

## Evidence check

5 June 2020

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

## Nosocomial COVID-19 infections

### Rapid review question

1. Is there evidence of transmission of COVID-19 to and from healthcare professionals?
2. What strategies are available to reduce risk of nosocomial infections of COVID-19?

### In brief

- There are documented outbreaks of nosocomial spread of COVID-19, including infections in healthcare workers.
- There are multiple reports of healthcare workers infected with COVID-19, as well as accounts of healthcare workers as a source of infection. However, the direction of transmission can be difficult to determine.
- The Centre for Evidence Based Medicine reported on 15 April 2020 that 13.8% of COVID-19 positive cases in the UK were critical key workers in the National Health Service and other sectors. In China, more than 3,300 healthcare workers were infected (4% of the 81,285 reported infections), while in Spain on the 25 March nearly 6,500 medical personnel were infected, 13.6% of the country's 47,600 total cases. As of 20 April 2020, there were 112 persons associated with the outbreak in north-west Tasmania, including 72 healthcare workers.
- In Lombardy, over-referral led to significant numbers of unwell people presenting to hospital, with subsequent spread within the facility. Healthcare workers then had a higher risk of exposure and became vectors of onwards transmission.
- Factors identified as contributing to nosocomial spread include: staff continuing to work despite showing symptoms, contact time, workplace activities, shortcomings in infection control practices, incomplete or delayed identification of close contacts of confirmed cases, high levels of staff mobility between different healthcare facilities, transfer of undiagnosed infectious or incubating patients between healthcare facilities.
- Use of personal protective equipment (PPE), staff surveillance, infection prevention, control and monitoring, isolating suspected or confirmed COVID-19 cases, social distancing in hospitals, real-time monitoring of staff, setting up infection control teams, measuring body temperature or testing staff, roster changes and team grouping are strategies described to mitigate the risk of nosocomial infection in healthcare workers.
- Modelling from the Imperial College COVID-19 response team found PCR screening of healthcare workers could reduce transmission of COVID-19 by a further 16-23%, on top of self-isolation based on symptoms, if results were available within 24 hours.

- Healthcare workers are at different risk of infection based on factors such as setting, clinical role and their interactions with others.
- There is a relationship between the stage of the pandemic and risk, e.g. in China most infections among healthcare workers occurred during the early stage of the outbreak, before protective measures were implemented.(1)

## Limitations

Evidence included in this review is low level, based on small numbers and information is still emerging about testing healthcare workers and observed reduction of nosocomial infection in healthcare settings. This review contains some publications that are in preprint or pre-peer review. Many general infection control guidelines exist, these have not been outlined in the table but are acknowledged as important sources in reducing the risk of nosocomial infections. Disparities in infection rates in terms of race and ethnicity are not well delineated in the literature. Media articles are included in this review, which should be interpreted with caution.

## Background

Healthcare workers are at risk of COVID-19 infection.(2) During the SARS and Middle East Respiratory syndrome epidemics, nosocomial infections were amplified.(3,4) According to the World Health Organization (WHO), healthcare workers accounted for 21% (1706/8096) of all SARS-1 cases reported.(4)

The Australian Guidelines for the Prevention and Control of Infection in Healthcare outline recommendations for a wide range of healthcare settings.(5)

## Methods (Appendix 1)

PubMed, Google and snowball sampling were conducted on 1 May 2020. Australian government websites were reviewed and results on guidance, risk to healthcare professional and the mental health of healthcare professionals were included. Results specific to COVID-19 were included.

## Results

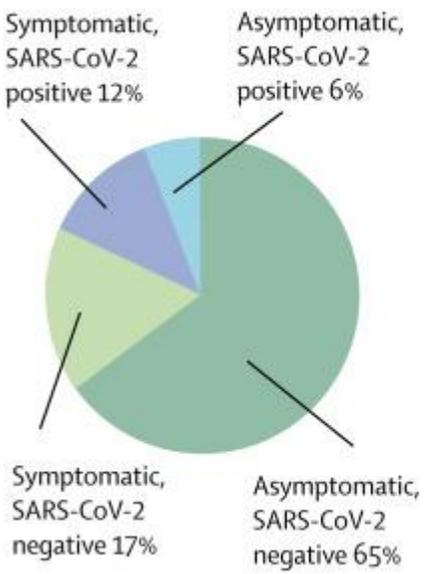
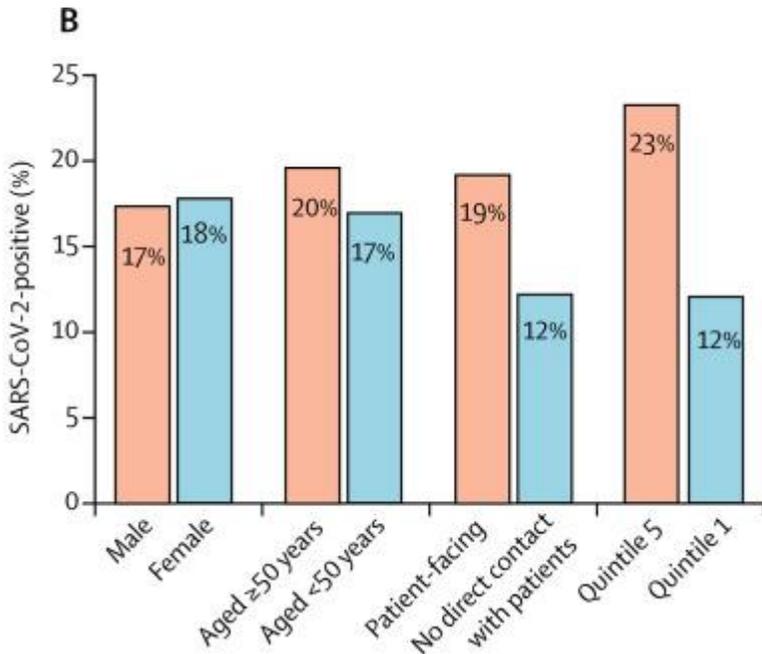
**Table 1: Nosocomial infection of COVID-19 in healthcare professionals**

