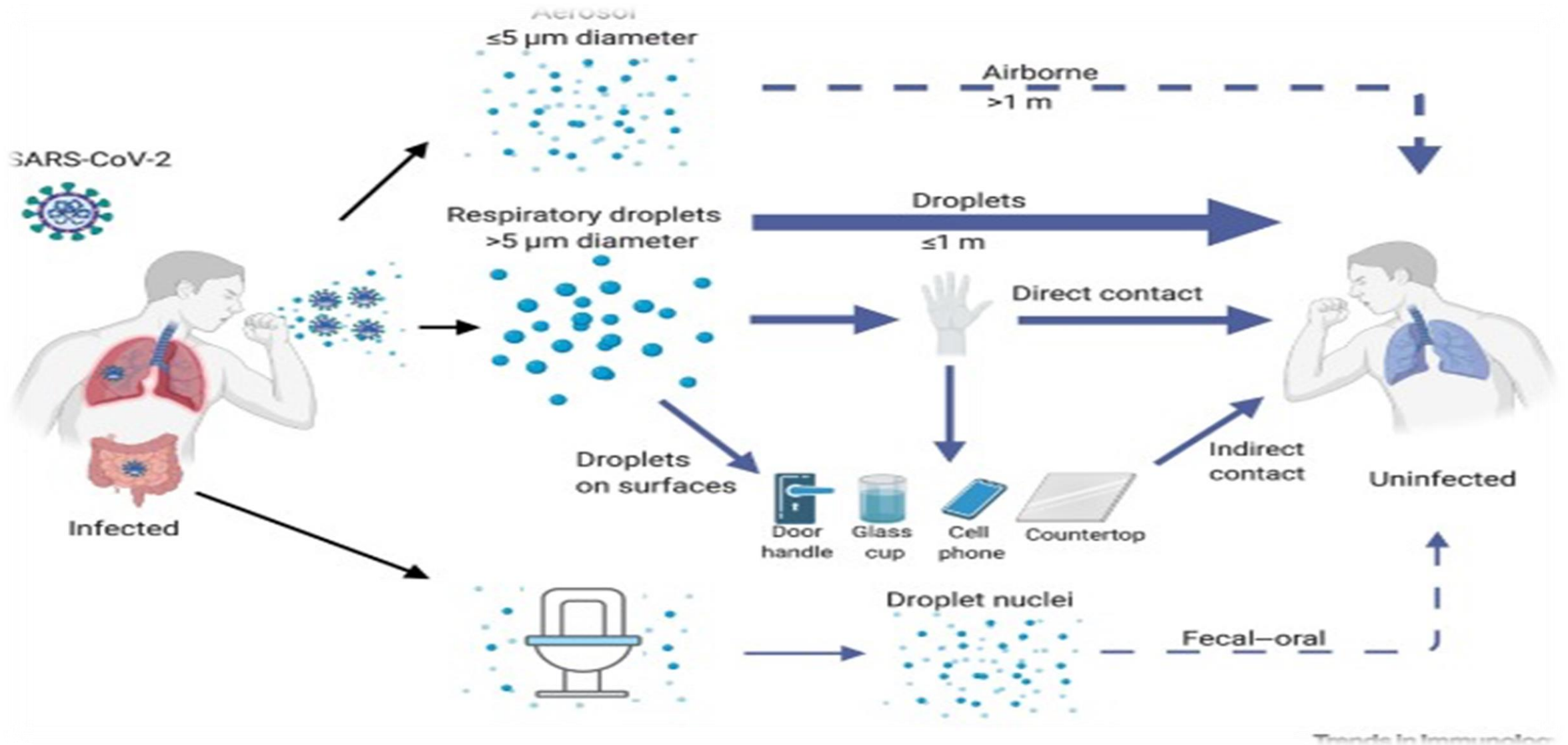
(Department of Health, 2015; Tellier et al., 2019).

