Infection Prevention and Control RESEARCH REVIEW™

Making Education Easy

Issue 10 – 2020

In this issue:

Abbreviations used in this issue
COVID-19 = coronavirus disease-2019
HCW = healthcare worker
MRSA = methicillin-resistant *Staphylococcus aureus*
MSSA = methicillin-susceptible *Staphylococcus aureus*
NICU = neonatal intensive care unit
PPE = personal protective equipment
SSI = surgical-site infection
STEC = Shiga toxin-producing *Escherichia coli*
UTI = urinary tract infection

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Welcome to the latest issue of Infection Prevention and Control.

The first two selections in this issue highlight lessons learned from the Havelock North campylobacteriosis outbreak and the more recent Canterbury measles outbreak. Other papers include an assessment of the epidemiology of MSSA in a neonatal intensive care unit, how chlorhexidine gluconate (CHG) application methods influence preoperative CHG skin concentration, and determination of ethnic inequities in COVID-19 infection fatality rates in NZ. Of relevance given the current COVID-19 pandemic is an assessment of presenteeism among healthcare workers with laboratory-confirmed influenza infection.

We hope that you learn something new from this issue of **Infection Prevention and Control**. We look forward to receiving your feedback.

Best regards,

Dr Chris Tofield
Medical Advisor, Research Review
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A large scale waterborne Campylobacteriosis outbreak, Havelock North, New Zealand

Authors: Gilpin BJ et al.

Summary: Following the 2016 Campylobacterosis outbreak in Havelock North, these researchers analysed epidemiological data collected from physician-confirmed diarrhoeal cases and estimated the total burden of Havelock North cases via a telephone survey. Whole genome sequencing was performed on Campylobacter isolates from case faecal specimens, groundwater samples, and sheep faecal specimens from paddocks adjacent to the drinking water source. The results indicate that ≤8,320 cases of illness were linked to the contaminated water supply. Of those, 953 cases were physician-reported, 42 were hospitalised, and three developed Guillain-Barré syndrome. There were at least four deaths for which Campylobacter infection was a contributing factor. Twelve Campylobacter genotypes were observed in cases: four were also observed in water, three were also observed in sheep, and one was also observed in both water and sheep.

Comment (MA): This ESR-led study nicely documents this major NZ campylobacteriosis outbreak. It illustrates the importance of sequencing in clarifying the epidemiology of the outbreak. The majority of diagnostic laboratories in NZ now diagnose campylobacteriosis by molecular methodology/PCR, but such an outbreak illustrates the need for laboratories to retain the capability to rapidly step up culture-based methodologies to allow reflex culture and genotyping of campylobacter isolates to take place in the context of an outbreak. At present, routine serotyping/genotyping of other enteric pathogens (Shigella, Salmonella, Yersinia, STEC) occurs in NZ, but not for Campylobacter. As typing methodologies develop and give more valuable information, this may need to be reviewed in order to facilitate cluster identification and public health investigation of campylobacteriosis.

Reference: J Infect. 2020;81(3):390–395
Abstract

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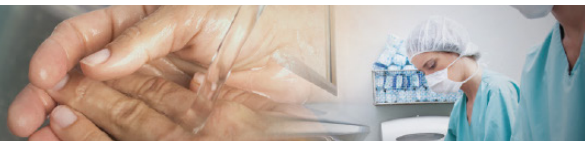
Independent commentary by Michael Addidle

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.



Lessons from a system-wide response to a measles outbreak, Canterbury, February–April 2019

Authors: Williams D et al.

Summary: To help inform measles control in NZ and elsewhere, this paper describes a contained measles outbreak in Canterbury in early 2019 and reflects on lessons learnt from a system-wide response. A total of 38 local cases were identified as well as an unidentified index case. The outbreak strain was linked to a large outbreak in the Philippines. The healthcare system response included active case and contact follow-up by public health and hospital personnel, and a prioritised vaccination campaign in primary care. Important features of a measles outbreak response in terms of an elimination strategy include cross-system liaison, co-ordination of communications, prioritisation of use of available resources, and support for households that were requested to isolate and/or quarantine.

