

Infection prevention and control of COVID in ports



health

Department:
Health
REPUBLIC OF SOUTH AFRICA



**NATIONAL INSTITUTE FOR
COMMUNICABLE DISEASES**

Division of the National Health Laboratory Service

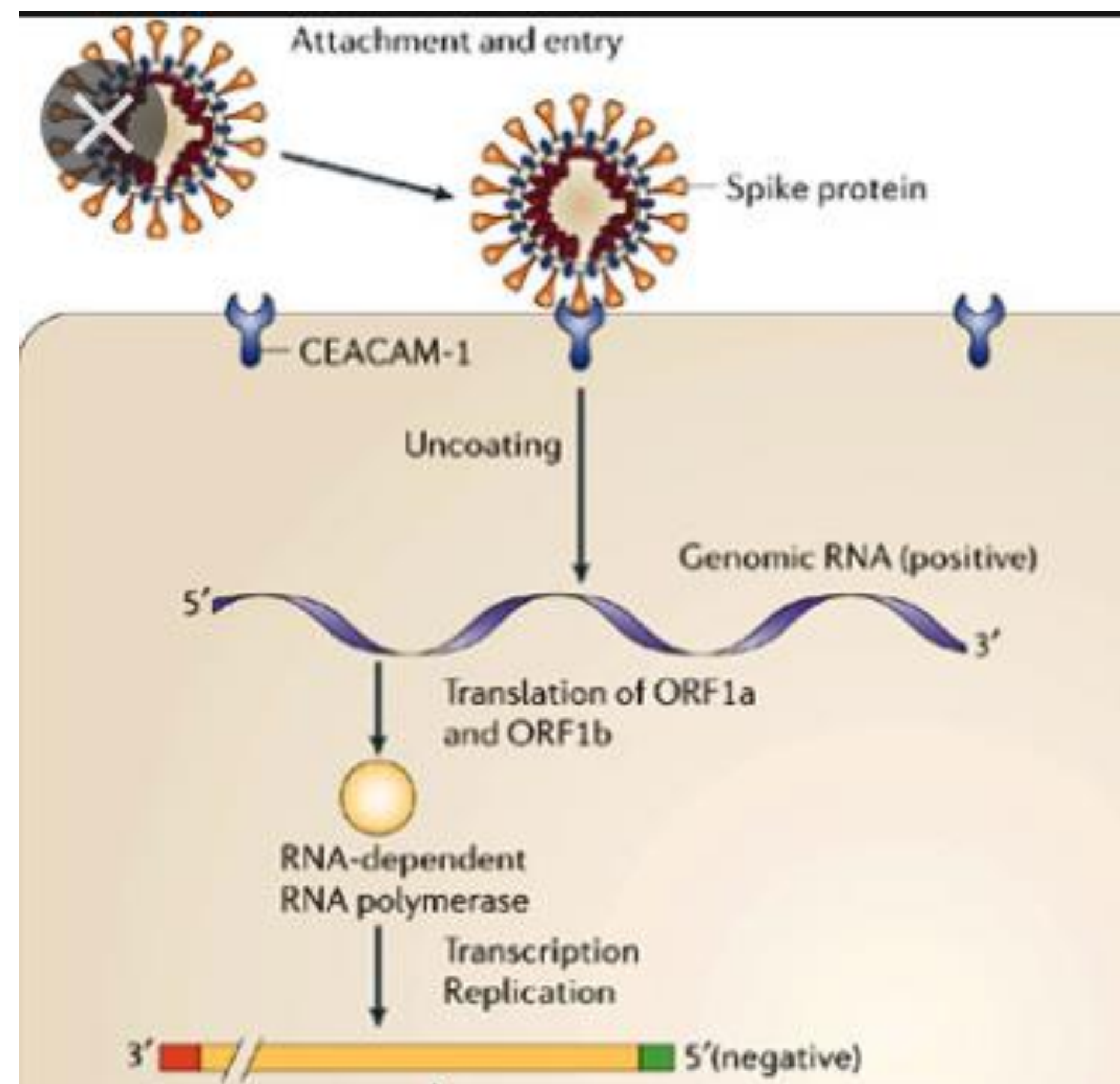
Overview

- How are diseases transmitted from person to person?
- What are the principles of infection prevention and control
- What IPC measures are other countries / organisations recommending for the transport industry/workers?
- How can we apply this knowledge to protect us while we protect our country?
 - Administrative controls = screening and awareness, people flow, health promotion
 - Environmental controls = ventilation, airflow,
 - Personal protective equipment = use of masks, gloves, hand hygiene

How are diseases
transmitted from person-
to-person?

How are diseases transmitted from person-to-person?

- Before causing disease, a bacterium or virus must ATTACH to a cell
- Viruses attach to specific proteins on the surface of human cells
- After attachment, they are able to enter the cell and cause disease.
- The site of the specific receptor tells us how the organism is transmitted.



How is coronavirus transmitted from person-to-person?