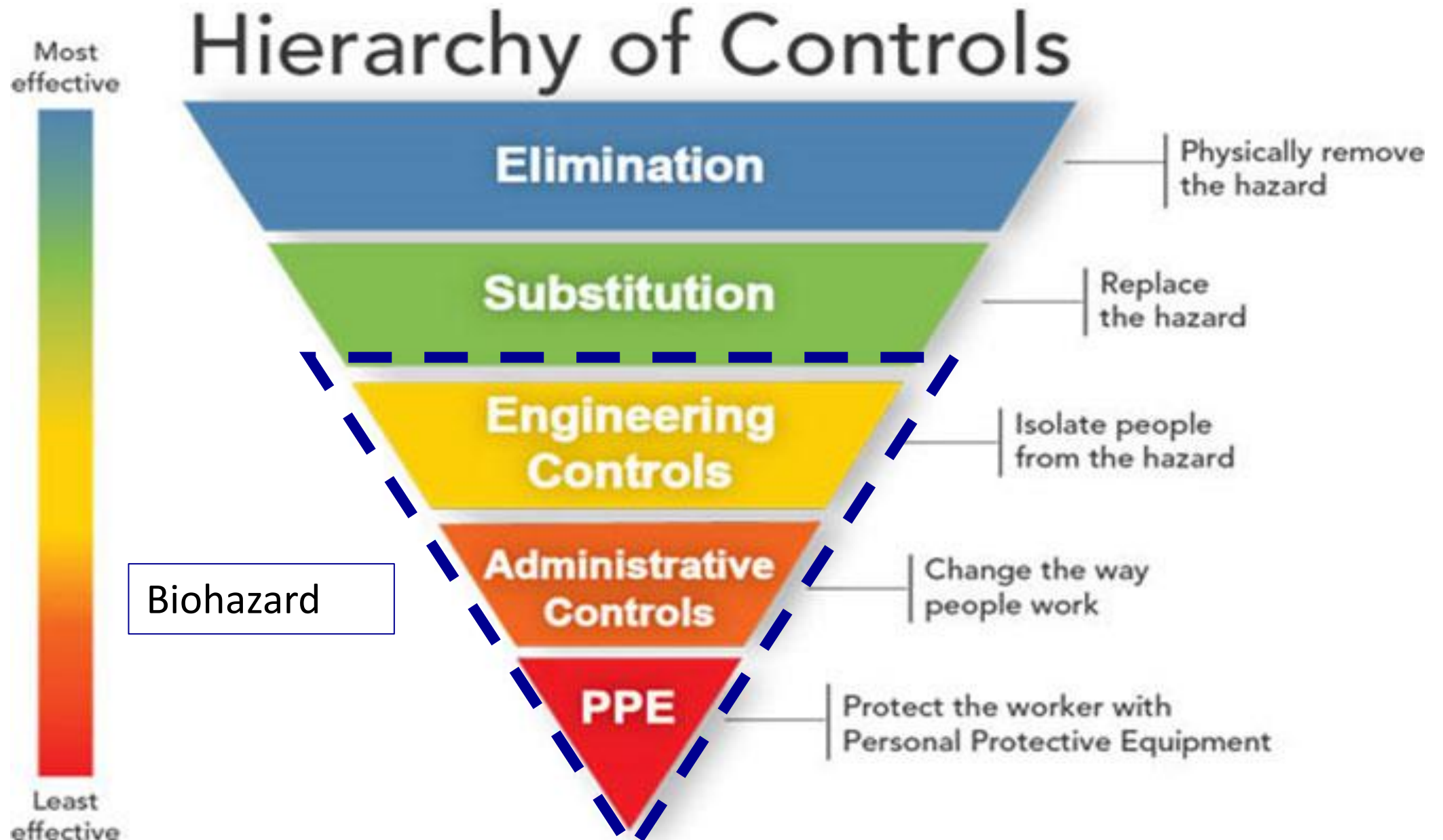
- **Respiratory viruses**

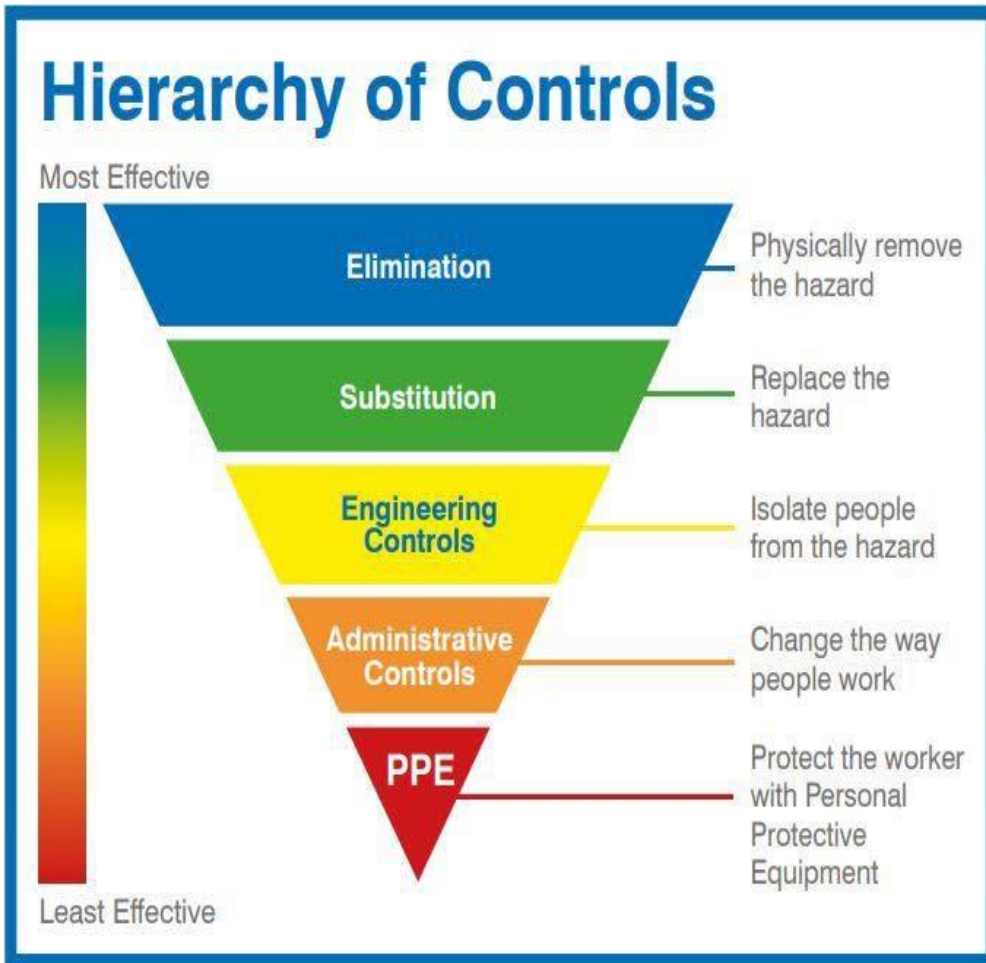
(Booth et al., 2013; Kim et al., 2016; Kulkarni et al., 2016; Li et al., 2007; Tellier et al., 2019)