Source title	Summary
Peer reviewed journals	
<p><a href="#">Coronavirus Disease 2019 (COVID-2019) Infection Among Health Care Workers and Implications for Prevention Measures in a Tertiary Hospital in Wuhan, China</a></p> <p>Lai X, et al. 2020 (1)</p>	<ul style="list-style-type: none"> <li>• Single-centre case series included 9,684 healthcare workers in Tongji Hospital, Wuhan, China. Data were collected from 1 January to 9 February 2020.</li> <li>• Exposure, epidemiological and demographic information was collected by a structured questionnaire. Clinical, laboratory and radiologic information was collected from electronic medical records. A total of 335 medical staff were randomly sampled to estimate the prevalence of subclinical infection among a high-risk, asymptomatic population. Samples from surfaces in healthcare settings were also collected.</li> <li>• Overall, 110 of 9,684 Healthcare workers in Tongji Hospital tested positive for COVID-19, with an infection rate of 1.1%. Of them, 70 (71.8%) were women and they had a median (interquartile range) age of 36.5 (30.0-47.0) years. Seventeen (15.5%) worked in fever clinics or wards, indicating an infection rate of 0.5% (17 of 3110) among first-line healthcare workers. A total of 93 of 6,574 non-first-line healthcare workers (1.4%) were infected. Non-first-line nurses younger than 45 years were more likely to be infected compared with first-line physicians aged 45 years or older (incident rate ratio, 16.1; 95%CI, 7.1-36.3; P &lt; .001).</li> <li>• Most infections among healthcare workers occurred during the early stage of disease outbreak. Non-first-line healthcare workers had a higher infection rate than first-line healthcare workers, which differed from observation of previous viral disease epidemics.</li> </ul>
<p><a href="#">Epidemiology of and risk factors for coronavirus infection in health care workers: a living rapid review</a></p> <p>Chou R, et al. 2020 (2)</p>	<ul style="list-style-type: none"> <li>• This review of 64 studies concluded that healthcare workers account for a large proportion of infection during the SARS-CoV-1 outbreak and that healthcare workers may experience a high incidence of infection, in particular when unprotected.</li> <li>• Use of PPE and infection control training was associated with decreased infection risk, and certain exposures were associated with increased risk.</li> </ul>

Source title	Summary
<p><a href="#">Respiratory surveillance wards as a strategy to reduce nosocomial transmission of COVID-19 through early detection: the experience of a tertiary hospital in Singapore</a></p> <p>Wee, et al. 2020 (43)</p>	<ul style="list-style-type: none"> <li>• Over a six week period a respiratory surveillance ward was introduced.</li> <li>• This segregated patients into designated areas, appropriate PPE could be used and patients could be tested.</li> <li>• 1,178 patients were admitted to the ward during the study period.</li> <li>• Mean length of stay was 1.89 days.</li> <li>• Among confirmed cases of pneumonia, 5/310 tested positive for COVID-19.</li> <li>• 126 healthcare workers were potentially exposed to the cases, however only 2.4% (3/126) required quarantine as the majority used appropriate PPE.</li> <li>• 13 inpatients overlapped with the index cases during their stay in the ward, of these 13 exposed patients, 1 subsequently developed COVID-19.</li> <li>• No patient to healthcare worker transmission was detected despite intensive surveillance.</li> </ul>
<p><a href="#">Rapid assessment of regional SARS-CoV-2 community transmission through a convenience sample of healthcare workers, the Netherlands, March 2020</a></p> <p>Ruesken, et al. 2020 (5)</p>	<p>A two day rapid study among nine hospitals with healthcare workers who were working and/or residing in an area of the Netherlands with suspected community transmission showed that 4.1% of hospital staff with mild respiratory symptoms were infected with COVID-19. The prevalence of 4% among healthcare workers with mild respiratory illness and no epidemiological link was interpreted as high and of concern. It suggests unnoticed community transmission, with a potential risk of nosocomial transmission.</p>
<p><a href="#">Clinical characteristics of 30 medical workers infected with new coronavirus pneumonia</a></p> <p>Liu, et al. 2020 (6)</p>	<p>This Chinese study of 30 infected healthcare workers showed an association between infection rates for staff, contact time and the amount of 'suction virus'. Strict protection measures are important to prevent infection for medical workers.</p>
<p><a href="#">Transmission of COVID-19 to health care personnel during</a></p>	<p>A report on 121 healthcare professionals who were exposed to a patient with unrecognised COVID-19. Three out of 43 symptomatic patients tested positive for COVID-19 and had unprotected patient contact. Unprotected prolonged</p>

