Infection Control & Hospital Epidemiology (2024), **45**, 790–792
doi:10.1017/ice.2024.27

SHEA

Concise Communication

High touch surface bioburden associated with the use of disinfectants with and without continuously active disinfection in ambulatory care settings

Heidi M. Torres MD[1,2], Jamie Marino PhD[1], Matthew S. Simon MD, MS[1,2], Harjot K. Singh MD, ScM[1,2], Lars F. Westblade PhD[1,2] and David P. Calfee MD, MS[1,2]

[1]Weill Cornell Medicine, New York, NY, USA and [2]NewYork-Presbyterian Hospital/Weill Cornell Medical Center, New York, NY, USA

Abstract

A quaternary ammonium and alcohol-based disinfectant with reported continuous activity demonstrated reduced microbial buildup on surfaces over time compared to routine disinfectants without continuous activity in *in vitro* and hospital studies. We compared these disinfectants in ambulatory settings and found no difference in bioburden on high-touch surfaces over time.

(Received 18 July 2023; accepted 17 January 2024; electronically published 20 February 2024)

Introduction

Microbial contamination of the healthcare environment contributes to pathogen transmission and the risk of healthcare-associated infections.[1–4] Environmental cleaning and disinfection is therefore an essential part of reducing the spread of organisms and development of infection in the healthcare setting.[2–4] Historically, liquid chemical disinfectants have had no residual bactericidal effects once a surface dries following application of the disinfectant. Thus, high touch surfaces (HTS) can quickly become recontaminated after disinfection.[5,6] A quaternary ammonium and alcohol (QAA) based disinfectant (Sani-24, Professional Disposables International (PDI), Woodcliff Lake, NJ) with claims of continuous active disinfection (CAD) for up to 24 hours against common healthcare-associated pathogens was approved as a healthcare disinfectant by the United States Environmental Protection Agency. Compared to traditional disinfectants, it has been associated with reduced microbial buildup on HTS over time *in vitro* and in hospital settings.[1,3,7] While studies involving this product and other disinfectants with persistent activity, such as QA organosilane solutions, have found efficacy in keeping microbial burden low, almost all studies have been done *in vitro* or inpatient settings[1,3] on surfaces which may not have had frequent or terminal disinfection.[7] We aimed to assess the efficacy of the QAA CAD disinfectant in reducing microbial contamination in the ambulatory care environment to inform the appropriateness of its use in this setting compared to disinfectants without CAD.

Methods

In this prospective observational study, non-porous HTS in two ambulatory locations were disinfected with a QAA disinfectant (Super Sani-Cloth Germicidal Disposable Wipe, PDI) or a QAA disinfectant with CAD (Sani-24 Germicidal Disposable Wipe, PDI) to compare differences in surface contamination over 24 hours. The study was conducted in an urgent care (UC) within an urban emergency department and an infectious disease outpatient clinic (OPC). HTS were chosen based on a prior study identifying HTS in the Emergency Department.[7]

Prior to each 24-hour sampling period, study personnel disinfected HTS using pre-saturated wipes containing one of the two disinfectants. HTS were allocated between the disinfectants evenly to ensure equitable distribution of distinct surface types between each disinfectant. Once the appropriate contact time had elapsed and surfaces were dry, samples were collected from each HTS. Sampling was repeated at 4–6, 8–12, and 24 hours by rubbing an ESwab (Copan Diagnostics, Murrieta, CA) pre-moistened with Dey-Engley neutralizing broth (Remel Products, Lenexa, KS) over 100 cm^2 on each surface. Curved surfaces had measurements taken to calculate the 100 cm^2 area. Samples were obtained from 66 HTS (33 per disinfectant) in the UC: 10 chair surfaces, 6 examination beds/tables, 4 bed rails, 22 patient room counter tops, 12 triage area counter tops, 9 doorknobs, and 3 light switches. In the OPC, 70 HTS (35 per disinfectant) were sampled: 46 chair surfaces, 12 examination beds/tables, and 12 doorknobs. After sampling, ESwabs were placed in 1 mL of Dey-Engley neutralizing broth. In the laboratory, each tube containing the ESwab was vortexed and 100 µL of broth was streaked with an inoculation loop onto trypticase soy agar with sheep blood

Corresponding author: Heidi M. Torres; Email: Het9037@med.cornell.edu

This work was presented in part as poster no. 1191 at IDWeek 2022 on October 21, 2022, in Washington, DC.