Comment (MA): As with the Havelock North campylobacteriosis outbreak, this paper again demonstrates the role of sequence-based genotyping in clarifying the outbreak epidemiology. The key thing I noted from reading this paper was the significant number of HCWs that were infected during this outbreak. This highlights to me the significant overlap between infection prevention/control and occupational health, and the importance of ensuring measles immunity in healthcare employees, particularly those in patient-facing roles. The other thing to note is the number of people who were infected despite having had one dose of MMR vaccine. The majority of adults born in NZ between 1969 and 2005 will only have had one dose of measles vaccine. I suspect that the National Immunisation Register will have increasing importance in ascertaining patient vaccination status and in the management of such outbreaks in the future.

Reference: N Z Med J 2020;133(1522):71–83
Abstract

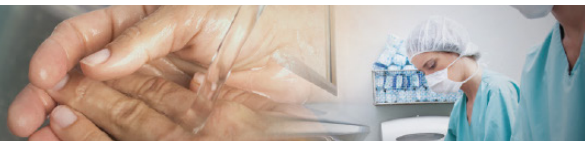
Impact of an automated hand hygiene monitoring system combined with a performance improvement intervention on hospital-acquired infections

Authors: Knepper BC et al.

Summary: Conducted in a 555-bed urban trauma centre, this investigation determined the effect of improvements in electronically-measured hand hygiene adherence on the incidence of hospital-acquired infections. An electronic hand hygiene system was installed in four locations and performance improvement strategies implemented including education, troubleshooting, data dissemination, and feedback. Rates of hospital-acquired infections were evaluated in the intervention units and in control units selected for comparison. Measured electronically, hand hygiene rates improved significantly from 47% at baseline to 77% after intervention. Adherence rates >70% were maintained 18 months after the intervention. There was a significant effect of hand hygiene on *Clostridioides difficile* infection rates in the first 9 months of the intervention.

Comment (MA): Hand hygiene monitoring by (manual) direct observation remains the gold standard. However, it is also labour intensive, tedious, intermittent, and vulnerable to the Hawthorne Effect. I think NZ needs to embrace and trial these automated hand hygiene monitoring systems (AHHMS). One feels that the manual-based hand hygiene monitoring system currently in place is not the future of hand hygiene monitoring. This paper on AHHMS suggests that the system decreased *C. difficile* rates in their institution. I found this conclusion a bit speculative given the data presented. The paper alludes to 85% of hand hygiene opportunities being captured but does not give any detail on how this figure was derived. This is important as the accuracy of AHHMS is one of its main criticisms. Finally, the paper could also have benefited from a cost analysis of the AHHMS compared with manual methodology. Money talks in the implementation of any new technology . . .

Reference: Infect Control Hosp Epidemiol. 2020;41(8):931–937
Abstract



N95 mask reuse in a major urban hospital: COVID-19 response process and procedure

Authors: Czubryt MP et al.

Summary: This study investigated potential reuse of N95 respirator masks (NRMs) worn daily in a major urban hospital. Reusability was assessed after collection of NRMs after 2–8 hours use, sterilization by autoclaving, and PortaCount fit testing. In addition, a workflow plan was prepared for recycling hundreds of masks daily. Used NRMs passed fit testing after autoclaving once, with 86% passing a second reuse-autoclave cycle. Used masks pre-warmed before autoclaving also passed fit testing. To recycle 200–1000 NRMs daily, processes were developed for collection, sterilisation, and re-distribution to reduce particle aerosolisation risk during NRM handling; to reject NRMs with obvious wear; and to encourage acceptance by staff. NRM recovery rates were 49–80% across 12 collection cycles.

