

Infection Prevention and Control

RESEARCH REVIEW™

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Issue 13 – 2021

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Welcome to the latest issue of Infection Prevention and Control.

Hand hygiene and protection research dominates this issue, including how sequencing of tasks when caring for a patient affects hand hygiene adherence, how COVID-19 has affected hand hygiene practice, whether universal gloving leads to increased hand hygiene adherence and fewer hospital-acquired infections, and a comprehensive systematic review of hand hygiene studies. Other selections investigate QWERTY keyboard contamination, control of a hospital waterborne infection outbreak, and COVID-19 vaccine coverage and effectiveness among healthcare workers.

We hope that the research in this issue of **Infection Prevention and Control** benefits your daily practice. Please keep your comments and suggestions coming.

Best regards,

Dr Chris Tofield

Medical Advisor, Research Review

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Hand hygiene and the sequence of patient care

Authors: Chang N-C et al.

Summary: To determine whether the order in which healthcare workers (HCWs) perform patient care tasks affects hand hygiene adherence, these researchers retrospectively analysed data collected during the Strategies to Reduce Transmission of Antimicrobial Resistant Bacteria in Intensive Care Units (STAR*ICU) study. STAR*ICU was conducted in 17 adult surgical, medical, and medical-surgical ICUs. HCWs were found to move from cleaner to dirtier tasks during 5,303 transitions (34.7%) and from dirtier to cleaner tasks during 10,000 transitions (65.4%). Physicians (OR 1.50; $p < 0.0001$) and other HCWs (OR 2.15; $p < 0.0001$) were more likely than nurses to move from dirtier to cleaner tasks. Glove use was associated with moving from dirtier to cleaner tasks (OR 1.22; $p < 0.0001$). Hand hygiene adherence was lower when HCWs moved from dirtier to cleaner tasks than when they moved in the opposite direction (adjusted OR 0.93; $p < 0.0001$).

Comment (MB): The sequencing of tasks when caring for a patient is not something I have given much thought to previously, so I was interested to review this paper. They studied transitions when caring for the same patient, rather than between patients, so the results relate to the potential for increasing healthcare-associated infection (HAI) risk by contaminating patient devices etc. with their own flora, rather than the risk of spreading MDROs between patients. Two thirds of transitions were from dirty to clean tasks, which was quite surprising, and it made me wonder how much consideration sequencing of tasks is given in general. Hand hygiene adherence was only around 50% or less for transitions. This study was actually performed back in 2005–2006, so I am not sure how relevant it is to current practice, and whether things (I hope) have improved since then, but I think task sequencing is something worth considering when investigating and trying to prevent HAIs, especially involving devices.

Reference: *Infect Control Hosp Epidemiol.* 2021 Apr 6;1–6 [Online ahead of print]

[Abstract](#)

COVID-19 outbreak and healthcare worker behavioural change toward hand hygiene practices

Authors: Huang F et al.

Summary: This study used an automated hand hygiene recording system to measure healthcare worker (HCW) hand hygiene on entry to and exit from patient rooms during the COVID-19 pandemic to determine whether hand hygiene behaviour by real-time measurement was related to the dynamics of the epidemic. The rate of HCW hand hygiene on room entry decreased over time. On room exit, the rate increased by 13.73% during the first wave of COVID-19, decreased by 9.87% during the post-lockdown period, then rebounded by 2.82% during the second wave. Hand hygiene during patient care and hand hygiene on room exit was positively related with the local COVID-19 epidemic. In contrast, hand hygiene on room entry did not depend on the trend of the epidemic nor on nursing of COVID-19 patients and it decreased over time.

Comment (MA): This interesting study shows how hand hygiene adherence increased during two separate COVID-19 pandemic waves in France. The increase seemed more marked during room exit, which they postulated was due to self-protection. The increase was however less pronounced on room entry, which they postulated was due to increased glove use. However, there was no hard data to support either of these claims, so the discussion part of the paper was all a bit speculative. One good point of this paper was that they detailed in the methods section a few of the difficulties when using automated hand hygiene monitoring in a real-life situation. Of note on this particular topic, [NZ data from HQSC](#) did not show any clear increase in hand hygiene adherence during the “lockdown” period. There is also an [editorial](#) on this topic which is worth reading.

