

**We are not doing enough to prevent the spread of COVID-19 and other respiratory viruses in Australian hospitals**

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Our current approaches to limiting transmission of respiratory viruses including COVID-19 are not good enough.

**Abstract (100 words)**

The evidence from the COVID-19 pandemic has clearly demonstrated that our current approach to controlling respiratory viruses using contact and droplet precautions is not sufficient to prevent their spread to health care workers and patients. Health care workers have been shown to be at increased risk of infection with SARS-CoV2. Evidence that aerosol transmission of SARS-CoV2 occurs in health care settings is now very clear. Effective strategies to limit the spread of respiratory viruses, including SARS-CoV2, need to include the application of airborne precautions, eye protection, and the adoption of more aggressive isolation strategies for potentially infected individuals in Australian hospitals.

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The health care community has been accused of not taking the nosocomial spread of respiratory virus infection to health care workers and patients seriously enough. The evidence from the COVID-19 pandemic has demonstrated that our current approach to controlling respiratory viruses were not sufficient. The overrepresentation of health care workers among those acquiring SARS-CoV-2 infection in workplace settings is a clear testament to this with adjusted hazard ratios of HR 3.40, (95% CI 3.37–3.43)(1). This issue needs to be critically examined in the light of the emerging evidence from the COVID-19 pandemic.

It is important to see this problem in the context of previous and future responses to the nosocomial transmission of respiratory viruses within health care facilities. Historically we have paid little attention to the risks of nosocomial spread of respiratory virus infection. This contrasts with the vital and successful activities in infection control and antibiotic stewardship, that have targeted nosocomial spread of bacterial infections (e.g. methicillin resistant *staphylococcus aureus*). As a community we have been slow to appreciate and to study the extent of transmission of respiratory viruses in our health care facilities or to implement appropriate infection control practices. For example, the Australian guidelines for the prevention and control of infection in healthcare settings, which were revised in 2019, recommend contact and droplet precautions for respiratory viruses, together with a weak recommendation to place these patients in a single room. Airborne precautions were only recommended for patients with infections where transmission is known to occur by the airborne route (aerosols), such as tuberculosis, with a stronger recommendation for these patients to be placed in a negative pressure or single room. The Cochrane systematic review, recently updated(2), highlighted the heterogeneity among trials on control of respiratory viruses and the weakness of the evidence supporting the use of contact and droplet precautions. In contrast, a World Health Organisation (WHO)-commissioned meta-analysis of data on transmission of coronaviruses, including SARS-CoV-2, showed that N95 respirators provide 96% protection versus surgical masks 67%. Eye guards provided further protection (3). We propose if applied our current guidelines fall short in achieving the optimum level of protection recommended by this review.

There is evidence that airborne transmission of influenza does occur and viable respirable Influenza has been detected in the air three hours after an infected patient has left the emergency department(4). Nosocomial outbreaks of seasonal influenza are common with spread among both patients and staff causing serious infections, especially in vulnerable populations(5). Nosocomial outbreaks with respiratory syncytial virus leading to similar serious consequences for vulnerable populations are also well documented(6). In both cases transmission of infection has occurred in the settings where infection control practices are aligned with our current guidelines.

Evidence for aerosol transmission of SARS-CoV2 has become much clearer. Infectious SARS-CoV2 survives in the air for in excess of 3 hours and longer on a range of surfaces found in health care facilities(7). Potentially infectious droplets containing SARS-CoV2 are detected in health care settings, and viable virus has been detected in the air at distances greater than 2m(8). Particles < 1µm in size have been detected in hospital rooms(9). This suggests that standard droplet precautions are likely to be insufficient to prevent transmission. Coughing and sneezing release a turbulent cloud of buoyant gas with suspended droplets of various