Source title	Summary
<p><a href="#">exposures to a hospitalised patient — Solano County, California, February 2020</a></p> <p>Heinzerling, et al. 2020 (7)</p>	<p>patient contact, as well as certain exposures, including some aerosol generating procedures, are associated with COVID-19 infection in healthcare personnel. The report recommends early recognition and isolation of patients with possible infection and the use of recommended PPE to help minimise unprotected, high-risk healthcare personnel exposures and protect the healthcare workforce.</p>
<p><a href="#">COVID-19, Australia: epidemiology report 12: Reporting week ending 19 April 2020</a></p> <p>COVID-19 National Incident Room Surveillance Team, 2020 (8)</p>	<p>As of 19 April 2020, there were 37 cases of care staff with COVID-19 associated in 24 residential aged care facilities in Australia. In addition, there were nine cases associated with 24 in-home Commonwealth funded aged care services staff providing support to older Australians who live at home. There were instances of COVID-19 outbreaks occurring in Australian healthcare settings. The outbreak of COVID-19 in hospitals in north-west Tasmania began in late March 2020. Cases occurred among healthcare workers, patients and household contacts. As of 20 April 2020, there were 112 persons associated with the outbreak, including 72 staff members. The outbreak resulted in widespread quarantine of healthcare workers, patients and visitors to the affected hospitals.</p>
<p><a href="#">Emergency responses to covid-19 outbreak: experiences and lessons from a general hospital in Nanjing, China</a></p> <p>Shen, et al. 2020 (9)</p>	<p>Three healthcare staff with confirmed COVID-19 in a hospital in China had no healthcare-associated infection, which was prevented by prompt actions. Actions included centralising administration, modifications of infrastructure, special arrangements for outpatient services, hospitalisation and surgeries, medical personnel training and patient education, COVID-19 research and application of information technology.</p>
<p><a href="#">Drugs supply and pharmaceutical care management practices at a designated hospital during the COVID-19 epidemic</a></p> <p>Ying, et al. 2020 (10)</p>	<p>This case study discusses the results of changes to the drug supply and pharmaceutical service in the pharmaceutical department of Third Hospital of Jilin University (THJU). Some of the changes provided effective support for prevention and control of nosocomial infections, such as systematic nosocomial infection prevention and control training. As of 31 March 2020, the mortality rate of patients with COVID-19 in THJU was 0% and the number of infected medical staff was 0.</p>
<p><a href="#">First known person-to-person transmission of severe acute</a></p>	<p>This epidemiological investigation tracked the spread from two patients in the USA. Overall, 372 contacts of both cases were identified, 347 (152 community contacts and 195 healthcare personnel) underwent active symptom</p>

Source title	Summary
<p><a href="#">respiratory syndrome coronavirus 2 (SARS-CoV-2) in the USA</a></p> <p>Ghinai, et al. 2020 (11)</p>	<p>monitoring. Of monitored contacts, 43 became persons under investigation, in addition to Patient 2. These 43 persons under investigation and all 32 asymptomatic healthcare personnel tested negative for COVID-19.</p>
<p><a href="#">Roll-out of SARS-CoV-2 testing for healthcare workers at a large NHS Foundation Trust in the United Kingdom, March 2020</a></p> <p>Keeley, et al. 2020 (12)</p>	<ul style="list-style-type: none"> <li>• This case study discusses results from staff testing at Sheffield Teaching Hospitals NHS Foundation Trust, United Kingdom. On the 17 March 2020, the NHS commenced testing of symptomatic staff for COVID-19, 18% were positive. The article advises testing healthcare workers is a crucial strategy to optimise staffing levels during the COVID-19 outbreak.</li> <li>• Staff members presenting with an influenza-like illness or persistent cough were directed to self-swab in the on-site assessment pods. The majority of test results were communicated to staff on the same or the next day. Staff with a negative COVID-19 result were able to return to work.</li> <li>• Authors discuss the importance of maximising the available health workforce. Facilitating testing may substantially decrease absence in staff when COVID-19 can be excluded.</li> <li>• The article suggests an additional boost to the workforce could be provided by access to testing for symptomatic household members of healthcare workers.</li> <li>• The authors advised testing asymptomatic staff has practical limitations and may not be feasible. However, testing staff with mild or non-specific symptoms should be considered for infection control purposes.</li> </ul>
<p><a href="#">Risk of nosocomial transmission of coronavirus disease 2019: an experience in a general ward setting in Hong Kong</a></p> <p>Wong, et al. 2020 (13)</p>	<ul style="list-style-type: none"> <li>• A COVID-19 patient was nursed in an open cubicle in the general ward before their diagnosis was made.</li> <li>• 71 staff and 49 patients were identified from contact tracing.</li> <li>• 7 staff and 10 patients fulfilled the criteria of close contact.</li> <li>• 28 day surveillance, 76 tests on 52 contacts.</li> <li>• All tests were negative.</li> </ul>
<p><a href="#">Clinical characteristics of 138 hospitalised patients with 2019</a></p>	<ul style="list-style-type: none"> <li>• 138 patients, 57 (41.3%) were presumed to have been infected in hospital.</li> </ul>