Received: 20 January 2020 | Accepted: 21 January 2020
DOI: 10.1002/jmv.25681

REVIEW

JOURNAL OF
MEDICAL VIROLOGY WILEY

Emerging coronaviruses: Genome structure, replication, and pathogenesis

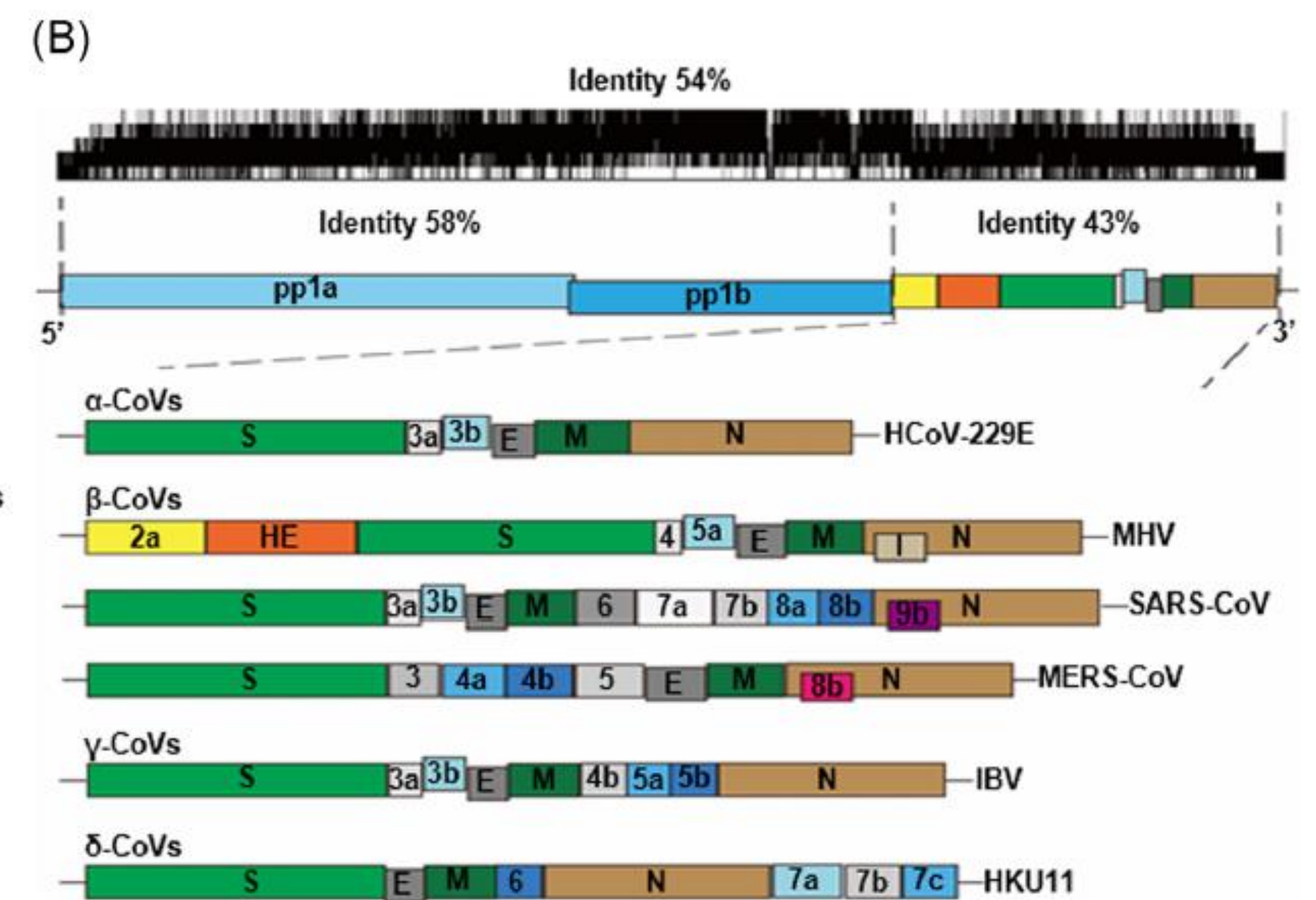
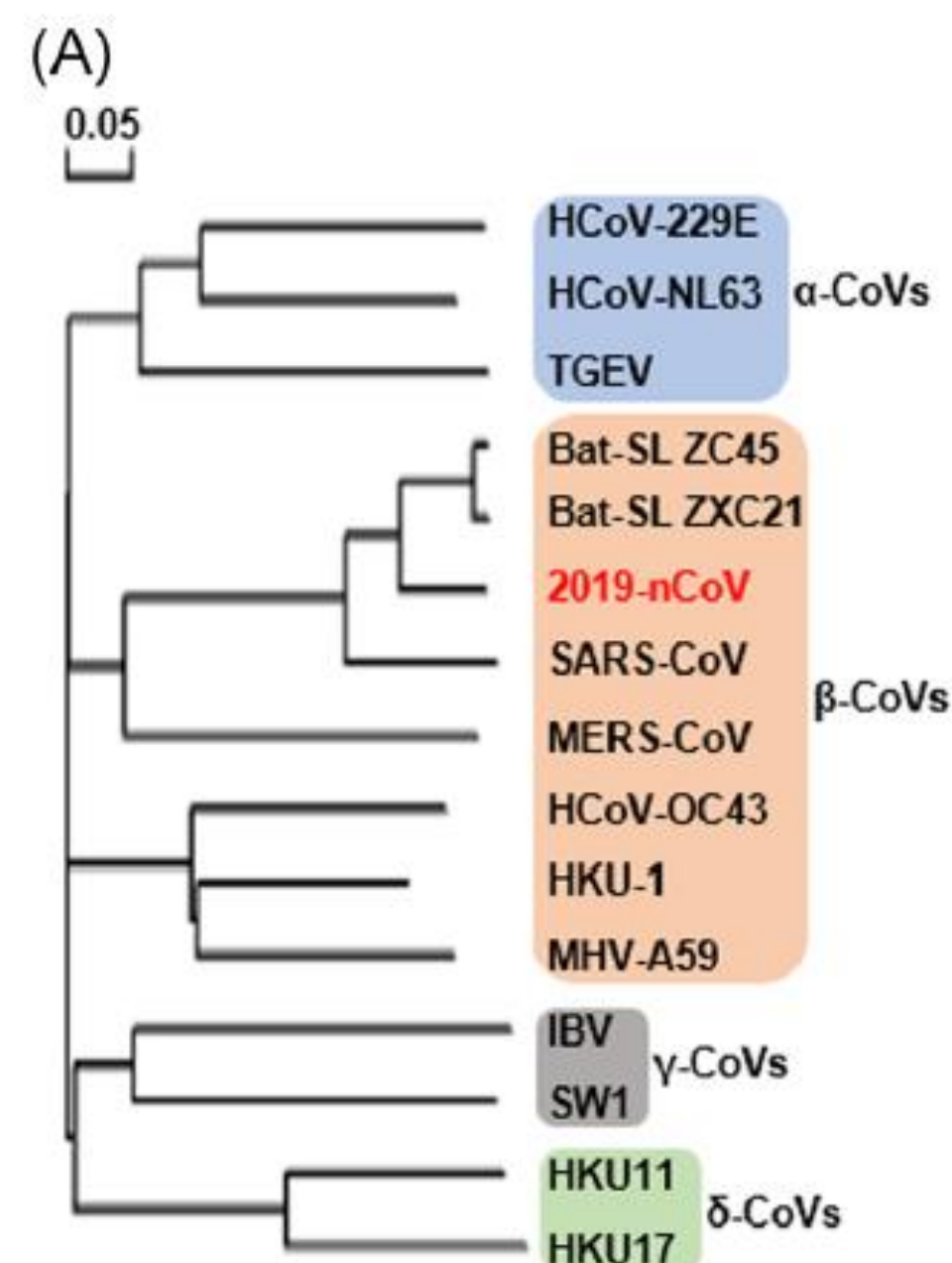
- Already (!!) researchers have understood that SARS-CoV-2 is very much SARS-CoV-1 (cause of SARS outbreak in 2003).
- It most likely binds to the same cell surface receptor – angiotensin converting enzyme (ACE) which is found on cells surfaces in the respiratory tract

Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding

Roujian Lu*, Xiang Zhao*, Juan Li*, Peihua Niu*, Bo Yang*, Honglong Wu*, Wenling Wang, Hao Song, Baoying Huang, Na Zhu, Yuhai Bi, Xuejun Ma, Faxian Zhan, Liang Wang, Tao Hu, Hong Zhou, Zhenhong Hu, Weimin Zhou, Li Zhao, Jing Chen, Yao Meng, Ji Wang, Yang Lin, Jianying Yuan, Zhihao Xie, Jinmin Ma, William J Liu, Dayan Wang, Wenbo Xu, Edward C Holmes, George F Gao, Guizhen Wu¶, Weijun Chen¶, Weifeng Shi¶, Wenjie Tan¶

Summary

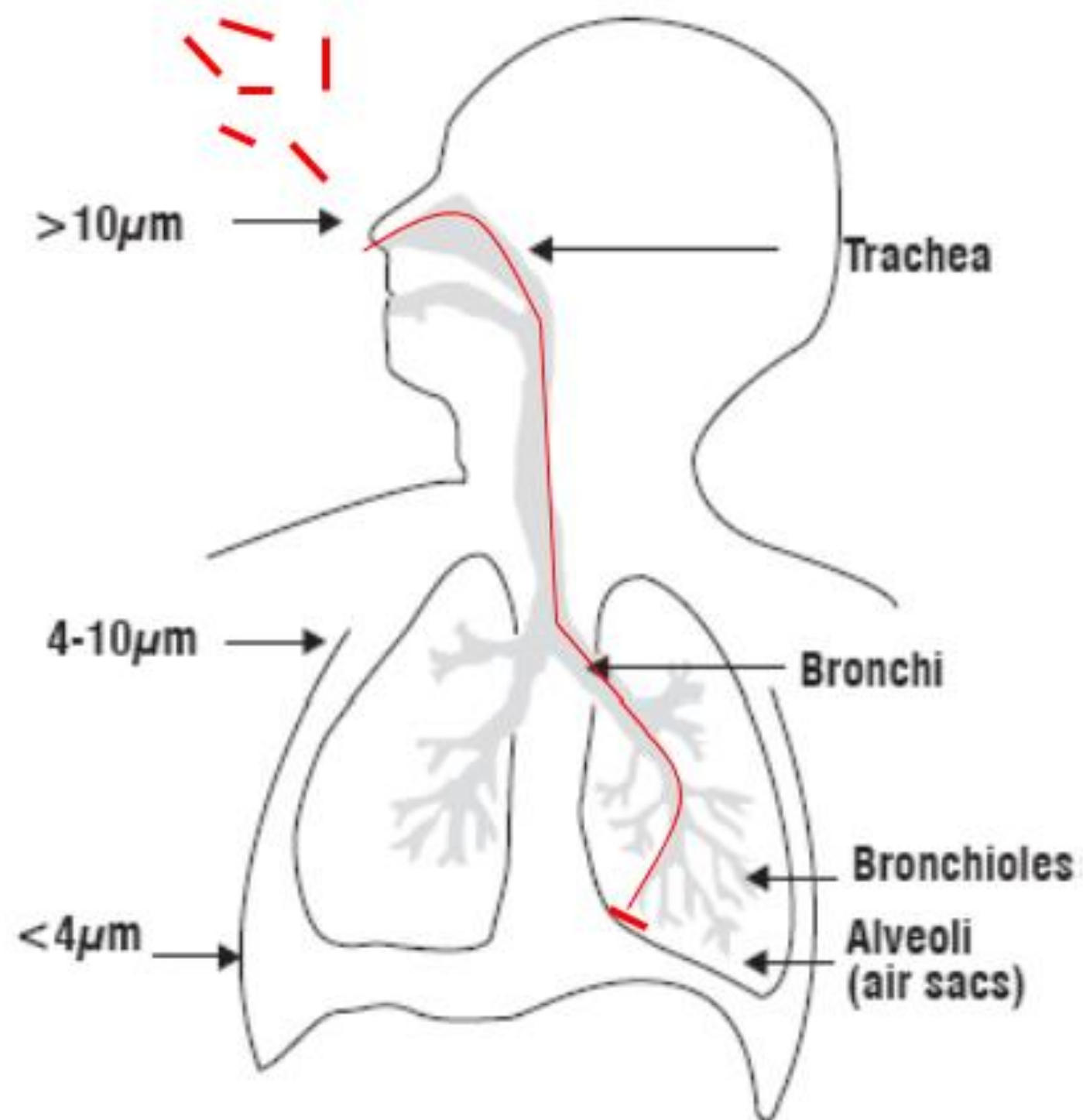
Background In late December, 2019, patients presenting with viral pneumonia due to an unidentified microbial agent were reported in Wuhan, China. A novel coronavirus was subsequently identified as the causative pathogen,



How are diseases transmitted from person-to-person?

- Tuberculosis bacteria must attach to proteins on the surface of the alveolar macrophage
- Therefore the 'carrier droplets' must be small enough to enter the alveoli