- SARS-CoV
- MERS-CoV (Middle East Respiratory Syndrome coronavirus),
- Respiratory Syncytial Virus
- Influenza

Transmission of Covid-19







Consist of 5 elements:

Elimination: eliminate the hazard

Substitution: change the hazard with something less harm

Engineering Control: to isolate the hazard from people

Administrative Control: change behaviour so the hazard can not harm the people

Personal Protective Equipment (PPE/ APD): an equipment that protect people from hazard

Due to Covid-19 is a biohazard, so we can not implement elimination and substitution element



Engineering Control:
Air & room engineering

Guideline that can be used



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

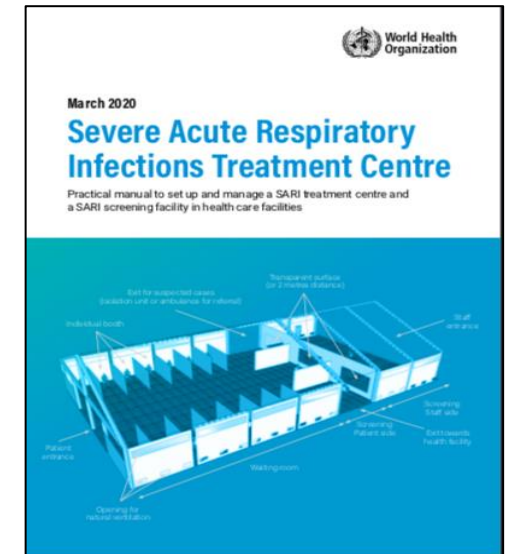
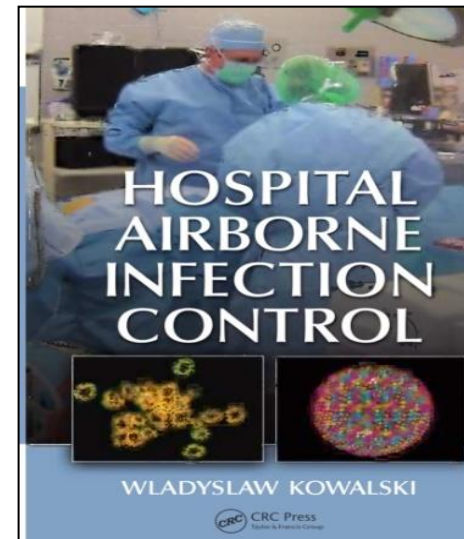
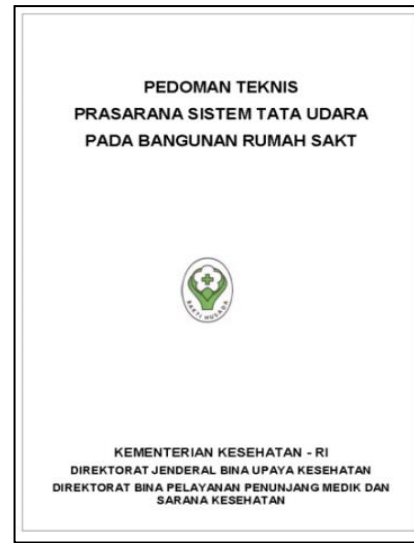
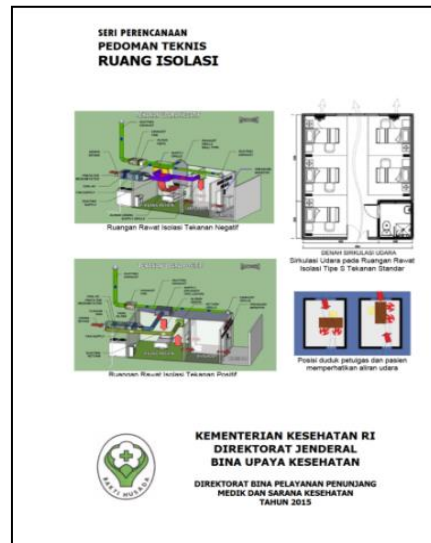
Interim guidance

January 2020

[WHO/2019-nCoV/IPC/v2020.1](#)



