Route of transmission of COVID-19

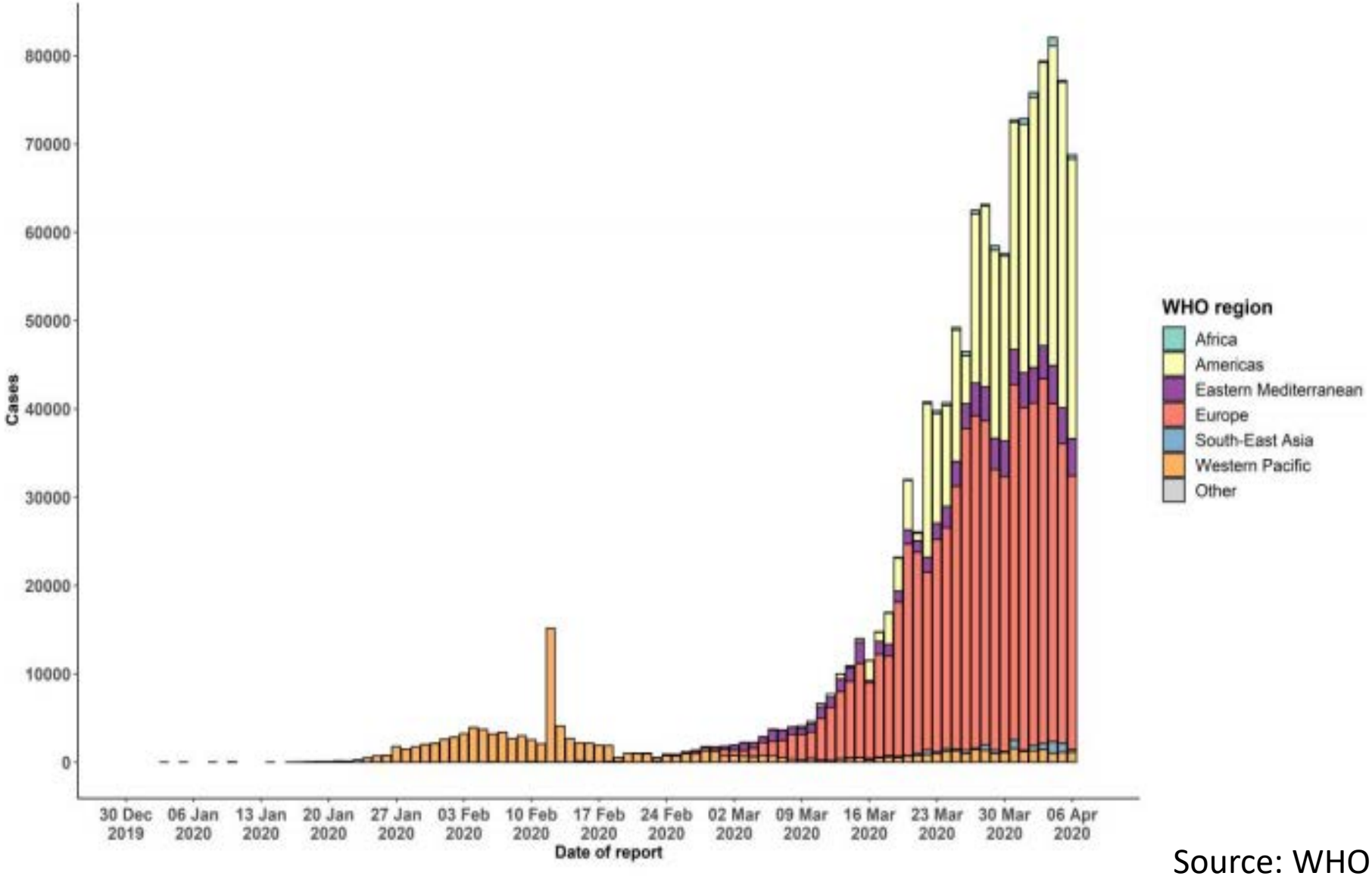
Dr Edmond MA

Associate Consultant

Infection Control Branch , CHP

8 April 2020

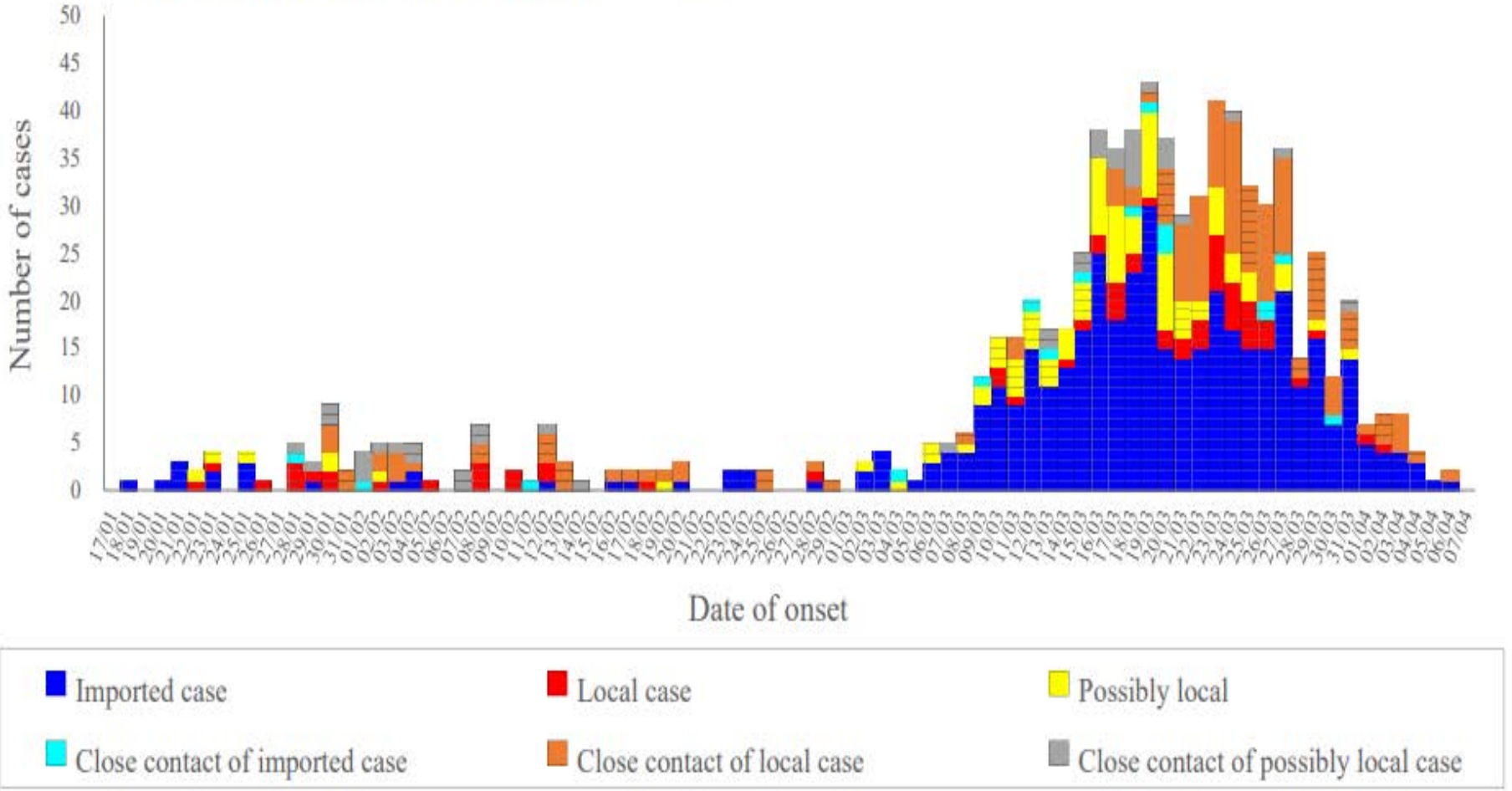
Figure 1. Epidemic curve of confirmed COVID-19, by date of report and WHO region through 7 April 2020



Source: WHO

Epidemic curve of confirmed and probable cases of COVID-19 in Hong Kong (as of 7 Apr 2020)

Number of confirmed and probable cases = 936



Note:

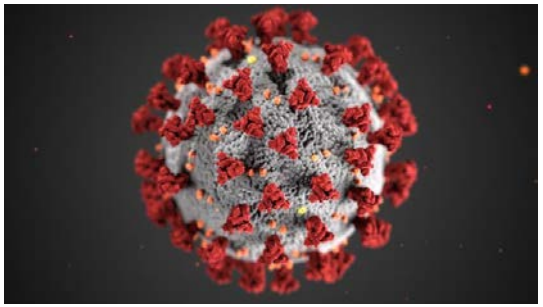
1. The case classification may be subject to changes when there is new information available.
2. Asymptomatic cases are not shown in this epidemic curve.