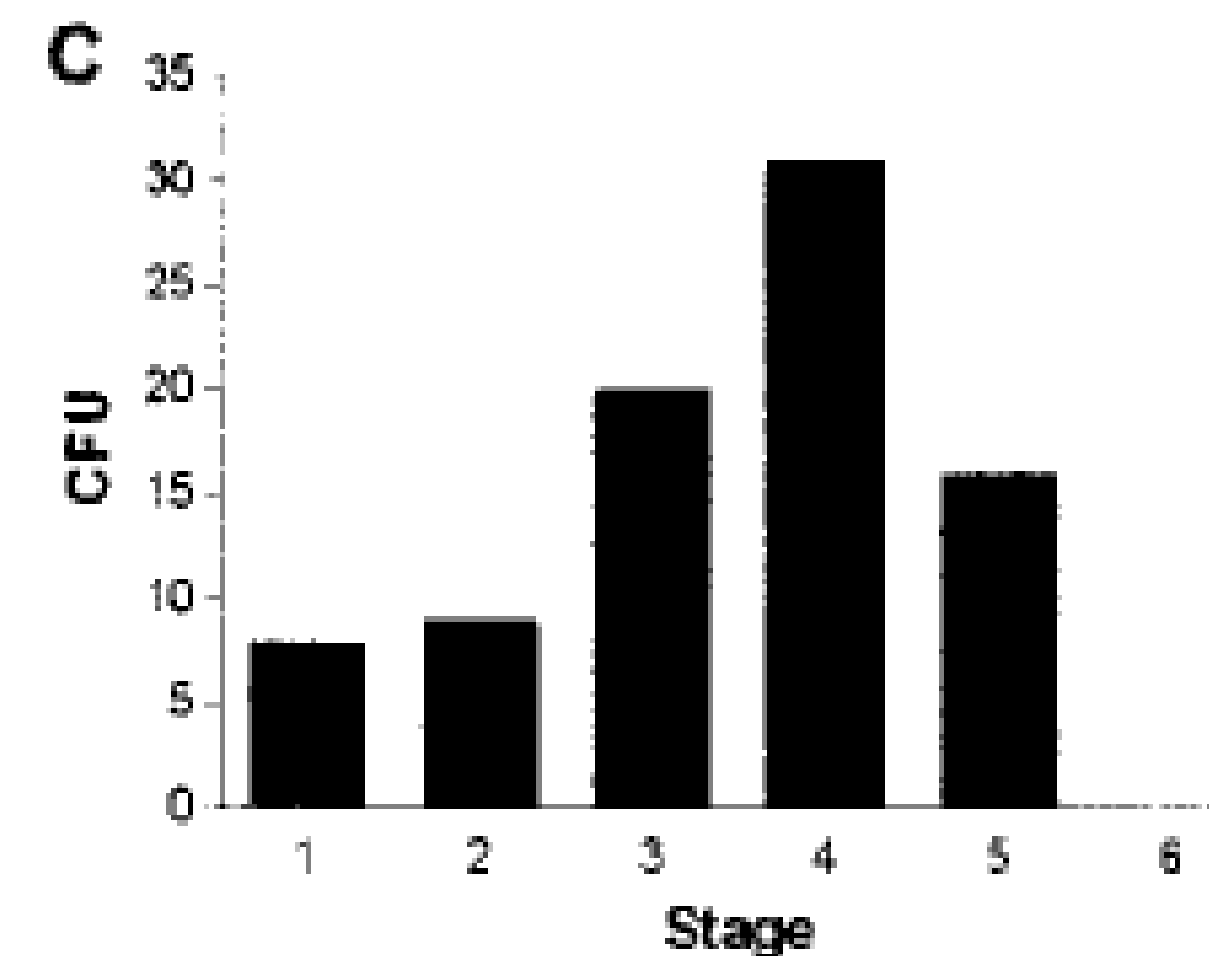
Figure 2. Sizes of droplet nuclei and site of deposition in the respiratory tract.



- Coronaviruses of the beta-coronavirus clade must attach to proteins on the surface of epithelial cells in the upper and lower airways called angiotensin converting enzyme (ACE)
- Therefore 'carrier droplets' need not be very small.

How are diseases transmitted from person-to-person?

- Coughing generates droplets of different sizes
 - Fennelly et al counted the number of particles of each size (histogram above) generated when a patient coughs
 - They range from 7mm-0.65um
- Larger droplets fall to the ground within a 1-2m radius of the person
- Droplet nuclei that are small enough to enter the alveoli remain suspended in air for up to 12 hours.



How are diseases transmitted from person-to-person?

The Wells-Riley equation

Risk of infection following exposure depends on

$$\frac{\text{Particles}}{\text{Volume}} \times \text{Exposure time}$$

Particles:

Production of infectious droplet nuclei

Volume:

Volume of air and ventilation

Exposure time:

Duration of exposure to contaminated air

How are diseases transmitted from person-to-person?

Coronavirus



Direct contact

- Touching an ill person or a contaminated surface
- E.g. agents of diarrhoea, skin infections, common cold, ebola virus

Control

- Gloves, +/- gowns, masks, visors (to prevent mucous membrane splashes, contamination of clothing)



Droplet transmission

- Inhaling droplets (up to 1/4mm in diameter)
- Persons within 2m radius are at risk. On aircraft, 2 rows behind and in front
- E.g. agents of bacterial pneumonia, Neisseria meningitidis

Control

- Gloves, surgical masks, +/- gowns, masks, visors (to prevent mucous membrane splashes, contamination of clothing)

Airborne transmission

- Inhaling droplets nuclei (10-20um in diameter)
- Persons breathing the same air
- E.g. influenza, measles, chickenpox,

Control

- Gloves, N95 masks, +/- gowns, masks, visors (to prevent mucous membrane splashes, contamination of clothing)

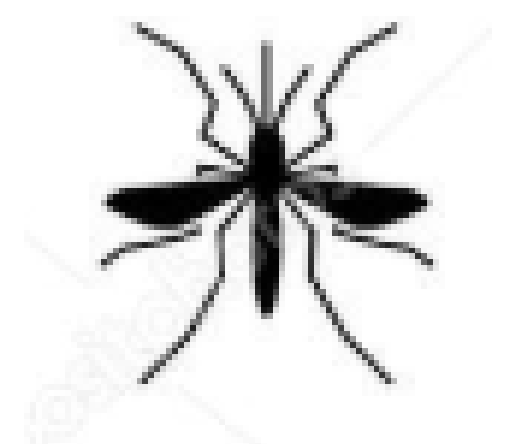


Vector transmission

- Contact with vector
- E.g. malaria, dengue, Zika,

Control

- Prevent/eliminate exposure to vector
- Chemoprophylaxis if possible



How are diseases transmitted from person-to-person?