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™



Room engineering



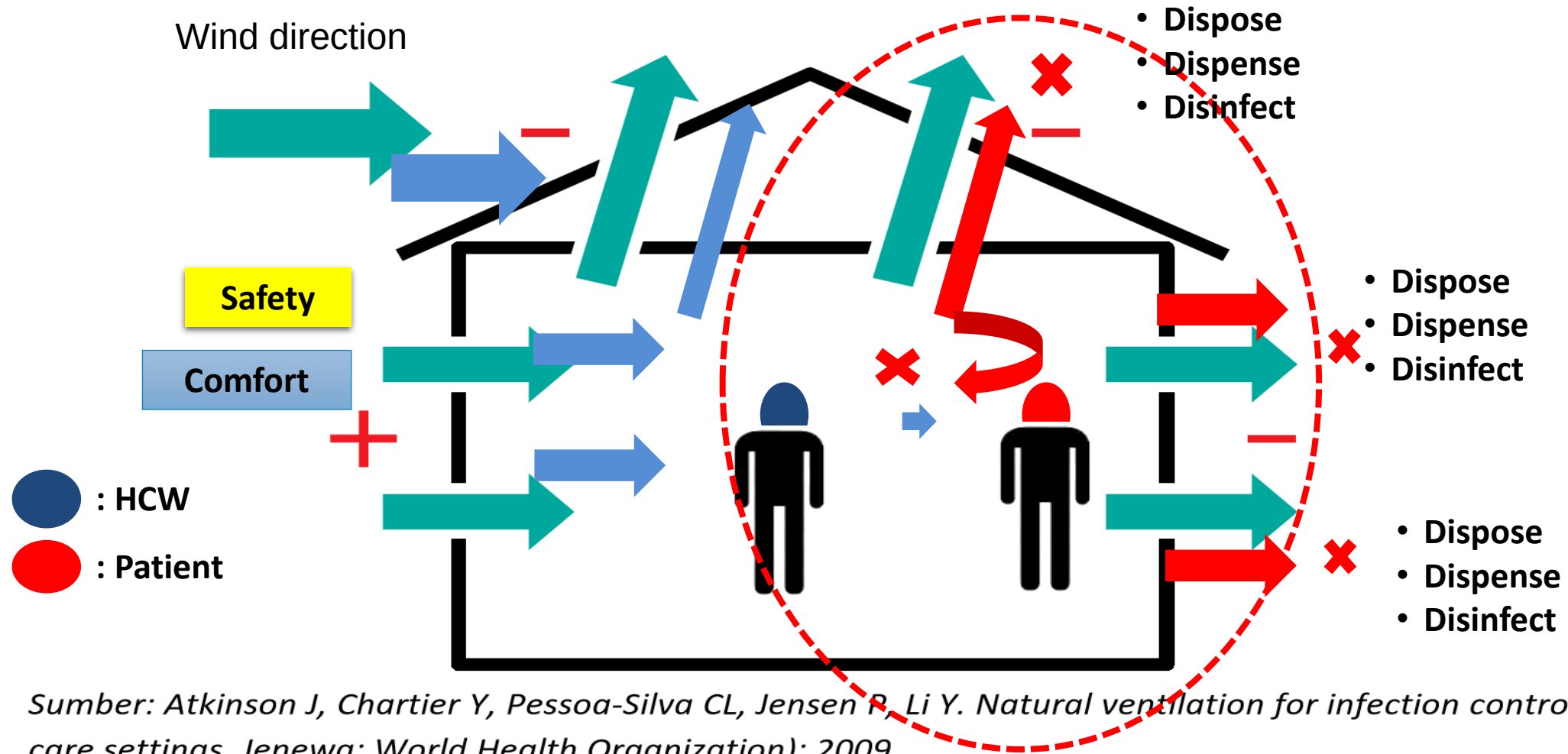
- Principle:

- Physical distancing
- Work flow: from clean to dirty

- room design:

- Hospital/ school/ office building/ public facilities
 - Hospital: waiting room, admission, emergency room, policlinic, surgery room, ICU, isolation room, laboratory, kitchen, laundry, sterilization unit, mortuary
 - Public: Work space, waiting room, class room, bath room, cafeteria,

Principle of Air Circulation in Covid-19



The principle of air engineering in health facilities

1. **Ventilation Type** that used
2. **Air Dilution** supply of fresh air that enters in the room within 1 hour = Air Change perHour (ACH -> 12X)
3. **Air Flow** → direct the air from the HCW to the patient, from clean to dirty
4. **Pressure difference between rooms** (negative Vs positive)
5. **Air filtration**
6. **Air Disinfection** → with UVGI or UV direct from the sunlight

1.

ventilation type



1. Natural Ventilation:

- Open windows or doors
- Air flow for each person: 160 l/second/person
- the air flow not always constant, can not predict, can not be adjusted

2. Mechanical Ventilation:

- We can adjust the air flow

3. Mixed Ventilation:

- Combine between natural ventilation & mechanic ventilation.

2. Air Dilution



- Dilute contaminated air with fresh air
- ACH (*Air Change perHour*) 12 X = the air in the room is clean if it has been dchange minimal 12 times per hour
- ACH >12 X = the process of dilution of the contaminant concentration in the airborne treatment room occurs faster

3.