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<p><a href="#">novel coronavirus–infected pneumonia in Wuhan, China</a></p> <p>Wang, et al. 2020 (14)</p>	<ul style="list-style-type: none"> <li>This includes 17 patients (12.3%) who were already hospitalised and 40 healthcare workers (29%).</li> </ul>																												
<p><a href="#">COVID-19 screening of health-care workers in a London maternity hospital</a></p> <p>Khalil, et al. 2020 (42)</p>	<p>Screening healthcare workers at The Portland Hospital for Women and Children (London, UK) between 17 March and 16 April 2020 resulted in 47 of 266 staff members testing positive. Of these positive cases, 31 (66%) were symptomatic and 16 (34%) were asymptomatic. Overall, 28 (48%) staff members remained positive at 7 days after the initial test was taken, 16 (34%) at 10 days and four (9%) at 14 days, with one healthcare worker remaining positive until 26 days. Of 25 symptomatic staff members who initially tested negative and were retested, only one (4%) became positive after 7 days. Potential factors associated with SARS-CoV-2 positivity are summarised in the figure.</p> <div data-bbox="660 694 1870 1348"> <p><b>A</b></p>  <table border="1"> <caption>Data for Figure A: SARS-CoV-2 Test Results</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Symptomatic, SARS-CoV-2 positive</td> <td>12%</td> </tr> <tr> <td>Asymptomatic, SARS-CoV-2 positive</td> <td>6%</td> </tr> <tr> <td>Symptomatic, SARS-CoV-2 negative</td> <td>17%</td> </tr> <tr> <td>Asymptomatic, SARS-CoV-2 negative</td> <td>65%</td> </tr> </tbody> </table> <p><b>B</b></p>  <table border="1"> <caption>Data for Figure B: Factors Associated with SARS-CoV-2 Positivity</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Male</td> <td>17%</td> </tr> <tr> <td>Female</td> <td>18%</td> </tr> <tr> <td>Aged ≥50 years</td> <td>20%</td> </tr> <tr> <td>Aged &lt;50 years</td> <td>17%</td> </tr> <tr> <td>Patient-facing</td> <td>19%</td> </tr> <tr> <td>No direct contact with patients</td> <td>12%</td> </tr> <tr> <td>Quintile 5</td> <td>23%</td> </tr> <tr> <td>Quintile 1</td> <td>12%</td> </tr> </tbody> </table> </div>	Category	Percentage	Symptomatic, SARS-CoV-2 positive	12%	Asymptomatic, SARS-CoV-2 positive	6%	Symptomatic, SARS-CoV-2 negative	17%	Asymptomatic, SARS-CoV-2 negative	65%	Category	Percentage	Male	17%	Female	18%	Aged ≥50 years	20%	Aged <50 years	17%	Patient-facing	19%	No direct contact with patients	12%	Quintile 5	23%	Quintile 1	12%
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	<ul style="list-style-type: none"> <li>• Test results by symptom status (A) and characteristics (B).</li> </ul>
<p><a href="#">Special attention to nurses' protection during the COVID-19 epidemic</a></p> <p>Huang, et al. 2020 (41)</p>	<p>This editorial states that as of 8 March 2020, of the 80,815 COVID-19 reported infections in China, more than 3,000 infections occurred among medical staff.</p>
<p><a href="#">Nosocomial Infections Among Patients with COVID-19, SARS and MERS: A Rapid Review and Meta-Analysis</a></p> <p>Zhou, et al. 2020 (15)</p> <p>Pre-peer review publication</p>	<ul style="list-style-type: none"> <li>• 40 studies included.</li> <li>• Among the confirmed patients, the proportions of nosocomial infections were 44.0% for COVID-19.</li> <li>• Of the confirmed patients, the medical staff and other hospital-acquired infections accounted for 33.0% and 2.0% of COVID-19 cases, respectively.</li> <li>• Nurses and doctors were the most affected among the infected medical staff.</li> </ul>
<p><a href="#">Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19)</a></p> <p>WHO, 2020 (16)</p>	<ul style="list-style-type: none"> <li>• As of 20 February 2020, there were 2,055 COVID-19 laboratory-confirmed cases reported among healthcare workers from 476 hospitals across China. The majority of healthcare worker cases (88%) were reported from Hubei.</li> <li>• Investigations among healthcare workers suggest that many may have been infected within the household rather than in a healthcare setting.</li> <li>• There were discrete and limited instances of nosocomial outbreaks in China as of 20 February 2020, however transmission within healthcare settings and amongst healthcare workers did not appear to be a major transmission feature of COVID-19 in China.</li> <li>• Surveillance among healthcare workers identified factors early in the outbreak that placed healthcare workers at higher risk of infection, and this information has been used to modify policies to improve protection of healthcare worker.</li> </ul>