Coronavirus

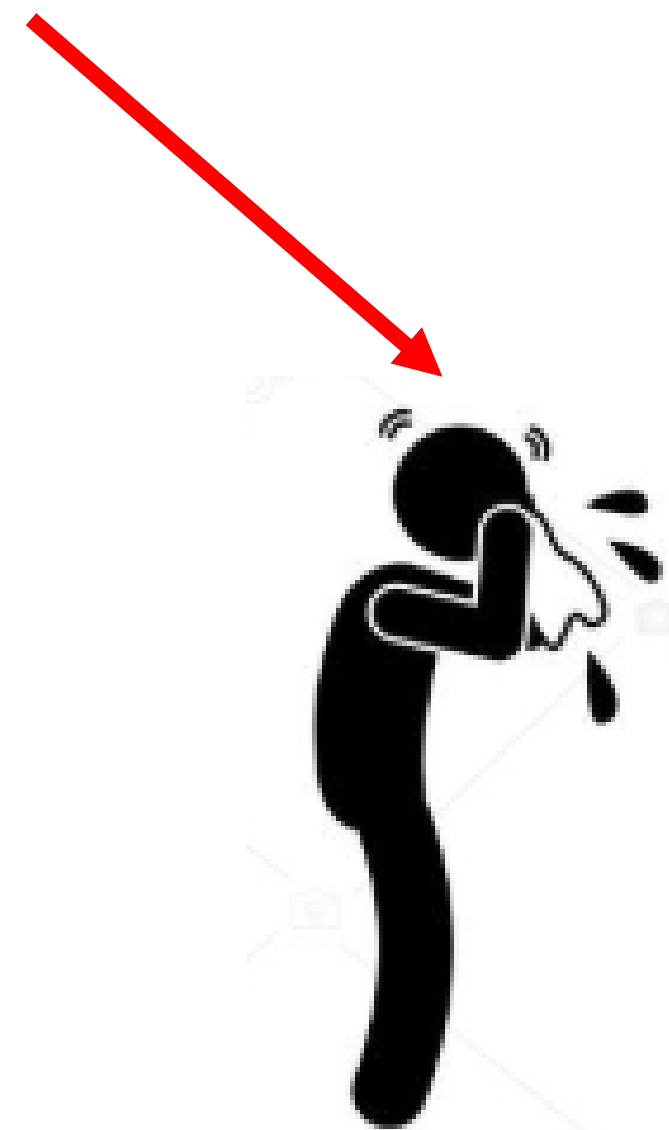


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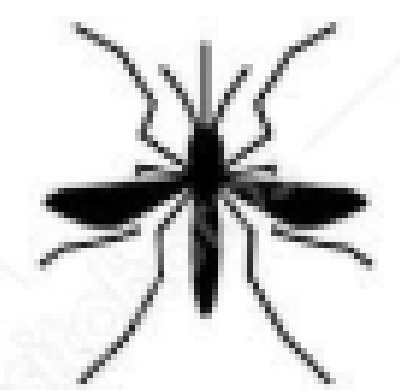


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How are diseases transmitted from person-to-person?

- Survival in the environment depends on
 - pH
 - Innoculum size
 - Dryness
 - Temperature
 - Exposure to disinfectants



Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin



Review

Transmission of SARS and MERS coronaviruses and influenza virus in healthcare settings: the possible role of dry surface contamination[☆]

J.A. Otter^{a,*}, C. Donskey^b, S. Yezli^c, S. Douthwaite^d, S.D. Goldenberg^d, D.J. Weber^e

^aImperial College Healthcare NHS Trust, London, UK

^bCleveland Veterans Affairs Medical Center, Cleveland, OH, USA

SARS-CoV and MERS-CoV appear to have an unusual capacity to survive on dry surfaces compared with other human coronaviruses (229E, OC43, and NL63).^{17,28,27,31,44} SARS-CoV, like the non-enveloped adenovirus comparator, survived for more than six days when dried on to Petri dishes compared with human coronavirus HCoV-229E, which survived for less than 72 h.²⁸ Although data are limited, it appears that MERS-CoV may survive on surfaces for longer than most human coronaviruses.¹⁶ Since other human coronaviruses do not share the

very limited capacity to survive on dry surfaces.^{13–15} However, several studies suggest that SARS-CoV, MERS-CoV and influenza virus have the capacity to survive on dry surfaces for a sufficient duration to facilitate onward transmission.^{16–18} SARS-CoV

Foundation Trust & King's College

1, and H5N7 influenza viruses, and East respiratory syndrome (MERS) SARS-CoV, MERS-CoV, and influenza sometimes up to months. Factors

How are diseases transmitted from person-to-person?

Coronavirus



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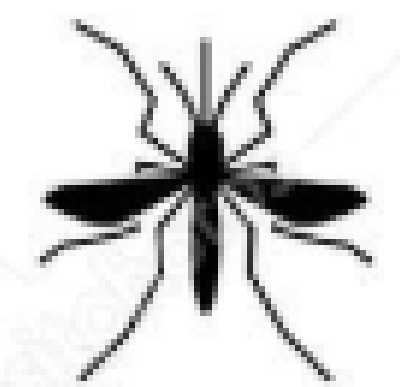


~~Vector transmission~~

- Contact with vector
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~~Control~~

- Prevent/eliminate exposure to vector
- Chemoprophylaxis if possible



Principles of infection prevention and control

Principles of infection control

The Wells-Riley equation

Eradicate the particles by

- Teach cough hygiene
- Giving people who cough a surgical mask

Risk of infection following exposure depends on

$$\frac{\text{Particles}}{\text{Volume}} \times \text{Exposure time}$$

x Exposure time

Reduce each person's exposure by

- Early screening of cases
- Triaging and seeing patients who cough first

Decrease the concentration of particles in the air by

- Standing >1m from a person
- Increasing the ventilation rate
- Opening windows

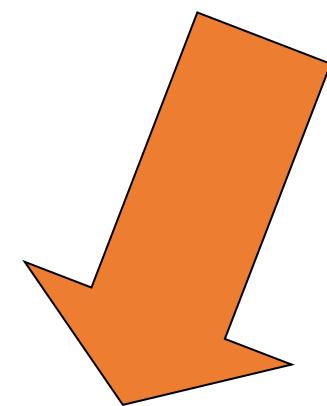
Particles:
Volume:
Exposure time:

Production of infectious droplet nuclei
Volume of air and ventilation
Duration of exposure to contaminated air

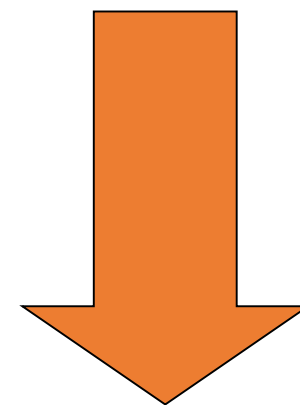
Principles of infection control

Must therefore be achieved through elimination and control of these

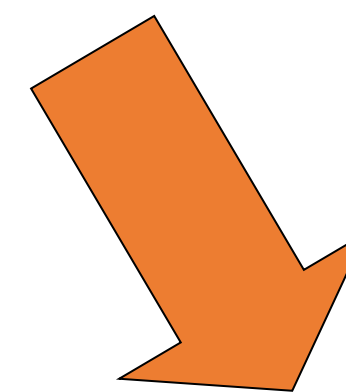
‘infectious TB particles’



