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Increased time spent on terminal cleaning of patient rooms may not improve disinfection of high-touch surfaces

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Organisms causing healthcare-associated infections (HAIs) are prevalent on high-touch surfaces in hospital rooms.¹ Quality of surface disinfection varies widely due to surfaces, disinfectant, and pressure for quick turnaround times in busy hospitals.² The need for quick terminal cleaning may impact bioburden reduction and ultimately affect HAI rates. The Association for the Healthcare Environment recommends that 20–45 minutes be dedicated to terminal room cleaning after a patient is discharged. This recommendation was previously not validated for impact on microbial load.³ A larger study of hospital room disinfection examined the relationship between time spent cleaning and level of disinfection achieved as quantified by aerobic bacterial colony (ABC) counts of 5 high-touch surfaces.

Methods

The study was conducted in an acute-care Veterans Affairs (VA) hospital in Temple, Texas. Single-occupancy rooms previously occupied for at least 48 hours prior to discharge were used. Precleaning and postcleaning samples were collected from 5 high-touch surfaces: bedrail, tray table, call button, toilet seat, and bathroom handrail. All rooms were sampled for ABC as described previously.⁴ Surfaces were manually disinfected by

environmental management services (EVS) personnel using 1 of 3 disinfectants: (1) sodium hypochlorite 10% solution (SH; Dispatch, Clorox Healthcare Services, Pleasanton, CA), (2) hydrogen peroxide + paracetic acid (HPA; Oxycide, Ecolab, St Paul, MN), and (3) quaternary ammonium compound (QAC; Virex II 256, Diversey, Sturtevant, WI). Sampling plates were incubated for 24 hours at 35°C. Aerobic bacterial colonies were counted or deemed too numerous to count (TNTC) when colony count exceeded 200. Of 450 samples, 43 were censored at a value of 200. Actual cleaning time was measured by stopwatch. Cleaning instructions limited time to 25 minutes or time was unrestricted. For analysis, cleaning time data were placed in 3 categories: (1) limited arm (restricted to 25 minutes), (2) unrestricted–moderate arm (<45 minutes taken), and (3) unrestricted–high arm (≥45 minutes taken).

Aerobic bacterial colony counts were modeled as a function of cleaning time category, disinfectant, precleaning ABC count (z-transformed), and sample surface location, in a Bayesian negative binomial mixed-effects censored regression model using the ‘brms’ package in R version 3.5.1 software.⁵ A random intercept for interaction of disinfectant and EVS staff was used to account for 12 EVS staff cleaning >1 room with potentially different disinfectants. A normal(0,5) prior was specified for fixed effects, a Student-*t*(3,0,10) prior was specified for standard deviation parameter group-level effects, and a $\gamma(0.01, 0.01)$ was specified for the negative binomial shape parameter. All chains converged, and Rhat was 1.0 for each parameter estimate. Results were reported as incident rate ratio (IRR) compared to limited time. An IRR = 1 indicated

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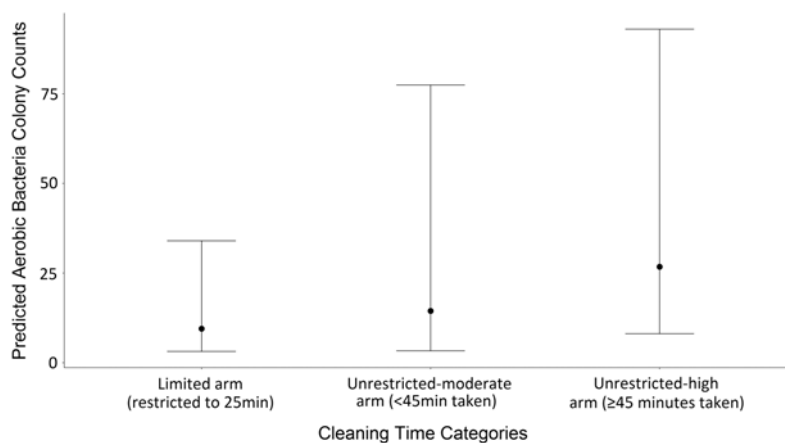


Fig. 1. Median and 95% uncertainty intervals of aerobic bacterial colony counts by cleaning-time category obtained by predicting the outcome variable from the regression model. The model results were inconclusive and can be seen in the large overlapping uncertainty intervals.

no effect; an IRR < 1 indicated lower ABC counts compared to the limited time arm; and an IRR > 1 indicated higher ABC counts.

Results

The limited time arm contained 225 samples (45 rooms), unrestricted-moderate arm accounted for 55 samples (11 rooms), and unrestricted-high arm included 170 samples (34 rooms). The model-estimated association between time spent cleaning a room and ABC counts on high-touch surfaces was inconclusive, even when adjusting for disinfectant used, surface location, and pre-clean ABC counts. With the reference category held at the limited time arm, the estimated IRR for the unrestricted-moderate arm was 1.54, with a 95% uncertainty interval of 0.39–6.67, which included 1. The estimated IRR for the unrestricted-high arm was 2.80, with a 95% uncertainty interval, 0.92 – 8.17, that also included 1.

Discussion

These results suggest that in the presence of appropriate disinfectants and trained EVS staff, the time spent on cleaning beyond 25 minutes does not affect disinfection of high-touch surfaces as assessed by ABC counts. This finding is similar to that of Rupp *et al.*,⁶ who found that cleaning time was not associated with improved cleaning as assessed by fluorescent marker. Although not within the constraints of the 95% uncertainty interval, our Bayesian analysis suggests some evidence that unrestricted longer cleaning times (≥ 45 minutes) were associated with the greatest postcleaning bioburden on the five high-touch surfaces sampled in this study, as can be seen in Figure 1.

These results may be entirely due to random chance within sampling, or they may represent different cleaning activities, such as cleaning more surfaces with less focus on proper application of disinfectant to the surfaces we sampled. To minimize the Hawthorne effect and to avoid inadvertent disclosure of the surfaces being sampled, we did not observe EVS staff directly in the room. Our results suggest that a decrease in bioburden on 5 high-touch surfaces is not limited by less time allotted for disinfection (within recommended time range), but rather a combination of adequate time and appropriate disinfectant use.

Our study was a single-center trial, the results of which may not be generalizable to other healthcare settings. Assignment to cleaning time arm was not randomized or balanced across groups, nor did we capture variables that affect disinfection such as disinfectant

contact time. Since we only reported ABC results, findings may not be generalizable across pathogens.

In summary, we found cleaning time as categorized in this study to have no conclusive effect on bioburden on high-touch surfaces.

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