

Designed for a pandemic: mitigating the risk of SARS-CoV-2 transmission through hospital design and infrastructure

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Background/Purpose: Outbreaks of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have occurred in many healthcare facilities in Australia and internationally. These outbreaks involved healthcare workers as well as patients, causing considerable morbidity and strain on healthcare facilities.

Opened in 2017, the new Royal Adelaide Hospital (RAH) was designed to respond to major disasters, including emerging pathogens and pandemics.

Approach: We describe the design and infrastructure of the RAH, including the sophisticated air-handling units (AHUs), that helped mitigate the risk of nosocomial SARS-CoV-2 transmission during the first surge of coronavirus disease 2019 (COVID-19) cases in Australia.

Outcomes/Impact: The RAH is an 800-bed quaternary hospital with 100% single rooms and dedicated ensuites, including 35 negative pressure and 3 full quarantine rooms. Pandemic areas are geographically stacked to allow patient movement via a single elevator system, reducing impact and potential contamination of the wider hospital. Under 'pandemic mode', AHUs allow the intake of 100% fresh air and exhaust all extracted air to prevent recycling in pandemic areas, and is scalable to include additional wards based on case load. Increased extraction rates also create a net negative pressure environment beyond dedicated negative pressure rooms.

From February – May 2020, 285 patients were admitted with suspected COVID-19 requiring enhanced respiratory precautions, including 113 patients with confirmed SARS-CoV-2. The median day of illness at admission for positive cases was 5 days, with 94% admitted during their infectious period. This large case load was compounded by limited understanding of SARS-CoV-2's mode of transmission and a global shortage of particulate filter respirators (e.g. N95 or P2 masks). Despite these challenges, no nosocomial transmissions of SARS-CoV-2 occurred, and only one staff member potentially acquired COVID-19 at work.

Innovation and Significance: Hospital design and infrastructure provides a crucial element to the suite of infection control interventions in preventing nosocomial transmission of SARS-CoV-2 and other respiratory pathogens.

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