Cite this article: Torres H. M., Marino J., Simon M. S., Singh H. K., Westblade L. F., Calfee D. P. High touch surface bioburden associated with the use of disinfectants with and without continuously active disinfection in ambulatory care settings. *Infect Control Hosp Epidemiol* 2024. 45: 790–792, doi: 10.1017/ice.2024.27

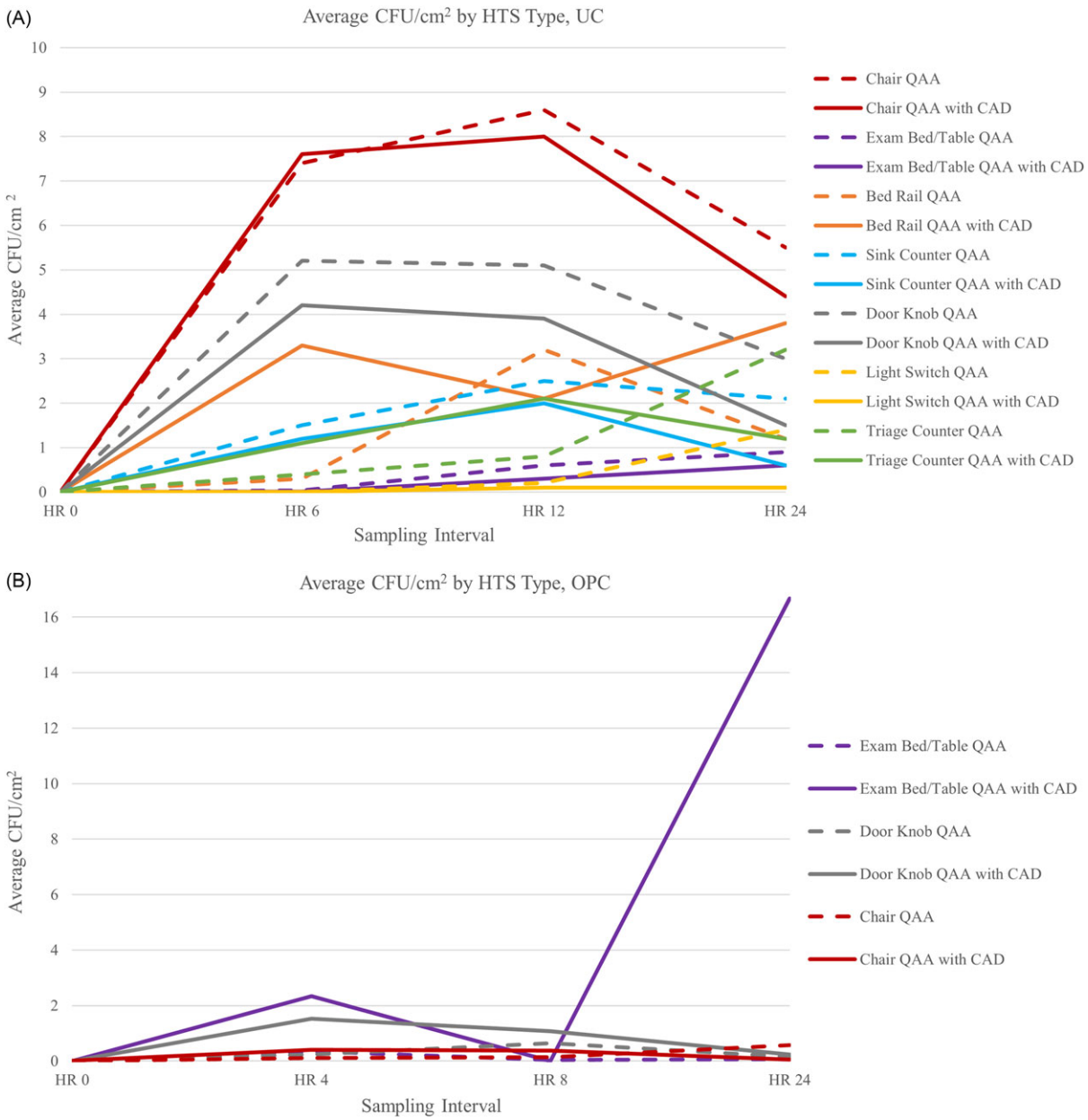

Figure 1. Average colony-forming units (CFU)/cm^2 over a 24-hour period on urgent care (UC, A.) and outpatient clinic (OPC, B.) high touch surfaces (HTS) by surface type cleaned with each disinfectant. *Note:* HR, hour; QAA, quaternary ammonium and alcohol; CAD, continuous active disinfection.

(Becton, Dickinson and Company, Franklin Lakes, NJ). Samples were plated within 1 hour of collection without dilution. After 48 hours of incubation at 35°C, 5% carbon dioxide, colony forming units (CFUs) were manually counted.

During each 24-hour period, between-patient or subsequent disinfection of HTS was performed by clinical personnel. In the OPC, clinical personnel were provided with the study disinfectant wipes assigned to each room being sampled and instructed to use the wipe assigned to that room for subsequent between-patient HTS disinfection. Due to the rapid pace of the UC and the large number of clinical personnel involved, UC clinical personnel were not asked to use study disinfectant wipes for between-patient disinfection. In this location, clinical personnel used hospital-approved disinfectant wipes, including the QAA wipe without CAD or a bleach-based wipe, for between-patient disinfection. Subsequent disinfection by personnel was not observed at either location. Environmental services personnel performing nightly terminal cleaning were unaware of the study and used hospital-approved disinfectants per protocol.