Comment (MA): The demand for NRMs during the COVID pandemic has prompted studies into the efficacy of recycling them. This paper is good because it studies masks that have actually been worn, therefore more accurately reflecting a "real world" situation. The study suggests that masks can only reliably withstand one sterilisation cycle, compared with other studies on unused masks which suggest they can withstand several cycles. I suspect in the "even more real world" this safe cycle number may primarily depend on the quality of the mask, and probably requires a degree of local validation. The paper also alludes to the potential reticence of HCWs to use recycled masks, particularly ones that were not originally their own and have been derived from a communal pool.

Reference: J Hosp Infect. 2020;106(2):277–282
Abstract

Presenteeism among health care workers with laboratory-confirmed influenza infection: a retrospective cohort study in Queensland, Australia

Authors: Imai C et al.

Summary: Data on laboratory-confirmed influenza cases and history of sick leave among HCWs were collected to determine the incidence of presenteeism and identify contributory factors. Overall sick leave incidence was 85.9% in the laboratory-confirmed periods. This translated to 14.1% of HCWs working while unwell with influenza. Approximately 25% of medical doctors attended work during the period. Shorter durations of leave were observed among medical doctors and full-time employees versus other HCWs and part-time employees.

Comment (MA): This is an interesting Australian study on "ill presenteeism", fancy words for working whilst sick. It benefits from the fact that it uses cold hard data in the form of payroll records and laboratory-confirmed influenza results. The number of HCWs who continued working despite having laboratory-confirmed influenza was somewhat disturbing and, perhaps not surprisingly, doctors were the worst offenders! I think the COVID-19 pandemic has reinforced to all of us the importance of not working whilst we are sick. Nevertheless, infection prevention and control specialists have an important role in changing the culture around "ill presenteeism" in their colleagues, leading by example and using objective data wherever possible.

Reference: Am J Infect Control. 2020;48(4):355–360
Abstract

Effectiveness of implementing link nurses and audits and feedback to improve nurses' compliance with standard precautions: a cluster randomized controlled trial

Authors: Donati D et al.

Summary: This cluster randomised controlled trial with a pre-test-post-test design was conducted with clinical nurses who worked in different wards of a university hospital to assess adherence with standard precautions to prevent healthcare-associated infection. The intervention group (n=61) had three infection control link nurses nominated and then attended systematic audits and feedback. The control group (n=60) received only the standard multimodal approach used in the hospital. At the post-test, nurses in the intervention group reported significantly increased adherence with hand hygiene. In contrast, no significant improvement was found in the control group. Nurses in both groups reported significantly increased scores on the Compliance with Standard Precaution Scale Italian version; however, a higher increase and practical significance was observed in the intervention group. Among participants who improved their scores, there was a significantly greater increase of individual scores in intervention group versus the control group.

Comment (NG): Infection control link nurses (ICLNs) have been recognised as a key element of an infection prevention and control (IPC) programme, just as auditing and feedback are key to increasing adherence with IPC practices. This study combined the two components to show that the standard multimodal approach used in hospitals may not be enough to obtain and maintain high adherence with hand hygiene and standard precautions. Auditing and feedback to department nurses kept the discussion and focus on hand hygiene and standard precautions throughout the year rather than just during an educational test completed once every year or two. The ICLN's role along with auditing and feedback assists with alignment of IPC theory and practice. Ward manager support and engagement with the ICLN's role and auditing duties are critical to the success of an IPC programme. If management does not prioritise and support a specific process or practice, why should the frontline staff view it as important? While this study focused on nurses, this model would be applicable to all HCW disciplines. Unfortunately, there were no outcome data (healthcare-associated infections) linked to this study, but it does reinforce the important role of an ICLN as a liaison between their ward and the IPC department.

Activities related to the COVID-19 pandemic have highlighted the importance of standard precautions and identified gaps in some frontline staff knowledge and practice of them. While COVID-19 has been a driver for increased knowledge and adherence with these basic IPC practices, the opportunity for improved adherence will result in prevention of many healthcare-associated infections.

