Australian Nursing & Midwifery Federation

ANMF EVIDENCE BRIEF

COVID-19: PERSONAL PROTECTIVE EQUIPMENT

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Question: What is the best available evidence regarding personal protective (PPE) equipment in the context of COVID-19?

***ALERT* Evidence regarding COVID-19 is continually evolving. This Evidence Brief will be updated regularly to reflect new emerging evidence but may not always include the very latest evidence in real-time.**

Key messages:

- Correct size, fit, use, and disposal of PPE is essential to safe, effective, and sustainable infection prevention and control activities in the context of COVID-19.
- Personal protective equipment for COVID-19 includes; gloves, medical/surgical/procedure masks, goggles or face shields, gowns, respirators (P2/N95 minimum), and fluid resistant aprons.
- Health and aged care staff and others in contact or close proximity to people with suspected or confirmed COVID-19 infection must receive appropriate PPE, clear and understandable information on PPE use, removal, and disposal, and associated resources, information, and services to maintain safe, effective infection control.
- Correct and consistently applied hygiene and infection control methods, organisational and point of care risk assessment, engineering and system controls, administrative controls, and patient accommodation must be implemented in tandem for PPE to be effective.
- Personal protective equipment precautions for droplet and environmental surface contamination, including floors and objects staff and patients may touch should be observed in the context of caring for people with suspected, probable, or confirmed COVID-19.
- Health care workers providing direct care or working within the patient/client/resident zone for individuals where risk assessment suggests a likely high-risk of transmission should use P2/N95 respirators rather than surgical masks.
- Personal protective equipment precautions for airborne transmission should be observed in high-risk areas, where planned or unplanned aerosol generating procedures take place for respiratory samples collection including for asymptomatic patients, and when providing frequent and/or close-contact care for people with suspected, probable, or confirmed COVID-19.
- Health and aged care staff working in low-risk environments and not involved in direct patient contact should wear masks and other designated PPE as appropriate for duty but maintain spatial distance of at least two metres from patients and use physical barriers (e.g. transparent Perspex, glass) where possible.

- Careful risk assessment and infection control measures for airborne transmission is particularly necessary for crowded, poorly ventilated, indoor environments as aerosolised droplets from coughing, sneezing, and speaking can travel several metres, remain airborne, and collect on surfaces.
- Members of the general public with fever, respiratory symptoms, under quarantine or investigation for COVID-19, or who have suspected, probable, or confirmed COVID-19, or who care for people with suspected, probable, or confirmed COVID-19 should wear medical masks and adhere to proper cough/sneeze etiquette and hand hygiene practices.

Summary

Background: COVID-19 (from 'severe acute respiratory syndrome coronavirus 2' (or 'SARS-CoV-2') was first identified in 2019 as the cause of a cluster of pneumonia cases in Wuhan, China.[1] Coronaviruses are similar to a number of human and animal pathogens including those which cause the common cold as well as severe acute respiratory syndrome (SARS/ SARS-CoV-1) and Middle East respiratory syndrome (MERS). The COVID-19 outbreak was declared a pandemic on March 11, 2020.[2]

People who are at the highest risk of infection are those in close contact with people carrying the SARS-CoV-2 virus. This includes health and aged care workers. Rational use of personal protective equipment (PPE) is vital and precautions are necessary for droplet, contact, and airborne transmission particularly in settings where respiratory aerosols may be generated or in crowded, poorly ventilated, indoor environments where people with suspected, probable, or confirmed COVID-19 infection are present.[3,4,5]

The Australian Government Department of Health recommends that health and aged care staff use P2/ N95 respirators instead of masks when performing aerosol-generating procedures and in emergency departments, residential care facilities, or in-patient facilities when undertaking close clinical care with people who have cognitive impairment, are unable to cooperate, or show challenging behaviours.[5,6] Further, respirators should be used in contexts where there are high numbers of people with suspected, probable, or confirmed COVID-19 and a risk of challenging behaviours or unplanned aerosol-generating procedures.[5]