(Last updated on 7 April 2020)

Source: CHP

Coronavirus Disease 2019 (COVID-19)

- Causative agent
  - A novel coronavirus is found to be the causative agent, which named as SARS-CoV-2



Courtesy of CDC

- Clinical features
  - Symptoms of the cases include fever, malaise, dry cough and shortness of breath
  - Some cases were in serious condition
  - People of older age or having underlying disease are at a higher risk of deterioration into serious condition

- Incubation Period
  - Estimated range from 1 to 14 days, most commonly around 5 days

Coronavirus Disease 2019 (COVID-19)

- Routes of transmission
  - The main mode of transmission is through respiratory droplets
    - Droplet transmission: when the mucous membrane of the eyes, nose and mouth of a susceptible person come into contact with infectious respiratory droplets
  - Can also be transmitted through contact
    - Direct contact: direct contact with secretions or other body fluid
    - Indirect contact: contact with contaminated object or environment

Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations

Scientific brief

29 March 2020

World Health Organization

This version updates the 27 March publication by providing definitions of droplets by particle size and adding three relevant publications.

Modes of transmission of the COVID-19 virus

Respiratory infections can be transmitted through droplets of different sizes: when the droplet particles are >5-10 µm in diameter they are referred to as respiratory droplets, and when then are ≤5µm in diameter, they are referred to as droplet nuclei.[1] According to current evidence, COVID-19 virus is primarily transmitted between people through respiratory droplets and contact routes.[2-7] In an analysis of 75,465 COVID-19 cases in China, airborne transmission was not reported.[8]

Droplet transmission occurs when a person is in in close contact (within 1 m) with someone who has respiratory symptoms (e.g., coughing or sneezing) and is therefore at risk of having his/her mucosae (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets. Transmission may also occur through fomites in the immediate environment around the infected person.[8] Therefore, transmission of the COVID-19 virus can occur by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person (e.g., stethoscope or thermometer).

Airborne transmission is different from droplet transmission as it refers to the presence of microbes within droplet nuclei, which are generally considered to be particles ≤5µm in diameter, can remain in the air for long periods of time and be transmitted to others over distances greater than 1 m.

In the context of COVID-19, airborne transmission may be possible in specific circumstances and settings in which procedures or support treatments that generate aerosols are performed; i.e., endotracheal intubation, bronchoscopy, open suctioning, administration of nebulized treatment, manual ventilation before intubation, turning the patient to the prone position, disconnecting the patient from the ventilator, non-invasive positive-pressure ventilation, tracheostomy, and cardiopulmonary resuscitation.

There is some evidence that COVID-19 infection may lead to intestinal infection and be present in faeces. However, to date only one study has cultured the COVID-19 virus from a single stool specimen.[9] There have been no reports of faecal–oral transmission of the COVID-19 virus to date.

Prevention

- There is no vaccine for this infectious disease at the moment
- Daily life
  - To maintain at all times strict personal and environmental hygiene is key to personal protection against infection and prevention of the spread of the disease in the community
- During work
  - Strictly comply with IC recommendations, especially HH and appropriate use of PPE

Hand Hygiene

Hand hygiene is the single most important measure of reducing the spread of diseases.

- Perform hand hygiene frequently.
- Wash hands with soap and water when hands are visibly dirty or visible soiled with blood, body fluid, after using the toilet or changing the diapers.
- When hands are not visibly soiled, 70-80% alcohol-based handrub is also an effective alternative.

Rub hands for at least 20 seconds

Hand hygiene technique

Personal Protective Equipment (PPE)

- The primary use of PPE is to protect healthcare workers and reduce opportunities for transmission of microorganisms in healthcare facilities