Reference: Am J Infect Control. 2020;48(10):1204–1210
Abstract

Independent commentary by Nikki Grae

Nikki Grae has been the senior advisor for the infection prevention and control programme at the Health Quality & Safety Commission since 2016. She has 12 years of infection prevention, quality, and patient safety experience in the healthcare sector. 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. Nikki relocated to New Zealand to enjoy the friendly people and spectacular scenery while continuing her career in infection prevention and control.

Estimated inequities in COVID-19 infection fatality rates by ethnicity for Aotearoa New Zealand

Authors: Steyn N et al.

Summary: To estimate inequities in infection fatality rates (IFR) in NZ by ethnicity, these researchers combined existing demographic and health data for ethnic groups in NZ with international data on COVID-19 IFR for different age groups. The data suggest that the IFR for Māori is 50% higher than that for non-Māori. Depending on the relative contributions of age and underlying health conditions to mortality risk, the IFR for Māori could be even higher.

Comment (NG): Reducing inequities in the NZ healthcare system continues to be a priority. Data on COVID-19 incidence and outcomes in the context of ethnic minority or Indigenous populations that experience inequities in health and healthcare is currently limited. Although the COVID-19 pandemic has not impacted NZ as much as other countries, there is still risk of a widespread community resurgence so understanding the inequities in the NZ population is crucial to effective planning and preparedness. This study has estimated the impact of inequities on the COVID-19 IFR for Māori and Pacific people. Combining demographic and health data for Māori, Pacific, and NZ European/other groups with international COVID-19 IFR data for different age groups, the authors were able to estimate the IFR for Māori is at least 50% higher than that of non-Māori.

While this modelling study has incorporated only some factors of disease transmission, it begins to highlight the need to perform further modelling to inform NZ's response to COVID-19. Utilising both IFR and incidence data will inform effective strategies that recognise the diversity of higher-risk groups in NZ.

Reference: N Z Med J. 2020;133(1521):28–39
Abstract

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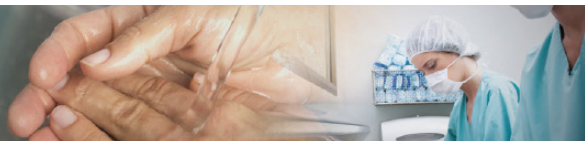

Molecular epidemiology of methicillin-susceptible *Staphylococcus aureus* in infants in a neonatal intensive care unit

Authors: Cho H-K et al.

Summary: This study investigated the molecular epidemiology of MSSA in infants in a NICU using whole-genome sequencing. A total of 68 MSSA-colonised infants were identified and Core genome multilocus sequence type (cgMLST) analysis was performed on 67 MSSA isolates. Eleven cgMLST isolate groups comprising 39 isolates (58%) were identified. Group sizes ranged from two to 10 isolates and 28 isolates (42%) were unrelated to each other or any of the isolate groups. Thirteen infants (19.7%) developed MSSA infections including bacteraemia (n=3), wound infection (n=5), conjunctivitis (n=4), and cellulitis (n=1). There was no association between these clinically manifest-infections and specific cgMLST groups.

Comment (MB): Most of the focus for *Staphylococcus aureus* in NICU from an IPC perspective has been on MRSA, so I was interested to see a paper on MSSA. This is an important NICU pathogen, and much more common than MRSA, especially in NZ. They used 'cgMLST', which is a much more discriminatory typing method than traditional ones. Important to note is that most infants on the unit were cared for in rooms with 4–6 beds. They did not report on nursing ratios, but did report low levels of hand hygiene compliance, initially at 40%, which improved during the study. Unfortunately, they did not report how many infants they screened, but reported an average of ≈385 infants per year, giving a cumulative incidence of ≈18% acquisition of MSSA. MSSA appeared to behave differently to MRSA in this study, with the take-home message being that MSSA occurred either sporadically or in multiple small clusters that tended to burn themselves out, as opposed to MRSA, which typically spreads more clonally over longer time periods. The question of course is what can be done to try to prevent transmission events, which this study does not answer, but it would be interesting to see the study repeated in a NICU with higher baseline hand hygiene adherence.