Reference: *J Hosp Infect.* 2021;111:27–34

[Abstract](#)



A quality improvement study on the reduction of central venous catheter-associated bloodstream infections by use of self-disinfecting venous access caps (STERILE)

Authors: Cruz-Aguilar R et al.

Summary: Catheter hub caps incorporating a 70% isopropyl alcohol are designed to reduce contamination and hence rates of catheter-associated bloodstream infection (CRBSI). These investigators conducted a before-after single-centre study accompanying the introduction of self-disinfecting catheter caps (SDCCs) in their clinic. Retrospective data from the year prior to the introduction were compared with one year of prospective data. Control (n=302) and SDCC (n=209) groups presented with CRBSI rates of 15.28 and 10.38 per 1,000 catheter days ($p=0.042$), respectively. However, after multivariate analysis, SDCCs were not identified as a significant independent protective factor for the occurrence of CRBSI (HR 0.69, $p=0.120$). There was no significant difference between the groups with respect to time to CRBSI nor the proportion of catheters removed due to suspicion of infection.

Comment (MB): This study examined the use of SDCCs (Curocaps) in a high-risk patient group with a high baseline incidence of CRBSI. They only looked at short-term central access devices, not peripherally-inserted central catheter (PICC) lines or ports. The study had a number of methodological weaknesses, such as being unblinded, non-randomised, and inherent issues with CRBSI definitions. However, they did collect a number of data points, which allowed them to adjust their analyses for potential confounders. After adjustment, their results did not support the use of these caps to reduce CRBSI in their population, although I do wonder whether they may have found a protective effect had their sample size been bigger. Interestingly, when they cultured the lines themselves, they grew more bugs from the SDCCs than the standard ones!

Reference: *Am J Infect Control.* 2021;49(5):586–592

[Abstract](#)

How dirty is your QWERTY? The risk of healthcare pathogen transmission from computer keyboards

Authors: Ledwoch K et al.

Summary: In this study, keyboards from nursing stations in three hospitals and a dental practice were tested for bacterial contamination. Surfaces were pre-treated to remove planktonic bacteria so that remaining bacteria were presumed to be associated with biofilm. Moist swabbing with sterile water did not detect bacteria from any keyboard samples. Use of enrichment broth, however, demonstrated presence of multi-drug-resistant organisms (MDROs) in most samples. Gram-negative bacteria were recovered from 45% of the samples, with methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococcus, and MDR *Acinetobacter* spp. recovered from 72%, 31%, and 17% of samples, respectively. Isolates were transferred from 69% of samples after wiping with sterile water compared with 54% of samples after wiping with 1,000 ppm sodium hypochlorite.

Comment (MB): These investigators were looking for 'dry surface biofilms' on keyboards, in which bacteria can survive on dry surfaces for prolonged periods. The complex nature of keyboard surfaces makes them a favourable environment for bacteria to survive. This, combined with the fact that keyboards are often situated in the near patient environment, makes them a potential contributor to the spread of hospital organisms. They used a fairly comprehensive sampling method, including the use of touch plates after wiping keys with either water or sodium hypochlorite, and were able to commonly detect various MDROs, even after sodium hypochlorite treatment. When they just used a moist swab, however, they did not grow any bugs. The unanswered question is how much these sampling methods equate to the real-life transfer of bugs to healthcare worker hands, but this study certainly demonstrates that keyboards commonly harbour important bugs, even after standard disinfection.

Reference: *J Hosp Infect.* 2021;112:31–36

[Abstract](#)

Independent commentary by Max Bloomfield

Max is an Infectious Diseases Physician and Clinical Microbiologist working at Capital & Coast DHB and Wellington Southern Community Laboratories. He has an interest in antimicrobial resistance and diagnostic stewardship. **For full bio** [CLICK HERE](#).



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South Canterbury DHB began implementing the programme in November 2020 and infection rates started decreasing after just a few months.

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“The programme is a great resource to push some of the very basics. It really empowers nurses and doctors to provide the very best care for patients.”