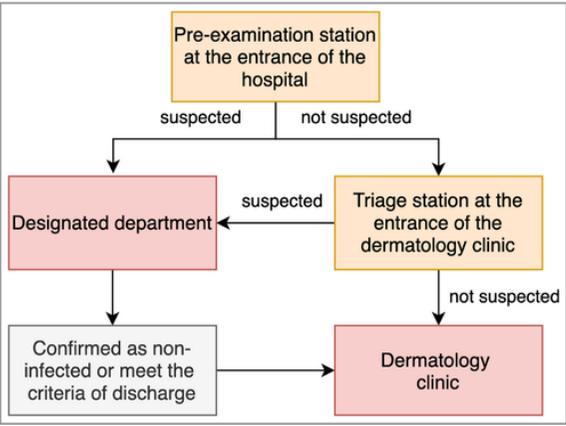
Source title	Summary
<p><a href="#">COVID-19 North West Regional Hospital outbreak - interim report</a></p> <p>Government of Tasmania 2020 (17)</p>	<p>Transmission events occurred within the different North West healthcare facilities through the transfer of infectious patients or through infectious staff working in multiple locations, including aged care facilities.</p> <p>Factors that may have enhanced person-to-person transmission in this setting were:</p> <ul style="list-style-type: none"> <li>• Staff attending and continuing to work while experiencing respiratory symptoms.</li> <li>• Workplace activities such as regular staff gatherings with people in confined spaces.</li> <li>• Any shortcomings in infection control practices, which may have enabled transmission of this very infectious agent in high-risk settings.</li> <li>• Incomplete or delayed identification of close contacts of confirmed COVID-19 cases for immediate isolation to limit further transmission.</li> <li>• High levels of staff mobility between different healthcare facilities.</li> <li>• Transfer of undiagnosed infectious or incubating patients between healthcare facilities.</li> </ul> <p>Actions, including actions underway, that will mitigate risk in Tasmanian Health Service settings include:</p> <ul style="list-style-type: none"> <li>• Strengthening the culture of safety regarding infection control practices, including optimising standard and transmission-based precautions.</li> <li>• Implementing procedural changes to strengthen social distancing in the hospital workplace (e.g. meal breaks, meetings, ward rounds, handovers and other work-related activities).</li> <li>• Addressing the drivers of presenteeism and implementing processes to prevent this, such as those contained in the Hospitals Directions No. 2 (of 17 April 2020), including screening all people, including staff, for symptoms on entry to the workplace.</li> <li>• Increasing human resources and information technology systems to enable immediate contact tracing for both infected patients and staff in every healthcare facility. This needs to be rapidly scalable.</li> <li>• Reducing the movement of staff between facilities, where possible and particularly during outbreaks.</li> </ul>

Source title	Summary
	<ul style="list-style-type: none"> <li>Minimising patient transfer within facilities and between healthcare facilities, particularly during outbreaks. When transfer is necessary, assess the risk and implement appropriate infection control precautions.</li> </ul>
<p><a href="#">Coronavirus concerns at Western Sydney aged-care facility where woman worked six shifts before testing positive</a></p> <p>Nguyen, 2020 (18)</p>	<p>At least one staff member worked with minor symptoms.</p>
<p><a href="#">Coronavirus cluster linked to Victorian aged care home investigated as state's COVID-19 cases rise by seven</a></p> <p>Rocca, 2020 (19)</p>	<p>'You don't always know the direction of travel when you test people, whether it's been introduced to a resident and then the resident to a staff member or the other way around,' Brett Sutton, Victorian Chief Health Officer.</p>
<p><a href="#">COVID-19 How many healthcare workers are infected?</a></p> <p>Heneghan, et al. 2020 (20)</p>	<ul style="list-style-type: none"> <li>Articles estimates 30.5% of health care workers are infected with COVID-19 in the UK</li> <li>Author highlights COVID-19 spread rapidly in a hospital setting in Italy, where healthcare workers became vectors.</li> <li>In China, more than 3,300 healthcare workers were infected and in Spain on the 25 March 2020, 6,500 medical personal were infected, 13.6% of the country's total cases.</li> <li>In Toronto health worker infection was a problem during the SARS outbreak.</li> <li>Reducing transmission in hospitals will be vital in resolving COVID-19.</li> </ul>

**Table 2: Strategies to reduce risk of nosocomial infections of COVID-19**

Source title	Summary
Peer reviewed	
<a href="#">The risk and prevention of novel coronavirus pneumonia infections among inpatients in psychiatric hospitals</a> Zhu, et al. 2020 (21)	This case study considers the lessons from the Wuhan Mental Health Center the first psychiatric hospital in China with clustered nosocomial COVID-19 infections.
<a href="#">Containing COVID-19 in the emergency room: the role of improved case detection and segregation of suspect cases</a> Wee, et al. 2020 (22)	A review on an emergency department (ED) in Singapore describes a shift from imported COVID-19 cases to locally transmitted cases over a three month period. The article describes a national strategy of containment used to reduce risk of nosocomial transmission and achieve better detection to improve infection outcomes.  ED workflow to reduce nosocomial infections, carried out the following: <ul style="list-style-type: none"> <li>• Categorising all patients presenting with respiratory syndromes or fever as high risk and sending them to a segregated fever area in the ED.</li> <li>• Wearing N95 masks, face shields, disposable gowns and gloves.</li> <li>• Outside of fever areas, ED staff wore N95 masks in triage areas, corridors of fever areas, in the observation ward and in critical care areas.</li> <li>• Over a three month period the hospital had no cases of nosocomial transmission from ED exposure. If staff were exposed in an unprotected environment, follow up for 14 days post exposure was required.</li> </ul>
<a href="#">Responding to the COVID-19 outbreak in Singapore: staff protection and staff temperature and sickness surveillance systems</a>	<ul style="list-style-type: none"> <li>• A cross sectional study among healthcare workers to evaluate the effectiveness of staff protection and surveillance strategy in Tan Tock Seng Hospital, Singapore.</li> <li>• The hospital used a multi-pronged approach to monitor staff with potential COVID-19 exposure:               <ul style="list-style-type: none"> <li>○ Risk-based personal protective equipment</li> </ul> </li> </ul>