- Appropriate use of PPE can safeguard oneself and the others

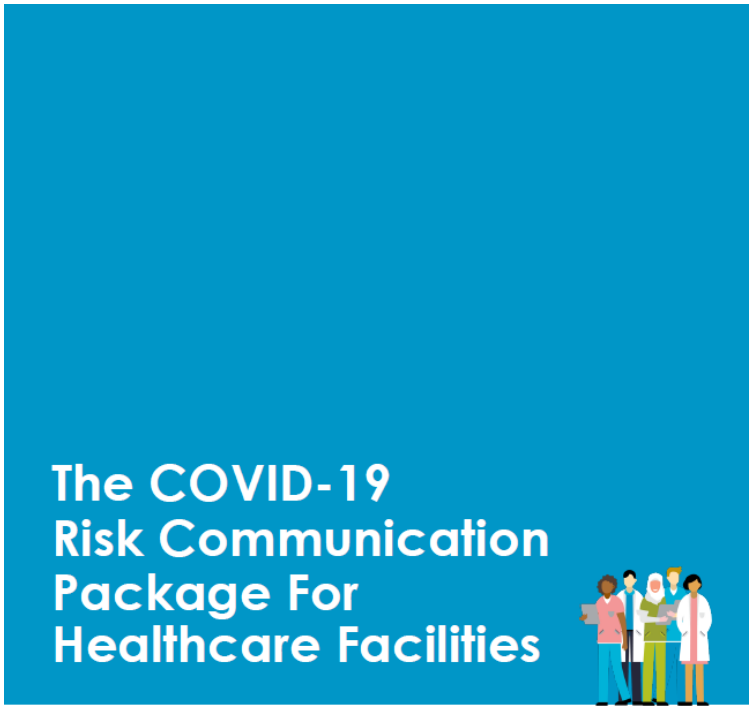
Appropriate of PPE

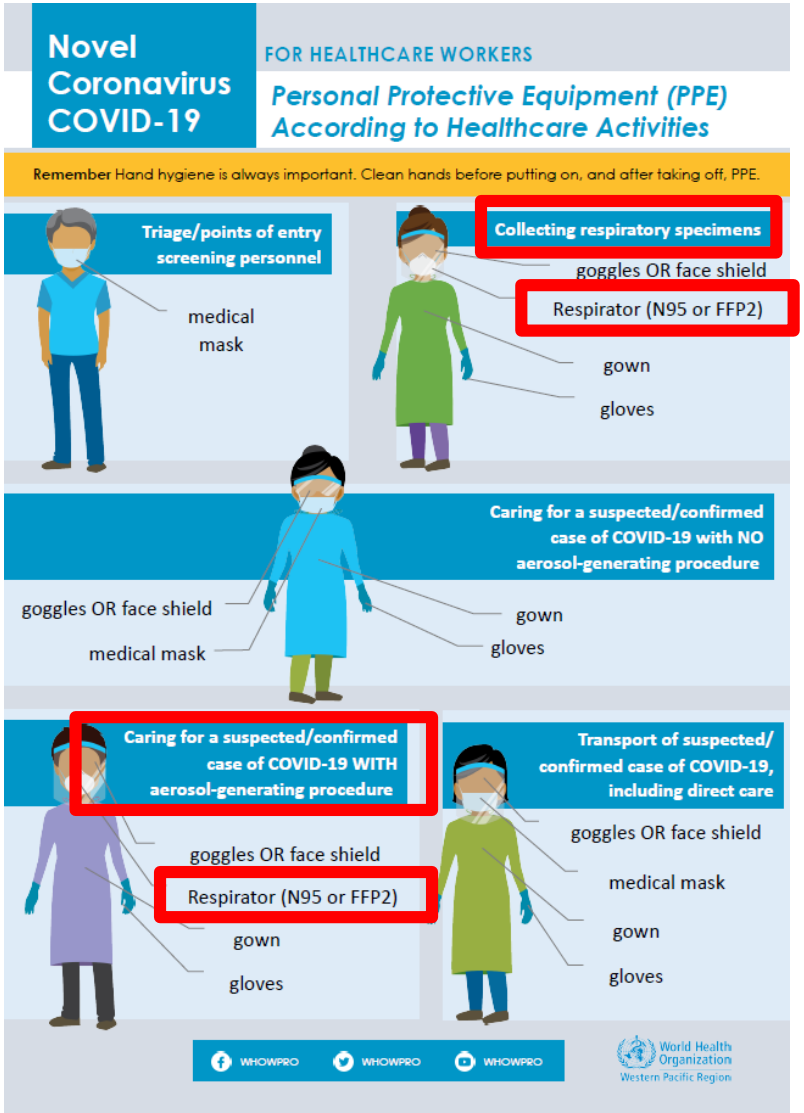
- Routes of transmission

- Risk assessment
  - Nature of contact
  - Working environment

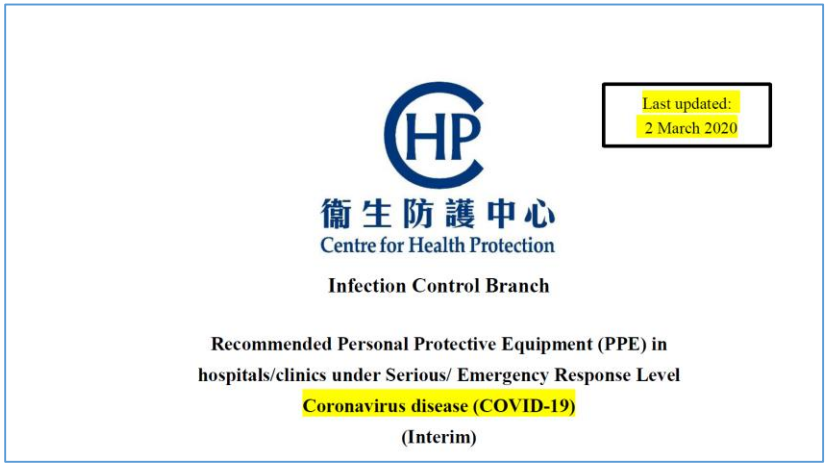
Aerosol Generating Procedures

WHO - The COVID-19 Risk Communication Package For Healthcare Facilities





CHP - Recommended Personal Protective Equipment (PPE) in hospitals/clinics under Serious/ Emergency Response Level Coronavirus disease (COVID-19) (Interim)



Last updated:
2 March 2020

衞生防護中心
Centre for Health Protection

Infection Control Branch

Recommended Personal Protective Equipment (PPE) in hospitals/clinics under Serious/ Emergency Response Level Coronavirus disease (COVID-19) (Interim)

Recommended Personal Protective Equipment for routine patient care and performing aerosol-generating procedures in hospitals/clinics under **Serious / Emergency Response Level**.

Apply Standard Precautions +/- transmission based precautions for all patients

Areas	Activities	Serious Response Level	Emergency Response Level
		Recommended PPE	
High-risk patient areas I. Triage stations of Out-patient Clinics and AEDs	Routine patient care and aerosol-generating procedures [a,b]	• Surgical mask • eye protection [d] • gown • gloves • cap(optional) Use N95 respirator when performing aerosol-generating procedures.	• Surgical mask • eye protection [d] • gown • gloves • cap(optional) Use N95 respirator when performing aerosol-generating procedures.
High-risk patient areas II. Designated clinics III. Isolation rooms (including isolation rooms in ICU and AEDs)	Routine patient care and aerosol-generating procedures [a,b]	• N95 respirator • eye protection [d] • gown • gloves • cap(optional) Use N95 respirator when performing aerosol-generating procedures.	• N95 respirator • eye protection [d] • gown • gloves • cap(optional) Use N95 respirator when performing aerosol-generating procedures.
	No patient contact (e.g. outside patient room)	• Surgical mask	• Surgical mask
Other patient areas	Routine patient care	• Surgical mask, Standard Precautions +/- transmission based precautions	• Surgical mask, Standard Precautions +/- transmission based precautions