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Investigation and control of an outbreak due to a contaminated hospital water system, identified following a rare case of *Cupriavidus pauculus* bacteraemia

Authors: Inkster T et al.

Summary: These investigators describe the investigation and control measures implemented for a waterborne infection outbreak in a new build hospital. Extensive water testing from various points within the water system was undertaken. Taps, showerheads, and components including flow straighteners were subject to microbiological analysis. Drains were also swabbed. Surveillance for Gram-negative infections was established on the unit. Water testing demonstrated widespread contamination of the water and drainage system. Outlets were also heavily contaminated, including flow straighteners. Drains were found to have underlying structural abnormalities. Water testing enabled detection of high-risk components within the water system such as the expansion vessels and outlets and the results assisted with hypotheses generation. Review of commissioning data and risk assessments showed that extensive risks were present within the water system both prior to and after hospital opening.

Comment (MA): I chose this paper for two reasons: firstly, because I know the author from my training days in Glasgow; and secondly, because my knowledge of waterborne nosocomial infections is rather sketchy! On review, this is a very well written paper, which really is a "must read" for all IPC practitioners. At first, I thought this outbreak was going to be related to old and decaying pipework, so prevalent in UK hospitals, so I was surprised to find that this outbreak occurred in a "new build", only 3 years old. The paper provided me with a few important learning points. If you get a "waterborne" bacterium in a positive blood culture, and particularly if the patient is immunocompromised, it is important to consider the possibility of nosocomial acquisition from the water supply. It is also important to involve hospital engineering/estates staff on the local IPC committee, as a lot of water and air quality monitoring within NZ hospitals is now contracted out to "commercial" environmental laboratories. Finally, for high-risk areas such as haem-oncology units, one must be meticulous with maintenance, monitoring, and servicing of the water supply, taps, and sinks.

Reference: *J Hosp Infect.* 2021;111:53–64

[Abstract](#)

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Independent commentary by Michael Addidle



Michael Addidle is a UK trained Clinical microbiologist now working at both Pathlab and ESR laboratories in New Zealand. He holds fellowships in general medicine and clinical microbiology. He is involved in infection control in both public and private hospitals throughout the Bay of Plenty and Waikato regions. Michael has a keen interest in the pivotal role of the diagnostic laboratory in good diagnostic and antimicrobial stewardship.

Evolving epidemiology of carbapenemase-producing Enterobacterales: one hospital's infection prevention and control response over nine years

Authors: Foley M et al.

Summary: These researchers assessed the evolution of IPC measures in a tertiary acute care hospital in Ireland from 2011 to 2019 as cases of carbapenemase-producing Enterobacterales (CPE) increased. CPE data collected prospectively from the laboratory, IPC team, and outbreak meeting records were reviewed to assess how the IPC team adapted to the changing CPE epidemiology. Of 178 cases of CPE, 152 (85%) were healthcare-linked and there was a marked increase in cases from 2017. The number of screening samples tested annually increased from 1,190 in 2011 to 16,837 in 2019. Six outbreaks were documented (with larger outbreaks identified in later years) and OXA-48 carbapenemase was detected in 88% of isolates. Attendance at outbreak meetings alone accounted for 463.5 hours of IPC team members' and related staff time.

Comment (MA): This study (from my home country) is a sobering one for IPC personnel in NZ as it may be a taste of things to come for us, given the similar population size and healthcare philosophy. It is interesting to note that despite various control measures implemented over the years, the numbers of CPE in their hospital setting continue to increase. One is left wondering what the situation would be like if nothing was done ... My one criticism is that the paper focuses much more on screening and isolation/barrier precautions than on reducing the selection pressure through restricted broad spectrum antibiotic use, particularly carbapenems. My personal feeling is that if you do not make reduction of selection pressure your top priority, then it does not matter how much screening you do, you are always on a hiding to nothing over the longer term! I liked the fact that this study documented objectively the amount of time spent in outbreak meetings by IPC practitioners. This is very useful data to take to managers when looking for resourcing for CPE control ...

Reference: *J Hosp Infect.* 2021;112:61–68

[Abstract](#)

Estimated methicillin-resistant staphylococcus aureus decolonization in intensive care units associated with single-application chlorhexidine gluconate or mupirocin

Authors: Lofgren ET et al.

