American Journal of Infection Control 47 (2019) 580–581

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Commentary

Journal Club: Clothing and shoes of personnel as a potential vector for transfer of health care–associated pathogens to the community

Timothy L. Wiemken PhD, MPH, CIC, FAPIC, FSHEA [a,*], Hillary Hei MPH, CIC [b]

[a] Saint Louis University Center for Health Outcomes Research, St. Louis, MO
[b] Children's Hospital of Philadelphia, Philadelphia, PA

The topic of this Journal Club commentary is the article "Clothing and shoes of personnel as a potential vector for transfer of health care–associated pathogens to the community," by Kanwar et al.[1] Environmental contamination has been documented as an important route of transmission for health care-associated pathogens for some time.[2] Contamination of health care provider attire with these epidemiologically important pathogens is also well-documented.[3] However, it is not clear as to the potential for pathogens on attire to be transmitted to patients and cause infection. This has resulted in infection prevention guidance with respect to attire to be largely based on expert opinion.[4] Regardless, it can be reasonably inferred that if attire harbors a substantial bioburden of pathogens, those pathogens may be transmitted to the environment or directly to others during care or at home. The latter issue is the primary concern in the present study.

The primary objective of this study was to determine if attire worn by health care providers in an acute care setting and then worn home was contaminated with pathogens known to cause health care–associated infections (HAI). Results of their study suggest that attire can indeed become contaminated with pathogens often associated with HAI, as methicillin-resistant *Staphylococcus aureus* (MRSA), carbapenem-resistant gram-negative bacilli, and *Clostridium difficile* were identified on nurse and physician clothing or shoes after providing patient care.

OVERVIEW

In this study, Kanwar et al[1] aim to document postshift microbial contamination on health care worker hands and attire (clothing and shoes) intended to be worn home. Beyond this objective, they also evaluated nasal carriage of MRSA among physicians with MRSA contamination on their attire.

This was a single-center study at an acute care facility from January 2018 through May 2018, using a convenience sample of nurses (n = 16) and physicians (n = 25). Health care worker attire cultures were obtained from sleeve cuffs, external pockets, shirt collars, and the waistline and external pant pockets using premoistened cotton gauze pads. These specimens were self-obtained by the health care provider. Hand and shoe cultures were obtained using premoistened culture swabs. All specimens were tested for MRSA, *C difficile*, carbapenem-resistant gram-negative bacilli, and vancomycin-resistant enterococci.

Of the 41 individuals in the study, 44% had documented contamination with at least 1 of the organisms of interest. Of those contaminated, 44% had clothing contamination and 67% had shoe contamination. Of the 6 physicians with MRSA clothing contamination, 2 had nasal carriage of MRSA. Further, 100 physician-patient interactions were observed to document potential opportunities for direct or indirect attire contamination. Sixty percent of those observations were suggestive of clothing-patient or clothing-environment contact.

DISCUSSION AND IMPLICATIONS FOR INFECTION PREVENTIONISTS

The results of this study add to the body of evidence that health care provider attire does indeed become contaminated with pathogens known to cause HAIs. Authors suggest implications including the need for enhanced education to reduce provider clothing contact with patients, and not wearing surgical scrubs home. Implementing these findings into practice would require coordinated efforts and careful assessment of resources. For example, this may necessitate on-site resources for laundering scrubs or providing outsourced laundering, product tracking, physical space to store and change attire, and methods to transport to and from the facility. Given that there is still no evidence that attire truly increases the likelihood of HAIs, the risks and benefits to this approach would need to be carefully considered.

In consideration of translating these findings into practice (to proceed, gather more information, or not proceed), the infection preventionists should consider the following information.

Environmental sampling is known to be troublesome, with many different options, each with poor specificity.[5] Without standardized protocols and use of techniques known to provide the highest yield, negative cultures are of little use in documenting lack of organism presence. Because of these issues, there is a high probability that attire contamination was much more prevalent than documented.