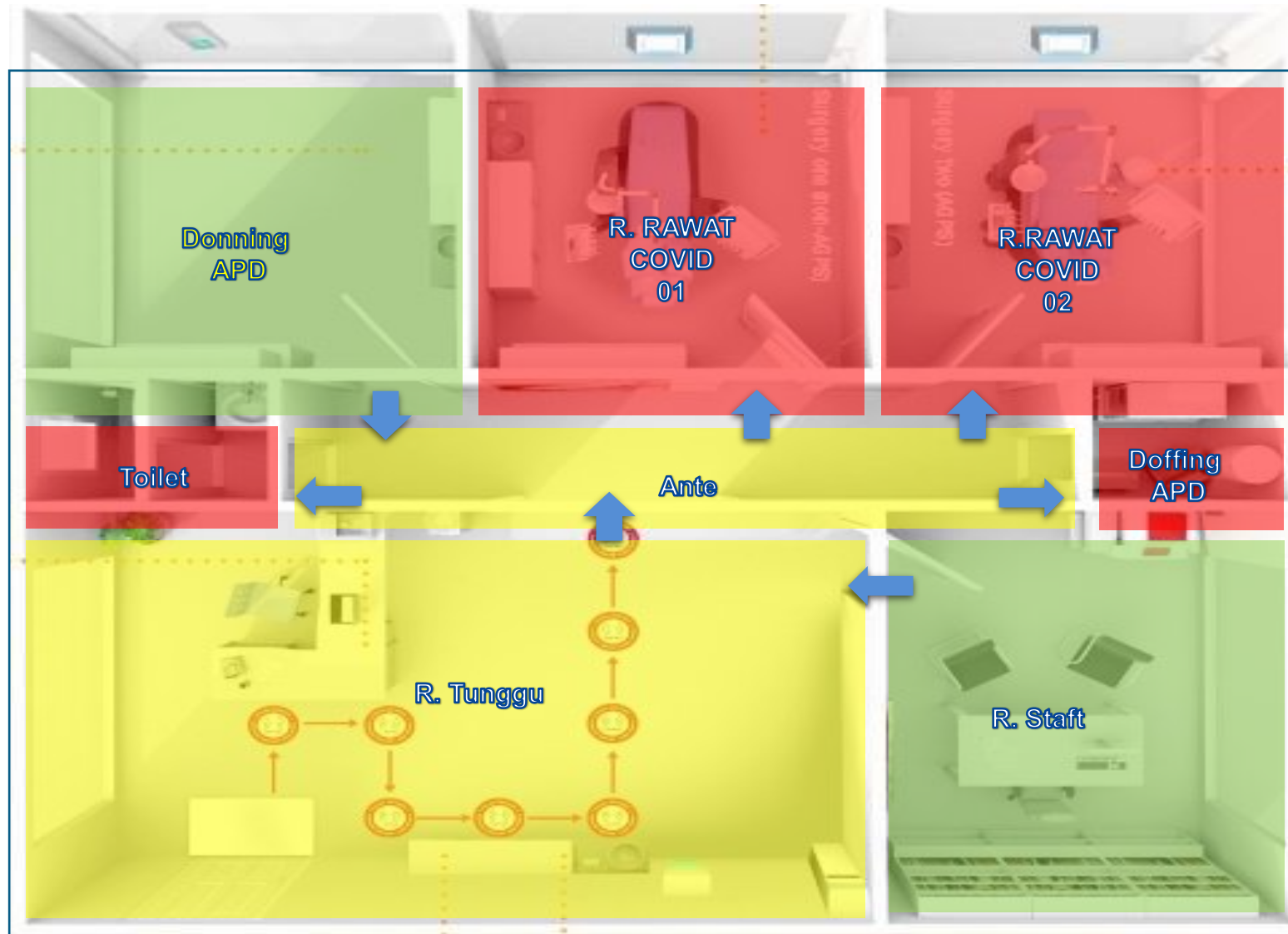
Airflow direction



- Airflow direction from positive to negative pressure
- Adjust the airflow from the cleanest room to the dirtiest room
- Goal: Prevent Cross Contamination / migration of viruses to the surrounding space

3.