Decrease the number of particles formed by people with TB disease



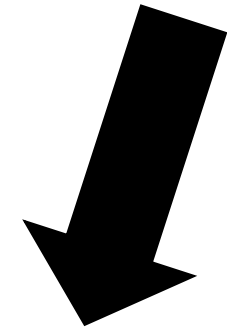
Remove the particles from the air – ie clean the air



Prevent people from inhaling the particles and reduce their risk of developing TB disease

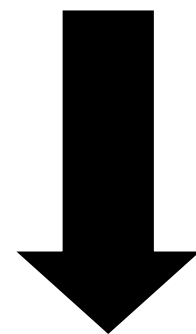
Principles of infection control

- Create an enabling environment



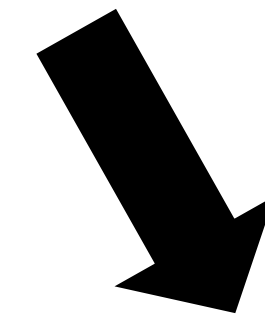
- Reduce formation of infectious particles

Administrative Controls



- Remove infectious particles

Environmental Controls

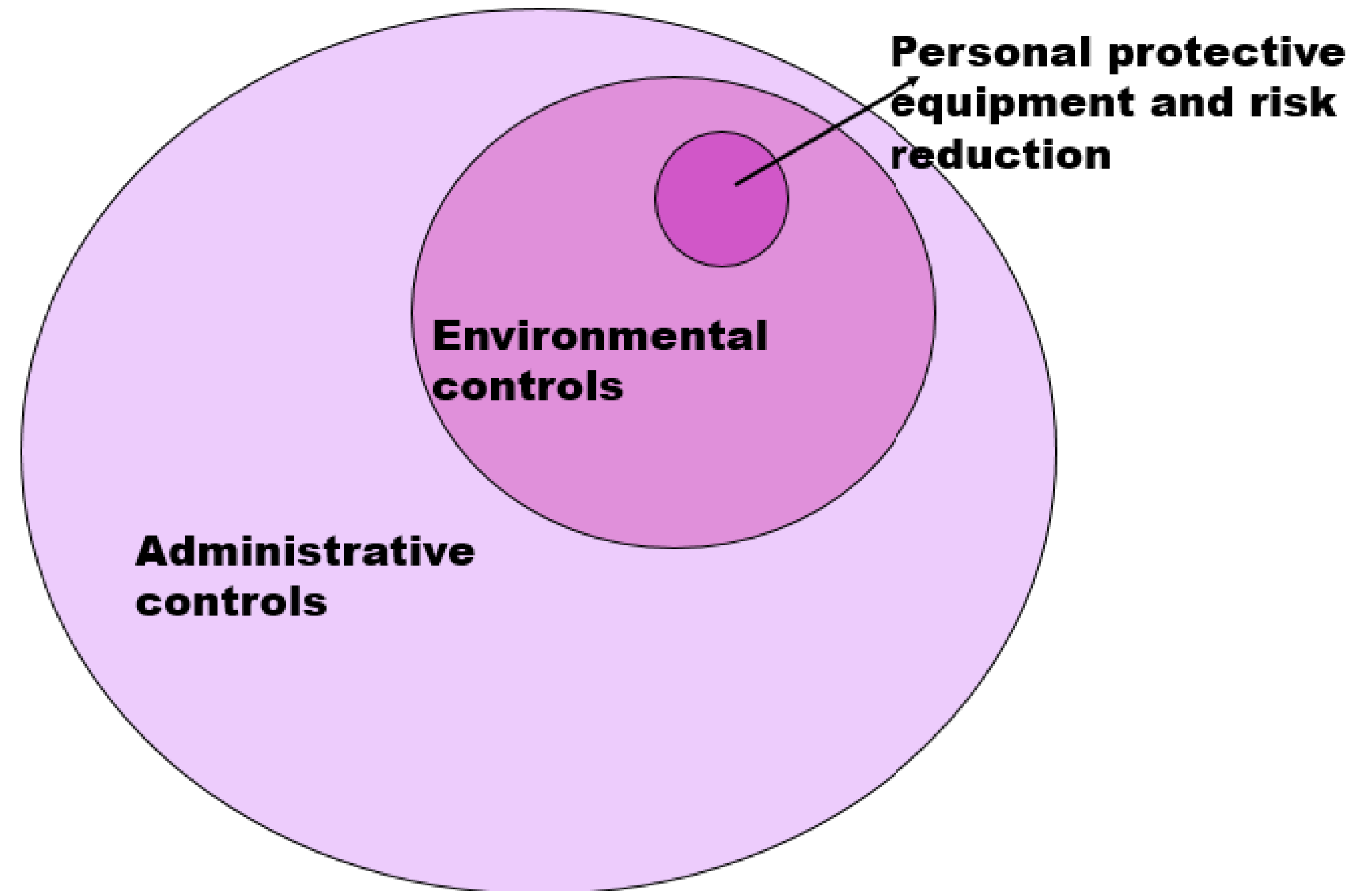


- Reduce risk of inhaling infectious TB particles and developing TB disease

PPE and risk Reduction

Ability to prevent transmission of infectious organisms

- The relative ability of each component of IPC is shown by the size of the circle
- Screening and triage (administrative controls) are most important
- Environmental controls are important
- PPE is the least effective



Principles of infection control

- What is a N95 respirator?
 - It is a filter which traps infectious particles and stops them from being inhaled.
 - Masks which do this are called 'particulate filter respirators'
 - Droplet nuclei that are responsible for airborne transmission are 1-5 μ m in diameter.
 - Masks that are able to prevent TB infection must capture particles this size and larger.



Principles of infection control

N95 masks meet specifications required by the United States National Institute for Occupational Safety and Health (NIOSH) which include;

- **Filter size of $1\mu\text{m}$ in size**
- **Filter efficiency = 95%**
- **Tight facial seal.**

The letter 'N' in N95 refers to the fact that the mask/filter is 'Not resistant to oil'.