sizes, with only the larger droplets (>100µm) following a ballistic trajectory and being contained within 2 metres. Infection is more likely to occur after inhalation of aerosols which accumulate through breathing and speaking in poorly ventilated settings. Particles less than 100µm in size carry for more than 6 metres(10). The current dichotomous division between aerosol and droplet that is used to define a safe distance is flawed, based on limited evidence, while 8/10 studies show potentially infectious virus particles disperse more than the currently recommended 2m(8). In the health care setting aerosol transmission will assume greater importance due to a combination of several factors including: the indoor setting with variable rates of air exchange, the presence of infectious patients, the presence of patients who cough and breathe rapidly. While coughing and rapid breathing have been shown to be associated with substantially increased generation of aerosol particles. In fact, coughing generates more aerosols than tracheal intubation(11) This is the very scenario seen among admitted COVID-19 patients who are actively infectious, with uncontrollable frequent coughing, that is likely to increase the risk of aerosolization of infectious particles. Evidence from case series in healthcare workers suggest that contact and droplet precautions are not sufficient to prevent infection. In this series 14/41 (63.6%) of occupational infections occurred in health workers using a surgical mask, while no occupational infections were found while using aerosol precautions when treating suspected or confirmed COVID-19 patients(12). In Victoria 3561 health care workers acquired COVID-19, 73% were acquired in a health care setting; 50% were aged or disability workers, 40% nurses and 4.8% medical practitioners. Those most at risk are clearly those most in close regular contact with unwell patients attending to their daily care, not those performing procedures.

The application of a mask reduces transmission of respiratory viruses and SARS-CoV-2 in a hospital setting (13). A metaanalysis of 4 randomised trials compared the use of N95 masks with surgical masks in health workers and found that that N95 masks may have provided greater protection against symptomatic influenza-like illness (OR 1.49; 95% CI: 0.98-2.28)(14). Singapore, having painfully learnt from their experience with the first SARS epidemic, took an aggressive and systematic approach to the current pandemic. This included extremely rigorous hospital infection control, including the adoption of airborne precautions and the use of patient isolation. They have kept health care worker infection to amongst the lowest reported, with only 40 confirmed cases(1, 15).

More research is required to better understand the mechanisms of transmission of respiratory viruses within health care facilities. We argue that the currently recommended approach to prevention of transmission of respiratory viruses in Australian health care settings is insufficient in the context of the latest evidence. Contact and droplet precautions do not provide sufficient protection for frontline health care workers and vulnerable patient populations in hospitals.

We propose revising the existing approach to the control of transmission of respiratory viruses, including:

1. The application of both contact and airborne precautions, including eye protection, in managing all patients with suspected COVID-19 or influenza-like illness (regardless of whether so-called “aerosol-generating procedures” are being performed).
2. Health workers involved in care of patients with influenza-like illness should be trained in correct donning and doffing of personal protective equipment.
3. Fit testing be provided annually for health workers.
4. Health care facilities need ensure there is access to sufficient single rooms to effectively manage patients with respiratory viral infections.
5. Building and engineering controls in health care settings, including ventilation and air conditioning, should be optimised to minimise the risk of airborne transmission within facilities. Health care facilities need to ensure clinical and staff areas have sufficient ventilation and need to avoid overcrowding and air recirculation. Measures such as the use of filters and air disinfection could also be considered and trialled.
6. The poor evidence base in regard the transmission of respiratory viruses and infection control needs to be addressed as a health and research priority. A systematic approach needs to be undertaken prospectively to the burden of disease associated with respiratory virus infection, this should include;
  - a. studies of prevalence and their impact on prognosis and management.
  - b. Nosocomial transmission to staff and other patients that determine system and not individual failures and to improve safe work practices.
  - c. The impact of infection control policies on transmission and the trial of specific interventions in Australian health care settings that look at efficacy and implementation.

Some of these steps are strategic and will need to be planned, they will come with a cost, but so too does inaction. In the past we have neglected the risk of spread of respiratory viruses in health care settings. COVID-19 teaches us to do better. We now have the opportunity to do so and make lasting changes for the good of our patients and our colleagues.

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