COVID-19 transmission: droplets, surfaces, and aerosols

COVID-19 is transmitted when the virus enters the body via the mucosae (mouth and nose) or conjunctiva (eyes) which can occur through;[7,4]

- direct person-to-person contact,
- respiratory droplets >5-10 μm in diameter (e.g. from coughing and sneezing),
- inhalation of small respiratory droplets/aerosols (<5 μm) particularly within three to six feet of an infectious source, and;
- indirect contact from touching infected environmental surfaces/formites and transferring viral particles to the mucosae or conjunctiva.

The infectious dose necessary to cause COVID-19 infection is still unknown, but exposure to greater quantities of the virus is more likely to result in infection. It is important to recognise that both large and smaller droplets travel through the air and may be considered 'airborne', however smaller droplets behave differently to larger droplets as they are lighter, more buoyant, and evaporate more quickly.[8,9,10] Current evidence suggests that transmission from contaminated surfaces is unlikely to contribute substantially to new infections.[11]

Risk due to aerosolised particles from coughs, sneezes, speaking, breathing, and aerosol generating procedures mean that additional precautions beyond usual droplet and contact contamination should be considered in some contexts including crowded, poorly ventilated, and indoor environments where people with suspected, probable, or confirmed COVID-19 are present.[12,13,14,15] Exposure to aerosolised particles may include both those directly undertaking aerosol generating procedures, as well as those in the same areas where such procedures occur.[16] There is considerable variability regarding what procedures are considered 'aerosol generating' with some perspectives highlighting that it is not the procedure itself that increases the risk of transmission but rather the sustained proximity to the respiratory expirations of a patient.[17] Aerosol generating procedures include:

- Tracheal intubation
- Non-invasive ventilation
- Tracheotomy
- Cardiopulmonary resuscitation
- Manual ventilation before intubation
- Bronchoscopy

Collection of respiratory specimens, including those who are asymptomatic, may also result in aerosol production. This includes bronchoalveolar lavage and induced sputum.[18]

Droplets and aerosols from coughs, sneezes, breathing, and talking can travel and/or remain in the air for prolonged periods up to several metres under certain conditions, such as in indoor environments with poor ventilation.[19,20] This is why cough/sneeze etiquette and careful adherence to protective measures and infection control is vital.[21]

Personal Protective Equipment

Staff must have both access to appropriate PPE and receive information and training regarding how to correctly put on (don), take off (doff), and dispose of PPE.[22,23] Correct size, fit, use, and disposal of PPE is essential to safe, effective infection prevention and control activities in the context of responding to COVID-19.[3] Health and aged care workers should have ready access to adequate PPE to protect themselves and others from potential transmission and infection in the context of providing care for people with suspected, probable, or confirmed COVID-19 based upon carefully assessed local risks.[3] The WHO highlights that PPE is only effective when adopted within the setting of a range of infection control measures including:[3]

- Administrative controls and measures that ensure resources, access, testing, policies, placement of patients, triage, adequate staff-to-patient ratios, and training.
- Environmental and engineering controls that aim to reduce pathogen spread and contamination of surfaces and objects through ensuing adequate space and human distance, ventilation, and isolation rooms for patients with suspected or confirmed infection.

Selection of correctly sized and fitting of respirators is critical as the incorrect size or poor-fit renders the mask ineffective.[24,6]

In the context of COVID-19 PPE includes:

- single-use surgical masks
- single-use, powder-free, non-sterile gloves

- single-use fluid-resistant, long-sleeved, cuffed isolation gowns*
- single-use or reusable eye protection (goggles or glasses with side shields, plastic visors/face shields)
- single-use, fit-checked respirators (P2 or N95 minimum)†