Summary: The aim of this modelling study was to estimate the proportion of patients with methicillin-resistant *Staphylococcus aureus* (MRSA) decolonised per application of chlorhexidine gluconate (CHG) and mupirocin from existing population-level studies. A stochastic mathematical model of an 18-bed intensive care unit (ICU) in an academic medical centre operating over 1 year was used to estimate parameters for the proportion of simulated patients with MRSA decolonised per application of CHG and mupirocin. The decolonisation estimates found in this study indicate that there may be opportunities for improvement in anti-MRSA disinfectants, including the compounds themselves and their delivery. The results also indicated that these agents were associated with robust outcomes after delays in administration, which may help in alleviating concerns about patient comfort and potential toxicity.

Comment (MA): Wow! I did not realise at first sight that this was a mathematical modelling paper on MRSA decolonisation! This paper took some reading, as it was very different from your standard infection control study. For the model, the paper made many assumptions, so many in fact that I wonder whether this scenario was actually a good topic to study by modelling ... One of the assumptions was the MRSA colonisation rate within the ICU, which at 7.8% was higher than one would usually find in the NZ setting. Other assumptions were referenced but very open to debate. To be honest I am unconvinced we can take home any of the results in this study. However, I think we are going to see more papers like this in the future so I think we need to start getting used to them. Give this paper to your teenage child to read. They will probably understand it better than you!

Reference: *JAMA Netw Open.* 2021;4(3):e210652

[Abstract](#)



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“If the glove fits”: hospital-wide universal gloving is associated with improved hand hygiene and may reduce *Clostridioides difficile* infection

Authors: Prasad P et al.

Summary: These investigators carried out a multiple-year before-and-after quasi-experimental quality improvement study to determine whether a hospital-wide universal gloving programme would result in increased hand hygiene adherence and lower in-patient *Clostridioides difficile* infection (CDI) rates at a university hospital in the US. Gloving and hand hygiene adherence data as well as hospital-acquired infection rates were prospectively collected over a 3-year period by secret monitors. Hand hygiene adherence increased significantly ($p < 0.0002$) from 68% in 2015 to 88% by 2017. A 10% increase in gloving per unit was associated with a 1.13-fold increase in the odds of hand hygiene (95% credible interval: 1.12–1.14). There was a non-significant reduction in rates of CDI from 1.05 infections per 1,000 patient days in 2015 to 0.74 in 2017.

Comment (MA): I like the concept of universal approaches in infection control because of their simplicity. It is difficult to achieve complete adherence when infection control interventions are targeted at a selected cohort, no matter how robust the processes. Universal gloving has been a controversial area to date and the concept has not gained universal approval. Although the design of this paper was not ideal, it observed an association between universal gloving and increased hand hygiene adherence, as well as a trend towards decreased hospital acquired infections, without necessarily proving causality. It is also worthwhile noting that hand hygiene adherence was measured objectively with an electronic hand hygiene monitoring system. They did not perform a full cost-benefit analysis, but they documented the cost of the extra gloves (and hand hygiene product), which looked a bit painful at \$400k+. I think it would be difficult to make a business case for universal gloving based on this paper. In summary, the jury is still out ...

Reference: *Infect Control Hosp Epidemiol.* 2021 Apr 23;1–5 [Online ahead of print] [Abstract](#)

Hand-hygiene-related clinical trials reported between 2014 and 2020: a comprehensive systematic review

Authors: Clancy C et al.

Summary: This comprehensive systematic review of clinical trials assessing hand hygiene interventions was performed to inform healthcare leaders and practitioners regarding approaches to reduce healthcare-associated infections using hand hygiene. Medical literature databases were searched for clinical trials published between March 2014 and December 2020 on the topic of hand hygiene adherence among HCWs. Fifty-seven studies met the inclusion criteria, of which 45 (79%) were conducted in Asia, Europe, and the USA. In terms of healthcare setting, the majority of trials were conducted in acute care facilities, including hospital wards and intensive care facilities. Nurses represented the largest group of HCWs studied (44 studies, 77%), followed by physicians (41 studies, 72%). Thirty-six studies (63%) adopted the WHO's multi-modal framework or a variation of this framework. Many of these studies recorded hand hygiene opportunities at each of the 'Five Moments'; however, the recording of hand hygiene technique was uncommon.