* Address correspondence to Timothy L. Wiemken, PhD, MPH, CIC, FAPIC, FSHEA, Saint Louis University Center for Health Outcomes Research, 3545 Lafayette Ave #411, St. Louis, MO 63108.
E-mail address: timothy.wiemken@health.slu.edu (T.L. Wiemken).
Conflicts of interest: None to report.

https://doi.org/10.1016/j.ajic.2019.02.032

Although there is some discussion as to what levels of bioburden may be considered acceptable in the environment,[6] acceptable levels on attire are not yet documented. This is likely because it is unknown if any level can be transmitted to patients or the environment. It is important that studies evaluate quantitative microbial counts to assist in our understanding of the level of bioburden on attire. The study authors acknowledge this limitation of only the presence and absence of organisms rather than quantitative measures such as colony forming units.

Temporality is often an issue in observational studies. Here, investigators swabbed the nares of physicians identified with MRSA on their attire to see if they were concurrently colonized with MRSA. One-third of physicians with MRSA on their attire had nasal carriage of MRSA. The impact of this correlation is unknown, because they may have had nasal carriage resulting in clothing contamination or clothing contamination resulting in nasal carriage (or something else). Further, considering that MRSA is very common in the community, it is difficult to know where the contamination (or colonization) originated. This study did not specify washed clothing as a baseline, and because the attire may have been worn home on many occasions, it could have been contaminated at home and not in the health care environment.[7] Future studies in this area should consider longitudinal specimen collection and genotyping to assist in dissecting this issue.

Other factors the infection preventionists might consider in translating these findings into practice include: knowledge of the patient population under care (eg, were they colonized or infected with any of the pathogens under study?), the level of hand hygiene compliance, isolation prevalence and compliance, and the processes and frequencies used by health care providers to launder their garments at home.

In light of these points and acknowledged limitations, an important take-away is the emphasis on the many process issues present in health care that may allow for contamination of attire. As documented in this study, direct and indirect contact with patients and the environment is common, with most indirect contacts resulting from reaching under clothing for phones, notes, and pagers. Technology plays a critical role in health care and its importance will only increase in the coming years. Reducing the reliance on technologies required to be handled or stored within and underneath attire may reduce contamination. Additionally, it is important to note that pathogen transmission risk could have been reduced on all of the indirect contacts identified during observations with proper hand hygiene and/or glove use.

Overall, this study adds more evidence that health care workers should launder clothing often, as contamination is likely, particularly since washing and ironing has been shown to reduce bioburden on health care uniforms.[8] This study also underscores the need for large scale, well-designed, prospective studies to help us finally close the book on this story.

Acknowledgements

The Journal Club is an ongoing activity of the Association for Professionals in Infection Control and Epidemiology Research Committee. As part of this activity, Research Committee members comment on select articles to demonstrate research implications for Infection Preventionists.

References

1. Kanwar A, Thakur M, Wazzan M, Satyavada S, Cadnum JL, Jencson AL, et al. Clothing and shoes of personnel as a potential vector for transfer of health care–associated pathogens to the community. Am J Infect Control.
2. Weber DJ, Anderson D, Rutala WA. The role of the surface environment in healthcare-associated infections. Curr Opin Infect Dis 2013;26:338-44.
3. Haun N, Hooper-Lane C, Safdar N. Healthcare personnel attire and devices as fomites: a systematic review. Infect Control Hosp Epidemiol 2016;37:1367-73.
4. Bearman G, Bryant K, Leekha S, Mayer J, Munoz-Price LS, Murthy R, et al. Expert guidance: healthcare personnel attire in non-operating room settings. Infect Control Hosp Epidemiol 2014;35:107-21.
5. Galvin S, Dolan A, Cahill O, Daniels S, Humphreys H. Microbial monitoring of the hospital environment: why and how? J Hosp Infect 2012;82:143-51.
6. Dancer S. How do we assess hospital cleaning? A proposal for microbiological standards for surface hygiene in hospitals. J Hosp Infect 2004;56:10-5.
7. Sanon MA, Watkins S. Nurses' uniforms: how many bacteria do they carry after one shift? J Public Health Epidemiol 2012;4:311.
8. Lakdawala N, Pham J, Shah M, Holton J. Effectiveness of low-temperature domestic laundry on the decontamination of healthcare workers' uniforms. Infect Control Hosp Epidemiol 2011;32:1103-8.