Reference: Infect Control Hosp Epidemiol. 2020 Sep 16 [Online ahead of print]
Abstract

Impact of preoperative chlorhexidine gluconate (CHG) application methods on preoperative CHG skin concentration

Authors: Warren BG et al.

Summary: This multicentre, non-randomised, prospective cohort study of 139 adult patients undergoing elective surgery determined whether three 4% chlorhexidine gluconate (CHG) liquid formula application methods differed in preoperative CHG skin concentration and the proportion of samples that met key CHG skin concentration thresholds. The study results suggest that bathing with 4% CHG for more consecutive days provides higher levels CHG skin concentration on the day of surgery and that those levels are more frequently at or above key CHG skin concentration thresholds.

Comment (MB): No-rinse 2% CHG-impregnated cloths have previously been shown to result in higher CHG concentrations and lower microbial density on skin than 4% liquid formulae when tested immediately and at 6 hours post use. These investigators examined different strategies of application of the 4% liquid formulation in patients undergoing various orthopaedic procedures, as this is used by some for pre-operative skin preparation. This was a non-randomised study, with three different institutions using different protocols. The population demographics, however, appeared to be reasonably similar. They gave written instructions to patients in the same way it would be done in routine practice. The five-day regimen appeared to give significantly higher concentrations of CHG on the skin on day of surgery compared to the 3-day and night-before regimens, with the threshold for inhibiting Gram positive organisms achieved 97% of the time versus 94% and 86%, respectively, although these percentage differences were not statistically significant. The five-day regimen met the threshold for inhibiting Gram negatives in 60%, which was significantly higher than the other strategies. The take-home message seems to be that the 2% cloths are probably better but a five-day regimen with the 4% liquid may be a fall-back option, particularly if supply chains are interrupted, given the current global situation.

Reference: Infect Control Hosp Epidemiol. 2020 Sep 30 [Online ahead of print]
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, diagnostic stewardship and the microbial composition of sourdough bread. He trained at University College Hospital London and Wellington Hospital, gaining fellowship with the RACP and the RCPA. He has higher degrees from the University of Cambridge and Queen Mary University of London.

How testing drives treatment in asymptomatic patients: level of pyuria directly predicts probability of antimicrobial prescribing

Authors: Gupta K et al.

Summary: This retrospective cohort study assessed the association between pyuria and antimicrobial initiation during the perioperative period in patients who underwent non-urologic surgery. Harms versus benefits of treatment were also assessed. Of 41,373 patients who had a urinalysis performed, 3617 had pyuria. A total of 887 (24.5%) patients with pyuria received antimicrobials versus 1918 (5.1%) patients without pyuria. As the degree of pyuria increased, the likelihood of receiving antimicrobials increased linearly. Pre-operative pyuria was associated with post-operative *Clostridioides difficile* infections with the risk being higher in patients who received antimicrobials. Pyuria was associated with increases in UTI after orthopaedic and vascular procedures and this risk was not mitigated by antimicrobial therapy. No association between pyuria and SSI was found.

Comment (MB): This paper demonstrated that routine urine testing prior to several types of non-urologic surgery was associated with harm to patients, providing further ammunition to stop this practice, and also to ban the dipstick! Almost 60% of those included in the study had a urinalysis performed within the 30 days prior to their surgery, in this predominantly male Veterans Affairs population, which I thought was an alarmingly high number. Almost a quarter of those with any degree of pyuria but a negative culture were prescribed antibiotics, and there was a clear dose-response relationship with degree of pyuria, demonstrating the common misconception that a positive dipstick indicates infection. They saw more *C. difficile* infection in those prescribed antibiotics, whereas there was no relationship between pyuria and subsequent SSI, regardless of antibiotic use. Pyuria appeared to be a risk factor for post-operative UTI; however, antibiotic prescription did not appear to alter this risk.

Reference: Clin Genet. 2018;93(5):1075–1080
Abstract