Principles of infection control

- A surgical mask:
 - Has only 50% filter efficiency – it only stops 50% of particles.
 - It lacks a tight facial seal.
 - It is useful to capture infectious particles *coming from the person who is wearing the mask*
 - Surgical masks stop surgeons 'spitting' into the operating field!!



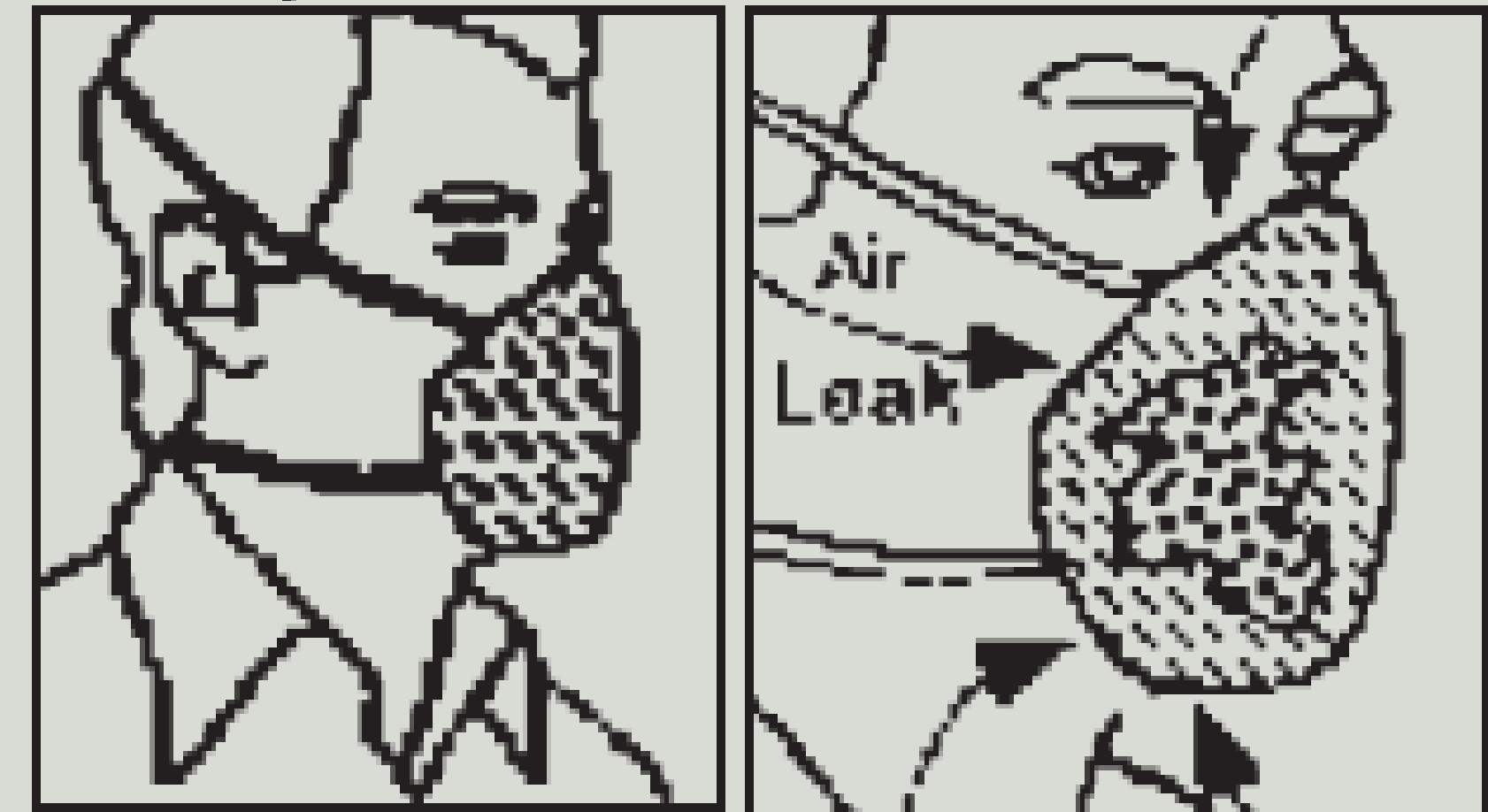
Principles of infection control

- N95 respirators will NOT work if:
 - They are not properly fitted
 - If the wearer has facial hair (beard) preventing a proper fit
 - They are damaged or crushed
 - They are saturated (reused until the filter capacity has been exceeded)
 - They get wet (even if they dry again).

Principles of infection control

- Fit the mask according to manufacturer's instructions.
 - Do not touch outside of mask on placing, and on removal
- Once the mask is in place, inhale sharply. The mask should be drawn in towards your face, indicating that a negative pressure has been generated.
- If the mask does not draw in towards your face, or you feel leakage at the edges, adjust straps by pulling back along the sides and/or reposition respirator.
- Repeat until mask is sealed properly.

Figure 1. (A). N95 mask (B) Air leaks on an incorrectly fitted N95 mask.



A badly fitted mask...



Objective 'fit-test'



Principles of infection control

Who should use N95 masks, and where?

- Where?

- Where airborne transmission is the dominant mode of transmission
- Where administrative and environmental controls cannot significantly reduce the risk to HCW
- Examples:
 - Where newly diagnosed TB or TB suspects are seen
 - MDR/XDR TB facilities
 - Respiratory isolation facilities

- WHO?

- Health Care workers
 - (NOT patients!)
 - Any cadre
- For protection of HCW from
 - TB infection or
 - airborne transmission or
 - where there is intense risk of transmission (e.g. intubating or suctioning a patient in ICU)

Principles of infection control

- Cleaning and disinfection of the environment
 - Hands – alcohol handsanitizer
 - Environment
 - General soap and water
 - If contamination suspected, can use ethanol, bleach, quaternary ammonium compounds
 - See ECDC reference document

ECDC TECHNICAL REPORT

Interim guidance for environmental cleaning in non-healthcare facilities exposed to 2019-nCoV

7 February 2020

Scope of this document

This document aims to provide guidance about the environmental cleaning in non-healthcare facilities (e.g. rooms, public offices, transports, schools, etc.) where 2019 novel coronavirus (2019-nCoV) confirmed cases have been before being admitted to hospital.

This guidance is based on the current knowledge about the 2019-nCoV and evidence originating from studies on other coronaviruses.