Source title	Summary
Htun, et al. 2020 (23)	<ul style="list-style-type: none"> <li>○ Staff fever and sickness surveillance</li> <li>○ Enhanced medical surveillance of unwell staff</li> <li>○ Using this strategy over a one month period no nosocomial infections were found.</li> </ul>
<a href="#">Management of patients with suspected or confirmed COVID-19, in the radiology department</a> Zanardo, et al. 2020 (24)	To reduce risk of COVID-19 transmission in radiology departments, this article recommends: <ul style="list-style-type: none"> <li>● Defining patient cases.</li> <li>● Isolating radiology imaging rooms for the examination of suspected or confirmed COVID-19 patients.</li> <li>● Wearing personal protective equipment.</li> <li>● Sanitising radiology equipment.</li> <li>● Reserving chest radiographs and chest CT scans for COVID-19 patients.</li> </ul>
<a href="#">COVID-19 in Australian healthcare workers: Early experience of the Royal Melbourne Hospital emphasises the importance of community acquisition</a> Muhi, et al. 2020 (25)	<p>A letter to the editor concluded that analysis from the Royal Melbourne Hospital found that COVID-19 is very uncommon in healthcare workers at present, and that the large majority of workers had contracted COVID-19 away from work.</p> <p>The letter describes a clinic that had been established by Royal Melbourne Hospital to screen staff who had developed a fever or new respiratory symptoms. The letter concludes, a dedicated screening service for staff, although may not be feasible in all settings, does provide access to rapid testing which provides staff with confidence and reassurance to return to work.</p>
<a href="#">First experience of COVID-19 screening of health-care workers in England</a> Hunter, et al. 2020 (26)	<p>The Tyne Hospitals National Health Services Foundation Trust screened symptomatic healthcare workers for COVID-19 to enable rapid identification and isolation of infected healthcare staff and to protect patients, as well as enabling the rapid return of healthcare staff to the workforce.</p> <p>Between 10-31 March 2020, 1,666 COVID-19 tests were conducted, 240 staff tested positive for COVID-19. Isolation and personal protective equipment protocols were sufficient in preventing high levels of nosocomial transmission.</p>

Source title	Summary
	<p>Article concludes, testing might have positive effects on healthy behaviour, by providing healthcare workers with confidence that they can self-isolate and that a rapid negative result will enable them to return to work with confidence in a timely manner.</p> <p>It was suggested that rapid testing might lessen the desire of staff with mild symptoms to continue working in fear of abandoning colleagues for 7-14 days, therefore contributing to nosocomial transmission.</p>
<p><a href="#">Emergency management for preventing and controlling nosocomial infection of the 2019 novel coronavirus: implications for the dermatology department</a></p> <p>Tao, et al. 2020 (27)</p>	<p>This article highlights the necessity of implementing protective measures, emergency management plans to prevent and control nosocomial infection of COVID-19 in dermatology departments.</p> <p>It describes a pre-examination triage for outpatients with skin disease as a protocol used to prevent nosocomial infection.</p>  <pre> graph TD     A[Pre-examination station at the entrance of the hospital] -- suspected --&gt; B[Designated department]     A -- not suspected --&gt; C[Triage station at the entrance of the dermatology clinic]     C -- suspected --&gt; B     C -- not suspected --&gt; D[Dermatology clinic]     B -- "Confirmed as non-infected or meet the criteria of discharge" --&gt; D     </pre>
<p><a href="#">COVID-19: the case for health-care worker screening to prevent hospital transmission</a></p> <p>Black, et al. 2020 (28)</p>	<p>A correspondence outlining the case for mass testing of both symptomatic and asymptomatic healthcare workers to:</p> <ul style="list-style-type: none"> <li>• Mitigate workforce depletion by unnecessary quarantine.</li> <li>• Reduce spread in atypical, mild, or asymptomatic cases.</li> </ul>