Comment (NG): Three things were underscored by the studies in this review: lacking research in specific settings, observational technique, and sustainability. A lack of clinical hand hygiene research remains in both primary and long-term care facilities. This may be due to the complexity of obtaining adherence data in these settings compared with acute care wards or that the perceived risk of healthcare-associated infections is not high in these settings. The systematic review implied that direct observations remain the gold standard for collecting hand hygiene adherence data. An alternative method, such as electronic monitoring, seems to be problematic due to high costs, negative attitudes by clinical staff attributable to a 'big brother'-like perception, and a distrust in data accuracy.

The studies compiled in this review also highlighted the lack of research and publications on observing hand hygiene technique. Hand hygiene usually only includes a binary data set (either hand hygiene was completed, or it was not). Understanding if hand hygiene technique correlates with healthcare associated infection reduction would also be an area of interest, especially since modified techniques are promoted. This review emphasised the need for ongoing measurement to ensure that improvement in hand hygiene adherence is sustainable. While there are many opportunities for hand hygiene research, the current methods appear to be working well.

Reference: *J Hosp Infect.* 2021;111:6–26. [Abstract](#)

COVID-19 vaccine coverage in health-care workers in England and effectiveness of BNT162b2 mRNA vaccine against infection (SIREN): a prospective, multicentre, cohort study

Authors: Hall VJ et al.

Summary: This prospective cohort study of healthcare workers (HCWs) in publicly-funded hospitals in the UK aimed to determine the factors associated with vaccine coverage for the BNT162b2 mRNA and ChAdOx1 nCoV-19 adenoviral vector vaccines and to document the vaccine effectiveness of the BNT162b2 mRNA vaccine in a cohort of HCWs undergoing regular asymptomatic testing. A total of 23,324 participants from 104 sites met the inclusion criteria for this analysis and were enrolled. Vaccine coverage was 89%, 94% of whom received BNT162b2 vaccine. Significantly lower coverage was associated with previous infection, gender, age, ethnicity, job role, and Index of Multiple Deprivation score. The BNT162b2 vaccine was shown to prevent both symptomatic and asymptomatic infection in working-age adults. This cohort was vaccinated when the dominant variant in circulation was B.1.1.7, and shows effectiveness against this variant.

Comment (NG): While NZ has been fortunate with the relatively low number of COVID-19 cases and their impact on HCWs, there is still the need to vaccinate and take all necessary precautions as the COVID-19 pandemic continues. The SIREN (SARS-CoV-2 Immunity Reinfection Evaluation) study shifted focus from investigating the effect of previous infection on protection against reinfection to investigate COVID-19 vaccine effectiveness in January 2021. This study incorporated working adults who were HCWs, some having high exposure and potential role in transmission as the B.1.1.7 variant accounted for at least 50% of the positive cases at the time.

Even with some slight bias to the null hypothesis due to testing frequency of the vaccinated population being higher than the unvaccinated population and infections detected at short intervals following vaccination, vaccine effectiveness was high following the first and second doses. This study determined vaccine effectiveness against asymptomatic infection, which is important to understand and communicate to HCWs and the general public who may be hesitant to get a SARS-CoV-2 vaccine. There is still much to learn about COVID-19 vaccines and how they affect transmission. While no vaccine is 100% effective, the data published in this study provides reassurance that the pandemic can be contained through wide-spread vaccination (I know I am preaching to the choir!).

Reference: *Lancet.* 2021;397(10286):1725–1735 [Abstract](#)

Independent commentary by Nikki Grae



Nikki Grae is a Senior Manager at the Health Quality & Safety Commission. She has an interest in infection prevention and quality improvement. Prior to working at the Commission, she managed and led the infection prevention and patient safety programmes for a health system in the U.S. Nikki has also worked as a Research Scientist in cancer biology and microbiology. She has a Master of Science degree in Microbiology.

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