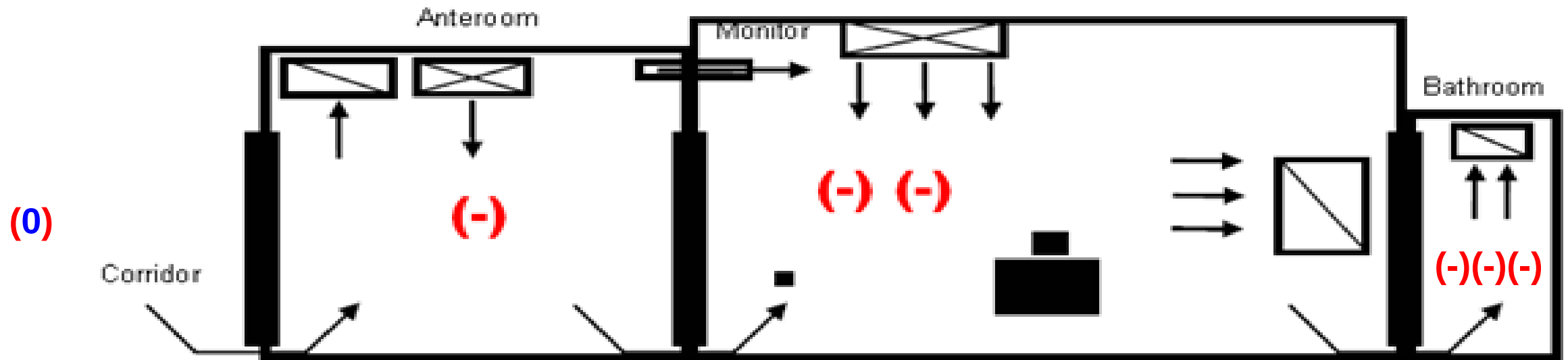
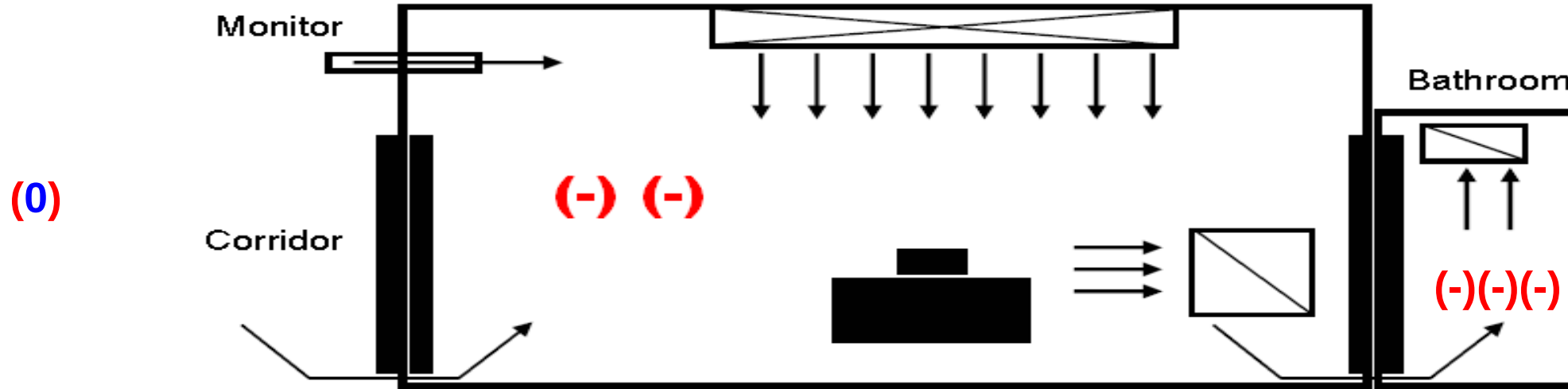
Airflow direction



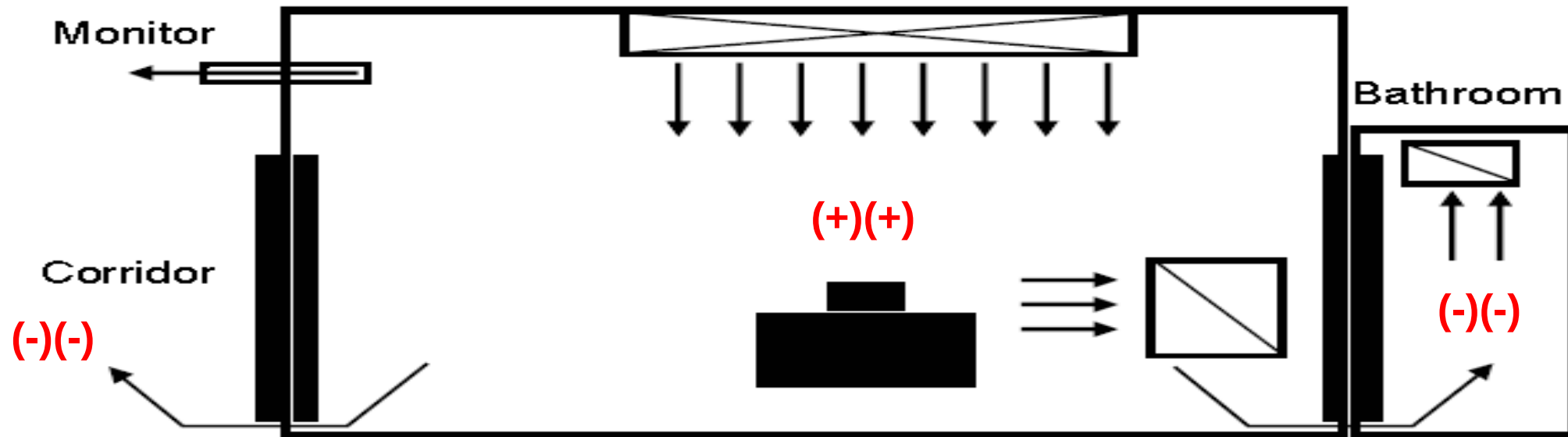
Keterangan :