Source title	Summary
	<ul style="list-style-type: none"> <li>• Protect the healthcare workforce.</li> </ul> <p>The author advises that healthcare worker testing could reduce hospital acquired transmission. The article cites a retrospective study which showed 41% of patients acquired COVID-19 in hospital, a hospital in Wales found half of their emergency department workforce tested positive for COVID-19 and blanket testing near Venice, Italy was able to identify asymptomatic cases and potentially eliminate a COVID-19 outbreak in a nearby village.</p> <p>The correspondence advises that protecting healthcare workers is important, especially as staff are limited. Maintenance of testing can ensure infected colleagues are tested and isolated, improving healthcare worker wellbeing. Expanding testing among healthcare workers will be critical when coming out of lockdown and for further flattening the curve.</p>
<p><a href="#">Preventing intra-hospital infection and transmission of COVID-19 in healthcare workers</a> Gan, et al. 2020 (29)</p>	<p>To prevent nosocomial infections, Singapore hospitals used a protocol to understand the impact of work systems and processes on health outcomes. The article recommends, as a part of their protocol, the use of respiratory swabs for COVID-19 PCR for frontline healthcare workers, documentation of healthcare staff temperatures twice daily and for staff to record their temperature data in a government developed IT platform.</p>
<p><a href="#">Safety at the time of the COVID-19 pandemic: how to keep our oncology patients and healthcare workers safe</a> Cinar, et al. 2020 (30)</p>	<ul style="list-style-type: none"> <li>• This article suggests that personal protective equipment, the early adoption of travel restrictions, arranging meetings over teleconference and establishing clear guidelines on when to stay at home and when to return to work for healthcare workers can help reduce staff transmission of COVID-19.</li> <li>• Healthcare workers with any concerning symptoms or exposure history should self-isolate and not report to work.</li> <li>• Establishing screening tools, daily questionnaires, and/or temperature checks to assess symptomatic healthcare workers decreases the risk of nosocomial infections.</li> <li>• Institutions should develop COVID-19 hotlines in collaboration with occupational health services to triage symptomatic healthcare workers to screening clinics for rapid testing.</li> <li>• If a healthcare worker is exposed to a COVID-19 positive patient without appropriate protection, they should contact the occupational health office of their institution for guidance on local policy.</li> </ul>

Source title	Summary
	<ul style="list-style-type: none"> <li>Investigation of exposure history should also be performed by occupational health to identify any other individuals who may be at risk.</li> <li>When possible, telecommuting for all employees should be encouraged with limited on-site staff who may rotate on a daily basis to reduce their exposure risk.</li> <li>A systematic rotating staff team system may also enable streamlined tracing of contacts, if an employee becomes COVID-19 positive.</li> </ul>
<p><a href="#">Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong</a></p> <p>Cheng, et al. 2020 (31)</p>	<p>This article describes infection control preparedness measures undertaken in Hong Kong for COVID-19 in the first 42 days after a cluster of pneumonia was announced in China.</p> <p>Measures taken by the hospital include active and enhanced laboratory surveillance, early airborne infection isolation, rapid molecular diagnostic testing and contact tracing for healthcare workers with unprotected exposure in hospitals.</p>
<p><a href="#">Practical experiences and suggestions for the 'eagle-eyed observer': a novel promising role for controlling nosocomial infection in the COVID-19 outbreak</a></p> <p>Peng, et al. 2020 (32)</p>	<p>A letter describing infection control measures implemented to minimise the risk of nosocomial infection and the provision of psychological protection of medical workers during COVID-19.</p> <p>It advises, before medical workers enter isolation wards to:</p> <ul style="list-style-type: none"> <li>Measure body temperature, record related information and instruct medical workers to enter a changing room.</li> <li>Guide staff to wear personal protective equipment (PPE) correctly and provide detailed instruction on precautions.</li> </ul> <p>When medical workers are in isolation wards:</p> <ul style="list-style-type: none"> <li>Observe disease status and mood of patients via computer monitors, respond to the needs of patients and on-duty staff, communicate and work with medical staff in a timely manner.</li> <li>Remind staff when occupational exposures may have occurred and guide their quarantine and management if necessary.</li> </ul>

Source title	Summary
	<ul style="list-style-type: none"> <li>• Coordinate specimen transportation, patient access and inspection, and supervise the implementation of disinfection.</li> <li>• Receive drugs, food and medical equipment and transfer them to isolation wards through delivery windows.</li> <li>• Record negative pressure parameters and airflow operation parameters and maintain the normal operation of the negative pressure isolation wards.</li> </ul> <p>After medical workers leave isolation wards:</p> <ul style="list-style-type: none"> <li>• Monitor PPE removal by medical staff using a monitoring system that can identify and correct problems.</li> <li>• Measure body temperature, record related information, and instruct staff to leave isolation wards.</li> <li>• Check, replenish, distribute and keep an inventory of PPE to ensure a sufficient supply of equipment and prepare a handover record.</li> </ul>
<p><a href="#">First reported nosocomial outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in a paediatric dialysis unit</a></p> <p>Schwierzeck, et al. 2020 (34)</p>	<p>Forty-eight cases were involved in a nosocomial outbreak of SARS-CoV-2 infections in a paediatric dialysis unit due to person-to-person transmission. Article outlines strategies to trace and monitor COVID-19 infected healthcare workers, including virology testing and infection control measures at the University Hospital of Münster, Germany.</p>
<p><a href="#">Kidney transplantation with pre-symptomatic COVID-19 positive surgeon</a></p> <p>Ravaioli, et al. 2020 (35)</p>	<p>A letter which reports an account of a pre-symptomatic surgeon who performed two operations on two different liver transplantation recipients, in total eight hours. The surgeon applied infection control measures: hand hygiene, surgical facial mask and gloves during the visit of the candidate before surgery. Infection control measures were also applied with his staff colleagues (10 doctors, 15 nurses), staff received negative test results. The kidney recipient did not become positive for COVID-19 and was tested four and ten days after the operation. The letter provides the following insights:</p> <ul style="list-style-type: none"> <li>• A strategy of screening with nasal and pharyngeal swab (NPS) specimens should be considered and applied for asymptomatic doctors and nurses in highly epidemic areas of COVID-19 and NPS should be performed even in cases of few symptoms or non-specific symptoms.</li> </ul>