	Aerosol-generating procedures [a,c,e]	• N95 respirator • eye protection [d] • gown • gloves • cap (optional)	• N95 respirator • eye protection [d] • gown • gloves • cap (optional)
	No patient contact	• Surgical mask is required in patient areas	• Surgical mask is required in ALL areas

Why not always N95?

- According to a study in Singapore involving 212 health care workers
  - continuous use of the N95 face-mask exceeding 4 hours were associated with development of headaches.

Acta Neurol Scand 2006: 113: 199–202 DOI: 10.1111/j.1600-0404.2005.00560.x

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Headaches and the N95 face-mask amongst healthcare providers

Lim ECH, Seet RCS, Lee K-H, Wilder-Smith EPV, Chuah BYS, Ong BKC. Headaches and the N95 face-mask amongst healthcare providers. Acta Neurol Scand 2006: 113: 199–202

Background: During the 2003 severe acute respiratory distress syndrome epidemic, healthcare workers mandatorily wore the protective N95 face-mask. *Methods:* We administered a survey to healthcare workers to determine risk factors associated with development of headaches (frequency, headache subtypes and duration of face-mask wear) and the impact of headaches (sick days, headache frequency and use of abortive/preventive headache medications). *Results:* In the survey, 212 (47 male, 165 female) healthcare workers of mean age 31 years (range, 21–58) participated. Of the 79 (37.3%) respondents who reported face-mask-associated headaches, 26 (32.9%) reported headache frequency exceeding six times per month. Six (7.6%) had taken sick leave from March 2003 to June 2004 (mean 2 days; range 1–4 days) and 47 (59.5%) required use of abortive analgesics because of headache. Four (2.1%) took preventive medications for headaches during this period. Multivariate logistic regression showed that pre-existing headaches [$P = 0.041$, OR = 1.97 (95% CI 1.03–3.77)] and continuous use of the N95 face-mask exceeding 4 h [$P = 0.053$, OR = 1.85 (95% CI 0.99–3.43)] were associated with development of headaches. *Conclusions:* Healthcare providers may develop headaches following the use of the N95 face-mask. Shorter duration of face-mask wear may reduce the frequency and severity of these headaches.

