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

Our current approaches to limiting transmission of respiratory viruses, including SARS-CoV-2, are inadequate

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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 coronavirus disease 2019 (COVID-19) pandemic has demonstrated that our current approach to controlling respiratory viruses is not sufficient. The overrepresentation of health care workers among those acquiring severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in workplace settings is a clear testament to this with an adjusted hazard ratio of 3.40 (95% CI, 3.37–3.43).[1] This issue needs to be critically examined in 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 (eg, methicillin-resistant *Staphylococcus aureus*). As a community, we have been slow to appreciate and study the extent of transmission of respiratory viruses in our health care facilities and to implement appropriate infection control practices. For example, the Australian guidance on the prevention and control of infection in health care settings (https://www.health.gov.au/committees-and-groups/infection-control-expert-group-iceg#icegendorsed-infection-control-guidance) recommends contact and droplet precautions for respiratory viruses, together with a weak recommendation to place these patients in a single room. Airborne precautions are 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. A 2020 Cochrane systematic review[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 Organization-commissioned meta-analysis of data on transmission of coronaviruses, including SARS-CoV-2, showed that N95 respirators provide much better protection than surgical masks (96% *v* 67%); eye guards provided further protection.[3] We propose that our current guidelines fall short of the optimum level of protection recommended by this review.

There is evidence that airborne transmission of influenza virus does occur and viable respirable influenza virus has been detected in the air 3 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 current Australian guidelines.

Evidence for aerosol transmission of SARS-CoV-2 has become much clearer. Infectious SARS-CoV-2 survives for over 3 hours in the air, and for longer on a range of surfaces found in health care facilities.[7] Potentially infectious droplets containing SARS-CoV-2 are detected in health care settings, and viable virus has been detected in the air at distances greater than 2 metres.[8] Particles < 1 μm 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 (> 100 μm) 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 < 100 μm in size carry for more than 6 metres.[10] The current dichotomy between aerosol and droplet that is used to define a safe distance is flawed and based on limited evidence, while eight out of ten studies show potentially infectious virus particles disperse more than the currently stated 2 metres.[8] In the health care setting, aerosol transmission assumes greater importance due to a combination of several factors

including the indoor setting with variable rates of air exchange, the presence of infectious patients, and 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 patients with COVID-19 who are actively infectious, with uncontrollable frequent coughing, that is likely to increase the risk of aerosolisation of infectious particles. Evidence from a case series in health care workers[12] suggests that contact and droplet precautions are not sufficient to prevent infection. In this series, 64% (14/41) of occupational infections occurred in health workers using a surgical mask, whereas no occupational infections were found while using aerosol precautions when treating suspected or confirmed patients with COVID-19.[12] In Victoria, of 3561 health care workers with COVID-19, 73% acquired the disease in a health care setting; of these, 50% were aged or disability workers, 40% were nurses and 4.8% were medical practitioners (https://www.dhhs.vic.gov.au/help-and-support-healthcare-workers-coronavirus-covid-19). Most at risk are clearly those in close regular contact with unwell patients attending to their daily care, not those performing procedures.

Mask use reduces transmission of respiratory viruses and SARS-CoV-2 in a hospital setting.[13] A meta-analysis of four 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 (odds ratio, 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 among 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 recommend revising the existing approach to the control of transmission of respiratory viruses as follows:

- Both contact and airborne precautions should be applied, including eye protection, in managing all patients with suspected COVID-19 or influenza-like illness (regardless of whether "aerosol-generating procedures" are being performed).
- Health workers involved in the care of patients with influenza-like illness should be trained in correct donning and doffing of personal protective equipment.
- Fit testing should be provided annually for health workers.
- Health care facilities must ensure there is access to sufficient single rooms to effectively manage patients with respiratory viral infections.
- 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 must avoid overcrowding and air recirculation. Measures such as the use of filters and air disinfection could also be considered and trialled.
- The poor evidence base regarding the transmission of respiratory viruses and infection control needs to be addressed as a health and research priority. A systematic approach should be undertaken prospectively to reduce the burden of disease associated with respiratory virus infection, including:
  - investigating the prevalence of respiratory virus infections in health facilities and their impact on prognosis and management;
  - acknowledging that nosocomial transmission of respiratory viruses to staff and patients indicates system (not individual) failures, and using this awareness to improve safe work practices; and
  - assessing the impact of infection control policies on transmission, and trialling specific interventions in Australian health care settings to improve the effectiveness of such these measures to prevent nosocomial spread of respiratory viruses.

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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