Source title	Summary
	<ul style="list-style-type: none"> <li>• A correct infection control measure may prevent transmission of the COVID-19 infection even during complex surgery performed by asymptomatic/pre-symptomatic COVID-19 positive surgeon. This rule was valid for any pathogen which may be transmitted, but it should be stressed in all the hospital areas and even among the medical staff.</li> <li>• In the highly epidemic areas, every doctor and nurse should consider themselves asymptomatic COVID-19 positive, therefore universal masking and any contact or with gloves should be considered.</li> </ul>
<p><a href="#">Minimising intra-hospital transmission of COVID-19: the role of social distancing</a> Wee, et al. 2020 (36)</p>	<ul style="list-style-type: none"> <li>• Hospital-wide social distancing measures.</li> <li>• In respiratory surveillance wards, patients were nursed in cohort rooms with three patients to a room, spaced at least approximately 2 metres apart and partitions were placed between beds.</li> <li>• In general wards, shared communal facilities were closed and patients were limited to one visitor at a time.</li> </ul>
<p><a href="#">Initiation of a new infection control system for the COVID-19 outbreak</a> Chen, et al. 2020 (37)</p>	<p>The hospital set up an innovative infection-control system called the observing system. This provided real time monitoring.</p>
<p><a href="#">Integrated infection control strategy to minimize nosocomial infection during outbreak of COVID-19 among ED healthcare workers</a> (Wang et al. 2020)</p>	<ul style="list-style-type: none"> <li>• The hospital set up a trans-department emergency infection control team.</li> <li>• Adjusted and optimised triage strategies.</li> <li>• Setting up an epidemic fever clinic management team.</li> <li>• Improving the management of protective equipment and materials.</li> <li>• Reduce crowding of ED, such as by prohibiting non-emergency patients from entering the centre.</li> </ul>
<p>Grey literature</p>	

Source title	Summary
<p><a href="#">Report 16: Role of testing in COVID-19 control</a></p> <p>Grassly, et al. 2020 (39)</p>	<p>A report from the Imperial College London uses a mathematical model to investigate how effective alternative strategies could reduce nosocomial COVID-19 infections.</p> <p>The report notes that healthcare workers have been disproportionately affected and infected by COVID-19, reporting between 4% and 19% of all reported COVID-19 cases in China and Europe.</p> <p>The report indicates that weekly screening of healthcare workers by PCR would reduce transmission from healthcare workers by a further 16-23%, on top of self-isolation based on symptoms if results were available at 24 hours, depending on the infectiousness of asymptomatic infections. If staff tests were to be done at the end of a shift and results made available before the next shift, then the time delay between testing and isolation would effectively be zero, increasing effectiveness to 25-33%.</p>
<p><a href="#">Are interventions such as social distancing effective at reducing the risk of asymptomatic healthcare workers transmitting COVID-19 infection to other household members?</a></p> <p>Jones, et al. 2020 (39)</p>	<ul style="list-style-type: none"> <li>• This review found no studies that examined social distancing of asymptomatic healthcare workers from family members within the home.</li> <li>• Symptomatic healthcare workers should follow guidelines for self-isolating in the home.</li> <li>• Healthcare workers can take measures to protect their families, such as hand hygiene at work and at home, using personal protective equipment at work and where available.</li> </ul>

## Appendix

### Search terms

PubMed search: (2019-nCoV[title/abstract] OR (ncov[title/abstract] OR ncov'[title/abstract] OR ncov's[title/abstract] OR ncovascularisatlon[title/abstract] OR ncovering[title/abstract] OR ncovid[title/abstract] OR ncovis[title/abstract] OR ncovmpro[title/abstract] OR ncovp[title/abstract] OR ncovp1[title/abstract] OR ncovs[title/abstract]) OR covid-19[title/abstract] OR covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]) AND ("health personnel"[MeSH Terms] OR ("health"[title/abstract] AND "personnel"[ title/abstract]) OR "health personnel"[ title/abstract]) AND ("Infectious Disease Transmission, Professional-to-Patient"[Mesh] OR "Infectious Disease Transmission, Patient-to-Professional"[Mesh] OR "Cross Infection"[Mesh] OR transmission[Title/Abstract] OR Nosocomial[Title/Abstract] OR hospital acquired infection[Title/Abstract]) AND ("2019/01/01"[PDAT] : "2020/12/31"[PDAT])

Pubmed search: (healthworkers[Title/Abstract]) OR (healthcare workers[Title/Abstract]) OR (healthcare staff[Title/Abstract]) AND (COVID-19[Title/Abstract]) OR (Coronavirus [Title/Abstract]) OR (Coronavirus [MeSH Terms]) OR (sars-cov-2[Title/Abstract]) AND (vector\*[Title/Abstract]) OR (spread [Title/Abstract]) AND (nosocomial [Title/Abstract])

### Google:

- COVID-19 and healthcare worker transmission.
- Screening healthcare staff COVID-19 guidance
- Testing health staff nosocomial infection COVID-19
- Testing healthcare workers impact nosocomial infections
- Role for testing healthcare professionals
- Healthcare staff vectors COVID-19 transmission

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