- : aerosol area
- : Mixed Area
- : HCW area
- : Airflow

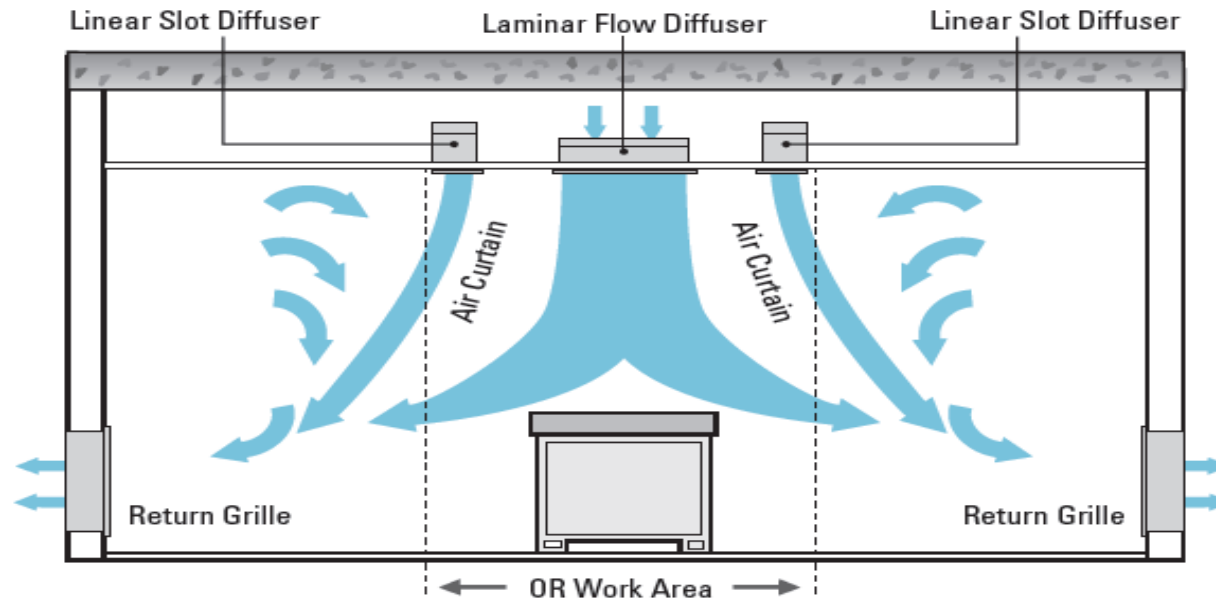
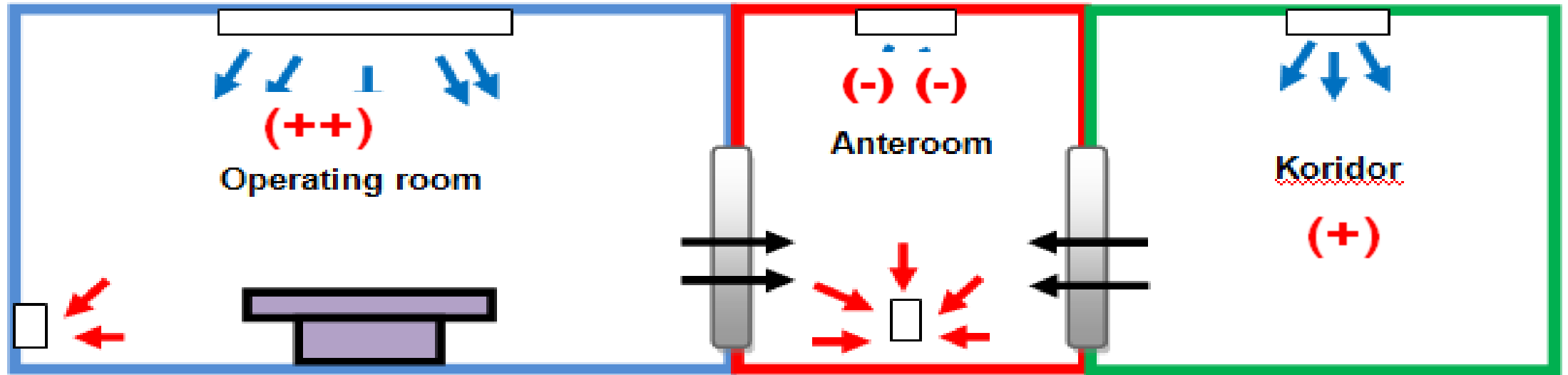
3. Airflow in Patient Room



3. Arah Aliran Udara di Kamar Pasien



3. Arah Aliran Udara di Kamar Operasi



4. Isolation Pressure Room



Negative Air Pressure

- When indoor air pressure is **lower** than pressure outside
- **Outside air rushes in** to try and balance out the pressure difference

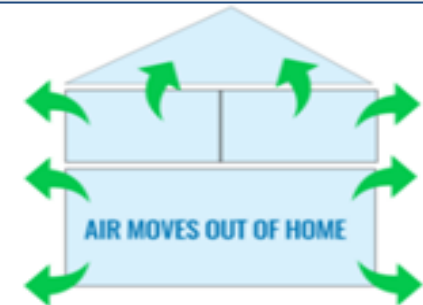


1. Negative Pressure

- Airborne Isolation Room
- Microbiology lab
- Pharmacist lab
- Autopsy Room

Positive Air Pressure

- Your air pressure inside is **greater** than pressure outside
- Air gets pushed into walls and insulation



2. Positive Pressure

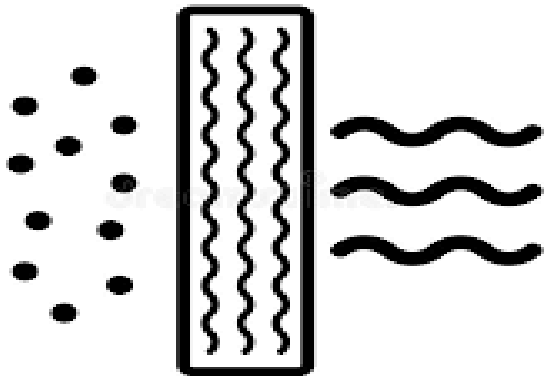
- *Clean room*
- Operating theatre, immunocompromised isolation room