E. C. H. Lim[1], R. C. S. Seet[1], K.-H. Lee[1], E. P. V. Wilder-Smith[1], B. Y. S. Chuah[2], B. K. C. Ong[1]

[1]Department of Medicine and [2]Department of Hematology-Oncology, National University Hospital, Singapore

Keywords: headaches; N95; frequency; risk factors; severity

Erle Chuen-Hian Lim, Division of Neurology, Department of Medicine, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074
Tel.: 65-67724353
Fax: 65-67794112
e-mail: mdcelch@nus.edu.sg

Accepted for publication November 11, 2005

Why not always N95?

3. N95/N100口罩

梁宗存表示，N95口罩中的「95」，是指能隔除95%空氣中的懸浮粒子，因N95口罩的口和鼻位都有橡筋緊箍著，形成密封的狀態，故N95口罩可隔除大部分及較細的污染物。

但許樹昌認為，N100較N95更能阻擋懸浮粒子，但由於PM2.5的體積過於微小、難以完全隔除。由於N95與N100口罩過於密封，長期帶若半小時後，便容易出現頭痛的問題，不適宜在社區長期使用。

Summary

- The main mode of transmission of COVID-19 is through respiratory droplets

- To maintain at all times strict personal and environmental hygiene is key to personal protection against infection and prevention of the spread of the disease in the community

- Strictly comply with IC recommendations, especially HH and appropriate use of PPE, can protect staff against the risk of COVID-19 while working in the clinic setting

Thank you

Supplementary slides

What is aerosol?

Aerosol refers to particles in suspension in a gas, such as small droplets in air

Nature	Aerodynamic Diameter	Implication on disease transmission	
Droplet Nuclei (Aerosol)	< 5 µm	• Follow airflow streamline, capable of short and long range transmission	• Readily penetrates the airways all the way down to alveolar space
	< 10 µm		• Readily penetrates below the glottis
Intermediate Droplet	10–20 µm	• Share some properties of both small and large droplets, settle more quickly than particles < 10 µm and potentially carry a smaller infectious dose than > 20 µm droplets	
Large Droplet	> 20 µm	• Falling mostly under the influence of gravity • Too large to follow inhalation airflow streamlines • Surgical masks would be effective as they will act as a direct physical barrier to droplets that are too large to be inhaled into the respiratory tract around the sides of the mask • Less likely for depositing and initiating an lower RTI since they will impact onto respiratory epithelial mucosal surfaces or be trapped by cilia before reaching the lower respiratory tract	

Source: Recognition of aerosol transmission of infectious agents: a commentary (2019)
https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-019-3707-y

Aerosol Generating Procedures (AGP)

- Aerosols are produced when an air current moves across the surface of a film of liquid, the greater the force of the air, the smaller the particles that are produced.[1]
- An AGP is defined as any medical procedure that can induce the production of aerosols of various sizes, including droplet nuclei.[1]
- AGPs are procedures that stimulate coughing and promote the generation of aerosols.[2]

Sources:

- Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care WHO 2014
- Aerosol Generating Procedures, Health Service Executive 2013

Aerosol Generating Procedures (AGP)

- With documented increased in risk of respiratory infection transmission
  - Endotracheal intubation
  - cardiopulmonary resuscitation
  - Bronchoscopy
  - open suctioning of respiratory tract (including tracheostomy care)
  - autopsy
  - non-invasive positive pressure ventilation (BiPAP & CPAP)

- With controversial/ limited studies evaluating the risk of respiratory infection transmission
  - high-frequency oscillatory ventilation
  - nebulizer therapy
  - sputum induction

- Nasopharyngeal aspiration (NPA) and high flow oxygen are theoretically at risk of dispersal of infectious respiratory droplets, therefore they should be performed in conditions as required for aerosol-generating procedures in high-risk patient areas


Last updated:
2 March 2020

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