At each location, the mean CFU/cm^2 for each HTS type (eg, chairs) was calculated at each sampling interval for each disinfectant. Normally distributed mean CFU/cm^2 data were compared between disinfectants for each surface type and all surface types combined at each location with two-tailed *t*-tests. The proportion of surface samples with ≤2.5 CFU/cm^2, a microbiologic standard for clean surfaces,[5] was also evaluated and compared between disinfectants with two-tailed Mann–Whitney U tests. This study was deemed non-human

https://doi.org/10.1017/ice.2024.27 Published online by Cambridge University Press

subjects research by the Weill Cornell Medicine Institutional Review Board.

Results

No statistically significant differences in mean CFU/cm^2 were found on any HTS type or combined HTS types at either ambulatory setting between the disinfectants (Figure 1, Supplementary Table 1). Additionally, there were no significant differences in the proportion of samples with ≤2.5 CFU/cm^2 between disinfectants by HTS type or combined HTS at either location (Supplementary Table 2).

Discussion

In this study performed in two ambulatory settings, no statistically significant differences in microbial contamination were observed between HTS disinfected with the QAA wipe with or without CAD over time. These findings differ from prior studies conducted in hospital settings.[3,6] Factors potentially contributing to this difference include higher patient turnover in ambulatory settings with disinfection between patients, less recontamination of surfaces due to less time spent in ambulatory areas, and differences in activities that occur in ambulatory locations. This differs from hospital locations where patients may have prolonged contact with their environments. Prior studies using CAD technology in hospital settings also allude to suboptimal cleaning and disinfection.[6] Similar to our study, Boyce et al[8] found no difference in bioburden between HTS cleaned with a disinfectant with organosilane compounds with persistent activity compared to routine QA disinfectants in hospital rooms. That study had the expectation of at least daily room cleaning. A study by Warren et al, observed a decrease in surface bioburden with CAD disinfectants compared to routine products but also found compliance with routine disinfection of hospital rooms was poor.[9]

Our study has limitations. Microbial bioburden in the clinic was low which may have made it difficult to detect a difference between disinfectants. The Hawthorne effect could have led clinical personnel to perform disinfection more thoroughly or frequently given our presence. Attempts were made to avoid repetitive sampling of the same area of each HTS at intervals to reduce risk of removing residual disinfectant but given the limited surface areas of doorknobs and light switches there was some overlap of these sampling sites. Finally, there may have been removal of some residual QAA disinfectant with CAD from surfaces in the UC during subsequent disinfection with non-CAD disinfectants. The latter, however, is not expected to have been an issue in the OPC as subsequent disinfection was performed with the same disinfectant.

Findings of this study suggest that disinfectants with CAD may not have additional benefit, compared to disinfectants without CAD, in ambulatory areas where disinfection of HTS is performed frequently and/or where rates and burden of recontamination are low.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/ice.2024.27.

Acknowledgements. Sani-24 Germicidal Disposable Wipes were purchased from Professional Disposables International (Woodcliff Lake, NJ) at market cost. The manufacturer was not involved in the design, conduct, or analysis of the study.

Financial support. HMT was supported by an NIH/NIAID T32 training grant (T32AI007613 Research Training in Infectious Diseases).

Competing interests. All authors report no conflicts of interest relevant to this article.

References

1. Rutala WA, Gergen MF, Sickbert-Bennett EE, Anderson DJ, Weber DJ. Antimicrobial activity of a continuously active disinfectant against healthcare pathogens. *Infect Control Hosp Epidemiol* 2019;40:1284–1286.
2. Weber DJ, Anderson D, Rutala WA. The role of the surface environment in healthcare-associated infections. *Curr Opin Infect Dis* 2013;26:338–344.
3. Schmidt MG, Fairey SE, Attaway HH. In situ evaluation of a persistent disinfectant provides continuous decontamination within the clinical environment. *Am J Infect Control* 2019;47:732–734.
4. Edmiston CE, Spencer M, Lewis BD, *et al.* Assessment of a novel antimicrobial surface disinfectant on inert surfaces in the intensive care unit environment using ATP-bioluminesence assay. *Am J Infect Control* 2020;48:143–146.
5. Attaway HH, Fairey S, Steed LL, Salgado CD, Michels HT, Schmidt MG. Intrinsic bacterial burden associated with intensive care unit hospital beds: effects of disinfection on population recovery and mitigation of potential infection risk. *Am J Infect Control* 2012;40:907–912.
6. Redmond SN, Cadnum JL, Silva SY, *et al.* Evaluation of a continuously active disinfectant for decontamination of portable medical equipment. *Infect Control Hosp Epidemiol* 2022;43:387–389.
7. Wang TZ, Simon MS, Westblade LF, *et al.* Quantitative characterization of high-touch surfaces in emergency departments and hemodialysis facilities. *Infect Control Hosp Epidemiol* 2020;42:474–476.
8. Boyce JM, Havill HL, Guerica KW, Schweon SDJ, Moore BA. Evaluation of two organosilane products for sustained antimicrobial activity on high touch surfaces in patient rooms. *Am J Infect Control* 2014;42:326–328.
9. Warren BG, Barrett A, Graves A, King C, Turner NA, Anderson DJ. An enhanced strategy for daily disinfection in acute care hospital rooms: a randomized clinical trial. *JAMA Netw Open* 2022;5:e2242131.