Negative Pressure Isolation Room



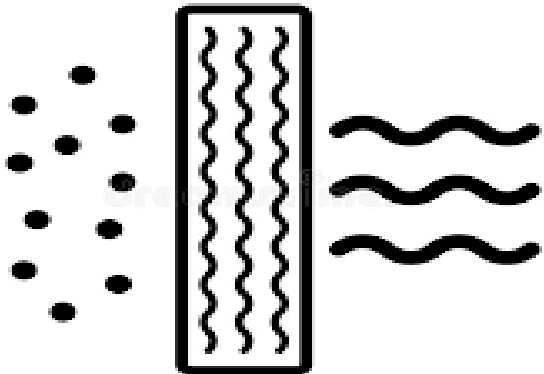
- Perbedaan tek. **-10 s/d -15 Pascal** dan minimal **-2,5 Pascal**
- Air exchange: **outlet** minimal $>10\%$ from **inlet** with $ACH \geq 12$ times
- Airflow **from clean to dirty**
- **Non recirculation** System with 100% *fresh Air*
- Circulation system can be applied with Hepa Filter Efficiency 99,75% for 0,3 μm particles
- Temperature room: $21 - 24^{\circ}C$
- Humidity $50 \pm 10\%$
- Dirty Air Exhaust:
 - 3 meters high from the surface of the tallest building
 - There is no activity of people within a 10 meter radius
 - in an infectious zone environment (limited access)

5. Air Filtration



- GOAL: to reduce the transmission of infectious pathogens from one area to another
- The components of the filtration apparatus consist of:
 - Fibrous or porous material to remove solid particles such as dust, pollen, mold and bacteria from the air.
 - Adsorbents or catalysts such as charcoal (carbon) can also remove odors and gaseous pollutants (volatile organic compounds or ozone)

5. Air Filtration



- HEPA = *High Efficiency Particulate Air*
- Mechanical air filter that can filter 99.97% of dust, pollen, mold, bacteria and other particles measuring 0.3 microns (μm).
- Can be installed in building air conditioning systems or portable

6. Air Disinfection with UV (UVGI)

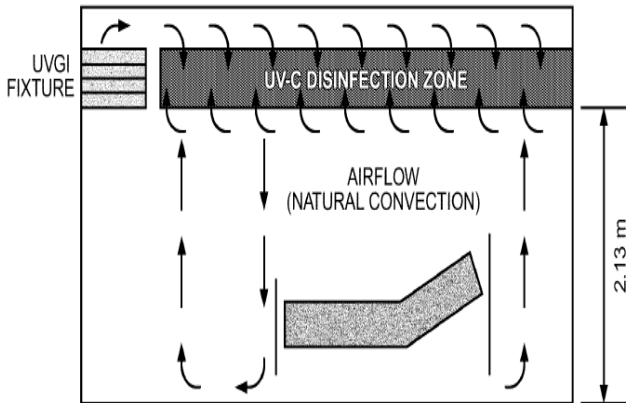


Fig. 5 Typical Elevation View of Upper-Room UV Applied in Hospital Patient Room



Fig. 8 Upper-Room UVGI Fixtures and Natural Ventilation in Corridor of TB Facility in Brazil
(Centers for Disease Control and Prevention)

- Ultra Violet Germicidal Irradiation
- Goal: kill the virus in the air in a room
- UV rays are directed horizontally to create a disinfection zone
- Airflow is directed into the UV disinfection zone
- Very effective with 2-6 ACH Installation location for UVGI fixtures: above the habitable zone at a height of 2.1 meters (7 feet) or more
- Adjust lamp for even illumination, Average 30 – 50 W/cm²
- Lamp power for floor zone: 18.7 W/m² Lamp power for upper zone: 6 W/cm³
- Be careful about safety/health problems that can be caused by UV lamps in inhabited rooms.

6.

Disinfeksi Udara (UVGI)



Precautions in the Use of UVGI:

- UV can degrade organic materials such as:
 - Electrical insulation.
 - Elastomers and sealants
 - Media Filters
 - Gaskets and pipe insulation
- The lamp life is determined by the manufacturer (6000-10,000 operating hours)
- UV lamps contain mercury (Hg) which is dangerous waste
- Use appropriate inspection ports and/or protective equipment
- Radiometer measurements to ensure acceptable and correct output levels.
- Beware of direct UV exposure:
 - Photokeratitis
 - Conjunctivitis
 - Erythema (skin irritation)

Referensi

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Kesimpulan:

Kondisi bangunan Faskes saat ini harus sangat mempertimbangkan tata udara.

Hirarki Kontrol sangat penting dikerjakan dalam menghadapi wabah Covid-19.

Pelajari banyak guideline & pertimbangkan modalitas serta kearifan lokal dalam melakukan rekayasa/remodelling ruangan maupun tata udara

Dalam pandemi, keamanan Nakes yang diutamakan

Validasi tata udara penting dilakukan untuk memastikan hasil keluaran dari rekayasa sesuai standar & keamanan saat digunakan



Thank You