Current COVID-19 guidelines for respiratory protection of health care workers are inadequate

Guidelines need to reflect the mounting evidence for airborne transmission of SARS-CoV-2

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The guidelines for protection of health care workers in Australia state that a medical mask is indicated for routine care of patients with coronavirus disease 2019 (COVID-19), and a respirator only for aerosol-generating procedures.[1] These guidelines are not aligned with the growing body of scientific evidence regarding transmission and prevention of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.

The hospital infection control paradigm has assumed since last century that pathogens can be classified by transmission modes of droplet, airborne or contact. Guidelines on droplet precautions (masks) and airborne precautions (respirators) assume that respiratory emissions can be separated into droplet or airborne spread.[1,2] This artificial assumption is based on limited data from the 1930s.[2] More recent studies show that droplets and aerosols exist in a continuum, and even a single large droplet may become airborne during its trajectory, because of evaporation. Studies show that large droplets can travel distances well over 2 metres.[2]

Large droplets are predominantly thought to originate from the nose, throat and mouth, whereas airborne particles may originate from the lungs or from evaporation of large droplets from the upper airway. Research shows that the highest viral load of SARS-CoV-2 is found in bronchoalveolar lavage of the lower respiratory tract, and throat swabs are less likely to be positive.[3] This is consistent with airborne potential for the virus, as a high viral load in the lower respiratory tract increases the likelihood of the virus being exhaled in fine respiratory aerosols. SARS-CoV-2 has been found in air samples and air vents in COVID-19 wards.[4,5] Seasonal coronaviruses are more likely to be aerosolised than other respiratory viruses such as influenza, and can be exhaled in normal tidal breathing.[6] Recent research demonstrated that SARS-CoV-2 has more propensity for aerosolisation than severe acute respiratory syndrome (SARS) coronavirus or Middle East respiratory syndrome coronavirus (both of which are accepted as having airborne potential), and that viable virus can be detected in the air 16 hours after aerosolisation.[7]

A mask is designed to prevent a stream of liquid (such as a blood spurt) entering the mouth or nose of a surgeon, and is not regulated on filtration or fit. Its original purpose was protection of a surgical wound from contamination by the surgeon, but it also protects proceduralists from spray or splatter. It is not designed for respiratory protection. A respirator, in contrast, is designed to filter 95% of airborne particles and to fit around the face. Without fit and seal around the face, air flows preferentially through gaps around the mask. The best available evidence is a meta-analysis,

which found that N95 respirators offer significantly better protection (96%) than surgical masks (67%) against SARS coronavirus, Middle East respiratory syndrome coronavirus and SARS-CoV-2.[8] Randomised controlled trials (RCTs) of other respiratory viruses including coronaviruses show significant efficacy of N95 respirators when used continually on shift, but fail to demonstrate efficacy of surgical masks.[9] Even against infections assumed to be droplet spread, such as influenza, respirators are protective and masks are not.[11] Two North American studies are often cited as proof of "equivalence" of masks and respirators, but neither had a control arm and therefore cannot prove efficacy.[9] This has led to unwarranted claims that facemasks are non-inferior to respirators. The principle of equivalence in RCTs arose from drug trials, and requires an experimental treatment to be compared and shown to be equivalent against an established treatment which is already proven to be superior to placebo. A trial lacking a control arm which compares two interventions, neither of which are proven against placebo, and which finds no difference, cannot prove equivalence; it may show equal inefficacy. The failure to understand this basic concept has resulted in poor guidelines for health care workers.

Further, the intervention in these RCTs was targeted use of an N95 respirator during aerosol-generating procedures.[9] An RCT which compared targeted N95 use with continuous N95 use, showed that only continuous use is protective, and neither targeted use nor medical masks are efficacious.[9] A review of health worker deaths in the United Kingdom found no deaths among intensivists and anaesthetists, suggesting that their higher level of personal protective equipment was effective.[10]

With daily rising infections among health care workers, the precautionary principle should be used. Health workers treating patients with COVID-19 or suspected COVID-19 should be afforded a respirator. This should be feasible, given Australia has scaled up domestic manufacturing capacity for disposable masks and respirators. Supply shortage is no reason to recommend substandard protection for health workers. We could

also consider reusable elastomeric respirators as a cost-effective option, as did Yale New Haven, Allegheny Health Network and the University of Maryland Medical System hospitals in the United States.