A range of hospital disinfectants are active against SARS-CoV and surrogates, and influenza, including alcohol, hypochlorites (bleach), quaternary ammonium compounds, and hydrogen peroxide, although inactivation is time and concentration dependent and will be influenced by other factors such as type of contaminated surface, specific product, and protein load.^{28,45,106,107} However, in-vitro disinfectant effectiveness is

How can we prevent
transmission of SARS-CoV-2
in our work environment?

How can we prevent transmission of SARS-CoV-2?

- Ensure ventilation is good, and aircon is working
- Provide bins for disposal of tissues, masks
- Stand away from people (social distancing)
- Clean the environment



- Screen everyone early
- Use health promotion messaging re symptoms
- Teach cough hygiene

- Hand hygiene
- Don't touch face/mouth
- Keep distance.
- If can't keep distance, use surgical mask and gloves

How can we prevent transmission of SARS-CoV-2?

STAGE OF ASSESSMENT OF TRAVELLERS/PERSONS UNDER INVESTIGATION FOLLOWING ARRIVAL AT PORT										
Symptom status	Arrival and disembarkation	Screening by Port Health	Screening by Port Health	Seen at Immigration and customs	In depth assessment at Port Health	Meets case definition, awaiting transfer by EMS	Transported by EMS to health facility	In Emergency Medicine Department (casualty)	Admission pending nCoV result	Confirmed positive test
Unknown	X			X						
No symptoms, does not meet case definition		X		X						
<u>Thermoscan positive</u>			X		X					
Meets case definition					X	X	X	X	X	X
Level of IPC care required by personnel	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab	Droplet precautions*, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab
Actions required	None	None	Immediately Port Health official gives patient a mask and moves traveller to private room,	None	Call NICD, collect throat swab, send to NICD Arrange transfer to medical facility	Limit staff entry to isolation room	Call ahead and request facility to prepare isolation room for clinical assessment	Take patient straight to isolation room Notify patient as suspected <u>nCoV</u>	Adhere to facility IPC protocols for respiratory isolation	Adhere to facility IPC protocols for respiratory isolation
References	WHO guidelines 'Advice on use of masks' (*individual may choose to wear mask)	WHO guidelines 'Advice on use of masks' (*individual may choose to wear mask)	WHO guidelines 'Advice on use of masks' (*individual may choose to wear mask)	WHO guidelines 'Advice on use of masks' (*individual may choose to wear mask)	RSA Coronavirus guidelines on NICD website WHO 'IPC for <u>nCoV</u> '	RSA Coronavirus guidelines on NICD website WHO 'IPC for <u>nCoV</u> '	RSA Coronavirus guidelines on NICD website WHO 'IPC for <u>nCoV</u> '	RSA Coronavirus guidelines on NICD website WHO 'IPC for <u>nCoV</u> '	RSA Coronavirus guidelines on NICD website WHO 'IPC for <u>nCoV</u> '	*If possible, facilities should use airborne precautions

How can we prevent transmission of SARS-CoV-2?

- Administrative controls
 - Facilitate hygiene – soap, red bins etc
 - Screen and triage early.
 - Give people who cough a mask
- When screening
 - Don't touch person – stand far from them
 - Don't touch mouth/eyes etc
 - Wash hands / use hand sanitiser
 - If using gloves/mask, use properly!!!
- On identification of a symptomatic person
 - Give them a mask
 - Isolate them
 - Use droplet precautions

Symptom status	Arrival and disembarkation	Screening by Port Health	Screening by Port Health	Seen at Immigration and customs	In depth assessment at Port Health
Unknown	X			X	
No symptoms, does not meet case definition		X		X	
<u>Thermoscan positive</u>			X		X
Meets case definition					X
Level of IPC care required by personnel	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Avoid crowds, keep 1m from people, frequent hand hygiene, MASKS not required*	Droplet precautions, incl surgical masks, gloves, disposable gowns, eye visor/goggles if collecting throat swab

How are other countries
protecting port health
officials?

How are other countries protecting port health officials?

The screenshot shows the GOV.UK website header with a search bar. Below the header is a message: "The UK has left the EU" with a link to "Find out what this means for you" and a "Hide message" link. The breadcrumb trail is "Home > COVID-19: guidance for staff in the transport sector". Logos for the Department for Transport and Public Health England are displayed. The main title is "Guidance COVID-19: guidance for staff in the transport sector" with a publication date of "Published 14 February 2020". A "Contents" section is visible on the left, listing "1. Signs and symptoms of COVID-19" and "2. Case definition". The main heading "1. Signs and symptoms" is partially visible.

3.1 How COVID-19 is caught and spread

Seasonal flu and coronavirus are both spread from person to person by close contact. Some examples of how it can be spread include:

- large droplets from coughing and or sneezing by an infected person within a short distance (usually one metre or less) of someone
- touching or shaking the hand of an infected person and then touching your mouth, eyes or nose without first washing your hands
- touching surfaces or objects (such as door handles) that have become contaminated with the virus and then touching your mouth, eyes or nose without first washing your hands

How are other countries protecting port health officials?

Guidance

COVID-19: guidance for staff in the transport sector

Published 14 February 2020

4.2 Taking necessary precautions

There is currently no vaccine for coronavirus but there are things you can do to help stop coronavirus spreading.

Public Health England (PHE) recommends that the following general cold and flu precautions are taken to help prevent people from catching and spreading COVID-19:

- cover your mouth and nose with a tissue or your sleeve (not your hands) when you cough or sneeze
- put used tissues in the bin straight away
- wash your hands with soap and water often – use hand sanitiser gel if soap and water are not available
- try to avoid close contact with people who are unwell
- clean and disinfect frequently touched objects and surfaces
- do not touch your eyes, nose or mouth if your hands are not clean

How are other countries protecting port health officials?

Guidance

COVID-19: guidance for staff in the transport sector

Published 14 February 2020

4.4 Facemasks

Staff are not recommended to wear respiratory masks. They do not provide protection from respiratory viruses. Respiratory masks are only recommended to be worn by symptomatic passengers to reduce the risk of transmitting the infection to other people.

PHE recommends that the best way to reduce any risk of infection is good hygiene and avoiding direct or close contact (closer than 2 metres) with any potentially infected person. Any member of staff who deals with members of the public from behind a screen will be protected from airborne particles.

Questions?

Public Hotline 0800-029-999