Coveralls, such as that used in the context of infections that are transmitted via bodily fluids (e.g. Ebola) are not required for managing COVID-19 infection. Three key actions are required to ensure optimal access to PPE considering current global shortages:[3]

i. Minimisation of PPE use
ii. Appropriate use of PPE
iii. Coordination of PPE supply chain

Minimisation of PPE use: The use of PPE can be minimised among healthcare staff while ensuring protection for staff and others. Interventions include:

1. Use of telemedicine to screen and evaluate suspected cases of COVID-19.
2. Use of physical barriers between patients and staff (i.e. plastic and glass windows).
3. Minimise contact and proximity between healthcare staff and patients via activity bundling and avoidance of unnecessary indirect care.
4. Prohibit or otherwise restrict visitors time in areas where patients with confirmed or suspected COVID-19 are being isolated.
5. Ensure healthcare staff and visitors correctly don, doff, and dispose of appropriate PPE.
6. Ensure healthcare staff and visitors correctly perform hand hygiene.

Appropriate use of PPE: Incorrect or overuse of PPE impact supply and use should be based on risk of exposure including type of activity and transmission dynamics. Interventions include:

1. Health and aged care staff working in areas where suspected, probable, or confirmed COVID-19 cases are, but who ***do not*** provide direct patient care or work in high-risk environments (e.g. where planned or unplanned aerosol generating procedures take place or crowded, poorly ventilated, indoor environments) should use:
    - Gowns, gloves, medical masks, eye protection (goggles/glasses and/or face shields).
2. Health and aged care staff involved in close (within two meters), frequent, direct care, in high-risk environments, or the same areas as planned or unplanned aerosol-generating procedures occur with people with suspected, probable, or confirmed COVID-19 should use:
    - Respirators (N95 or P2 standard or equivalent), eye protection, gloves, and fluid-resistant gowns or aprons (in the absence of suitable fluid-resistant gowns).
3. Healthcare staff ***not*** involved in direct patient contact and ***not*** working in high-risk environments with people with suspected, probable, or confirmed COVID-19 should not use PPE but maintain:
    - Spatial distance of at least two metres.
4. Healthcare staff involved in direct patient care of people *without* suspected or confirmed COVID-19 should use PPE according to standard precautions and risk assessment.

* Plastic aprons may be worn with a non-fluid resistant gown if suitable fluid-resistant gowns are unavailable.
† A single respirator may be used for up to four hours without being removed while caring for multiple patients with the same diagnosis.

5. Healthcare staff in administrative areas away from people with suspected, probable, or confirmed COVID-19 should not wear PPE unless otherwise indicated.
6. Laboratory staff manipulating respiratory samples should wear:
    - Gowns, gloves, eye protection (where splash risks exist).
7. Members of the general public with respiratory symptoms or suspected or probable COVID-19 infection and those caring for people with suspected, probable, or confirmed COVID-19 should wear:
    - Medical masks.
8. Members of the public who are asymptomatic should follow local directives regarding mask or face-covering use.

Coordination of PPE supply chain: Global and national supply of PPE should be coordinated and managed. Interventions include:[3]

1. Use PPE use forecasts based on rational quantification models to ensure rationalisation of supply.
2. Monitor and control PPE requests from countries and large responders.‡
3. Promote centralised request management approaches to minimise duplication and ensure strict adherence to stock management rule to limit wastage, overstock, and stock ruptures.
4. Monitor end-to-end distribution.
5. Monitor and control distribution of PPE from medical facilities stores.

Correct use of PPE: Correct size, fit, and use (donning, doffing, disposal) of all PPE must occur for effective and efficient use.[6,22,23] Users of PPE including healthcare and auxiliary staff and members of the public including patients must be provided with clear, understandable, and consistent information and training on correct use. Correct PPE use must also occur together with proper hand hygiene and personal infection control measures.

‡ Masks are not necessary for handling cargo from affected countries. Gloves are only required in the context of mechanical hazards (e.g. rough surfaces). No additional PPE is required for disinfecting pallets or supplies.

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