There are no published data to prove that contact, fomite and large droplets are the predominant mode of transmission. The same studies which found SARS-CoV-2 RNA in the air also found SARS-CoV-2 RNA on surfaces on the COVID-19 ward, so a similar level of evidence supports contact and airborne spread.[5,6] Currently, there are no published studies which have identified SARS-COV-2 in large droplets or catalogued the transmission of the virus by one mode or another. The evidence for airborne transmission is mounting,[5,6] and hospital workers with no patient contact have been infected with SARS-CoV-2, suggesting a distal risk beyond the patient care area.[11]

Our health workers are a precious asset, and warrant the highest protection, not simply for their occupational health and safety but for a functional and resilient health system. In Tasmania, one hospital outbreak resulted in over 1000 health workers being quarantined. During a nosocomial outbreak, visitors should be excluded from hospitals, as currently implemented in Victoria.

By reviewing all media reports which mentioned hospitals and health workers as of July 2020, we estimated that about 6% (507/8449) of all cases in Australia are health workers. This included 216 in Victoria before the current resurgence (only 17% are apparently attributed to occupational infection), 208 in New South Wales (about 88 attributed to the workplace), 73 in Tasmania (from a single hospital outbreak) and at least 10 infections from the rest of the country (unpublished data). In the absence of public national or state reporting of health worker infections, this is a minimal national estimate of health worker infections before the current resurgence in Victoria. It is estimated that as of 17 August 2020 there were over 1600 health worker infections in Victoria. We are also aware of hospital staff working in non-clinical duties acquiring infection during the current epidemic, which suggests widespread risk in the hospital setting. It is clear that health workers have a higher risk of COVID-19.[12,13]

We call for transparent national reporting of health worker infections. This should be based on role and specialty, with adjudication of source attribution (workplace or elsewhere) by an independent panel separate to health services or agencies to avoid conflicts of interest. COVID-19 is a notifiable disease in the National Notifiable Diseases Surveillance System. We propose that a field be added to the National Notifiable Diseases Surveillance System to flag health care worker status for all notified cases, regardless of attribution. A national protocol for attribution of source of infection for health care workers with COVID-19 should be developed, to ensure standardised and transparent reporting which requires documentation of occupational role and potential exposures within and outside of the workplace. Attribution should not be automatically made to a community source if there is no known close contact with a confirmed patient. This would create a confirmation bias for the theory that transmission only occurs with close contact. Health care workers themselves should be encouraged to review these investigations in keeping with consumer led and open disclosure principles. A national committee that reviews health care worker infections should have representatives from the Australasian Faculty of Occupational and Environmental Medicine, the Australian Nursing and Midwifery Federation, and representatives of national and jurisdictional work health and safety bodies.

Amid rising health worker infections, Victoria changed their personal protective equipment guidelines in late July 2020 to recommend use of a respirator for health workers caring for patients with COVID-19. The national guidelines did not substantially change. We can learn from the Canadian experience of the 2003 SARS outbreak, where experts in Toronto argued over whether N95 respirators were really necessary. Vancouver applied the precautionary principle and avoided a health worker outbreak. In Toronto, however, experts decided against using the N95 respirator, which protects against airborne transmission, believing that SARS was spread mostly by large droplets.[14] N95 respirator use was considered unnecessary except for aerosol-generating procedures, and a surgical mask was deemed sufficient in most instances. These recommendations were made even though knowledge about SARS and airborne transmission was still evolving.[14] As a result, over 300 health workers in Toronto were infected and three died.[14] During the SARS CoV-2 pandemic, a similar debate is driving guidelines. The lessons of the SARS Commission in Ontario, Canada, should be heeded. In the aftermath of SARS and deaths of health workers in Toronto, in 2006 the commission concluded:

> One example was the debate during SARS over whether SARS was transmitted by large droplets or through airborne particles. The point is not who was right and who was wrong in this debate. When it comes to worker safety in hospitals, we should not be driven by the scientific dogma of yesterday or even the scientific dogma of today. We should be driven by the precautionary principle that reasonable steps to reduce risk should not await scientific certainty.[14]

The report also warned that decisions about protection of health workers must involve broader stakeholder consultation, including the workers themselves, work health and safety experts, unions and the government agency responsible for industrial relations.[14]

Several hospitals in Melbourne have reported health worker infections during the current resurgence, and even more are in quarantine and unable to work. We must make the occupational health and safety of our health workers a national priority.

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