



Research Brief

What is the optimal frequency of sink drain decontamination with a foam disinfectant?

Martin Mathew Varghese MBBS¹, Maria M. Torres-Teran MD¹ , David Henry Greentree BS², Jennifer L. Cadnum BS¹ and Curtis J. Donskey MD^{3,4} 

¹Research Service, Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA, ²College of Medicine, The Ohio State University, Columbus, OH, USA, ³Geriatric Research, Education, and Clinical Center, Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA and ⁴Case Western Reserve University School of Medicine, Cleveland, OH, USA

(Received 1 February 2024; accepted 11 March 2024; electronically published 25 April 2024)

Contaminated sink drains and other wastewater drainage sites have been linked to outbreaks of infections with gram-negative bacilli.¹ Organisms colonizing sink drains can be dispersed from beneath the strainer to the bowl, countertop, and to patients or personnel.^{2–4} Thus, there is a need for effective strategies to reduce sink drain colonization. Pouring disinfectants into sinks has only a modest, transient effect because the disinfectants flow rapidly down the drain, providing inadequate contact time and poor penetration into areas harboring biofilm-associated organisms.^{5,6}

Recently, a foam application of a 3.13% hydrogen peroxide and 0.05% peracetic acid disinfectant (Virasept, Ecolab, Saint Paul, MN) has been shown to suppress sink drain colonization significantly longer than poured liquid disinfectants, presumably due to enhanced contact time and penetration into biofilm.^{7,8} The foam product is Environmental Protection Agency (EPA)-registered to kill *Pseudomonas aeruginosa* and *Staphylococcus aureus* biofilms with a 5-minute contact time. However, the optimal frequency of application is uncertain. Based on a single application of the foam disinfectant, Ramos-Castaneda et al.⁸ proposed that drain disinfection every 3–5 days might be effective. Jones et al.⁷ suggested that drain disinfection every 3 days might be effective and noted a progressive decrease in the bacterial burden with repeated treatments every 3 days. Here, we examined the impact of different frequencies of foam disinfectant application on the burden of gram-negative bacilli in hospital sink drains.

The study was conducted on medical-surgical wards at the Cleveland VA Medical Center. Twenty-four sinks in patient rooms or bathrooms were randomized (6 per group) to receive foam disinfection with Virasept at different intervals, including daily, every second day, every third day, or every fifth day. At baseline, all drains were colonized with *P. aeruginosa* with ~5–7 log₁₀ colony-forming units (CFU) per swab; *P. aeruginosa* is the predominant organism colonizing more than 95% of sinks in the hospital. The foam was generated from ~50 mL of the disinfectant and was allowed to dwell for 5 minutes before flushing with water.

Corresponding author: Curtis J. Donskey; Email: Curtis.Donskey@va.gov

Martin Mathew Varghese and Maria M. Torres-Teran contributed equally.

Cite this article: Varghese MM, Torres-Teran MM, Greentree DH, Cadnum JL, Donskey CJ. What is the optimal frequency of sink drain decontamination with a foam disinfectant?. *Infect Control Hosp Epidemiol* 2024. 45: 1143–1145, doi: [10.1017/ice.2024.58](https://doi.org/10.1017/ice.2024.58)

ESwabs (Becton Dickinson, Sparks, MD) were used to sample the drain to a depth of 2.4 cm below the strainer prior to the intervention and then daily for 14 days; swabs were collected immediately prior to foam application on days of sink treatment. The swabs were processed to quantify total gram-negative bacilli.⁷ The level of reduction in drain colonization required to minimize risk for dispersal of bacteria is uncertain; for the purposes of this study, a reduction to 2 log₁₀ CFU that was sustained for 2 or more treatments was deemed effective.

Based on the initial results, we hypothesized every third-day treatment might be effective in maintaining a sink drain concentration of <2 log₁₀ CFU of gram-negative bacilli if the burden was first reduced by applying foam daily for several days. Therefore, we treated 11 additional sinks colonized with *P. aeruginosa* with foam daily for 4 days followed by every third-day application for 4 treatments ($N = 7$ sinks) or no further foam application ($N = 4$ control sinks).

Figure 1(a) shows the effect of repeated foam application on the burden of gram-negative bacilli. The concentration of gram-negative bacilli was reduced to ≤ 2.2 log₁₀ CFU 1 day after each application. However, sustained reductions to less than 2 log₁₀ CFU within 2–3 days were only achieved in the daily application group. With every second-day application, the concentration of gram-negative bacilli trended downward and remained below 2 log₁₀ CFU after the sixth and seventh applications.

Figure 1(b) shows the impact of daily foam application for 4 days followed by every third-day application versus no further foam application. Daily foam application reduced the concentration of gram-negative bacilli to 2 log₁₀ CFU. However, the concentrations of gram-negative bacilli increased to above 2 log₁₀ CFU during subsequent every third-day applications and returned to baseline in control sinks that did not receive further foam applications.

In response to outbreaks linked to sinks, it has been recommended that facilities consider disinfection of sink drains using an EPA-registered disinfectant with claims against biofilms in consultation with state or local public health departments.⁹ Previous studies have demonstrated that the EPA-registered hydrogen peroxide and peracetic acid disinfectant administered as foam can suppress drain contamination.^{7,8} Our findings suggest that daily application may be required to achieve a rapid and consistent reduction in colonization. Application of the foam

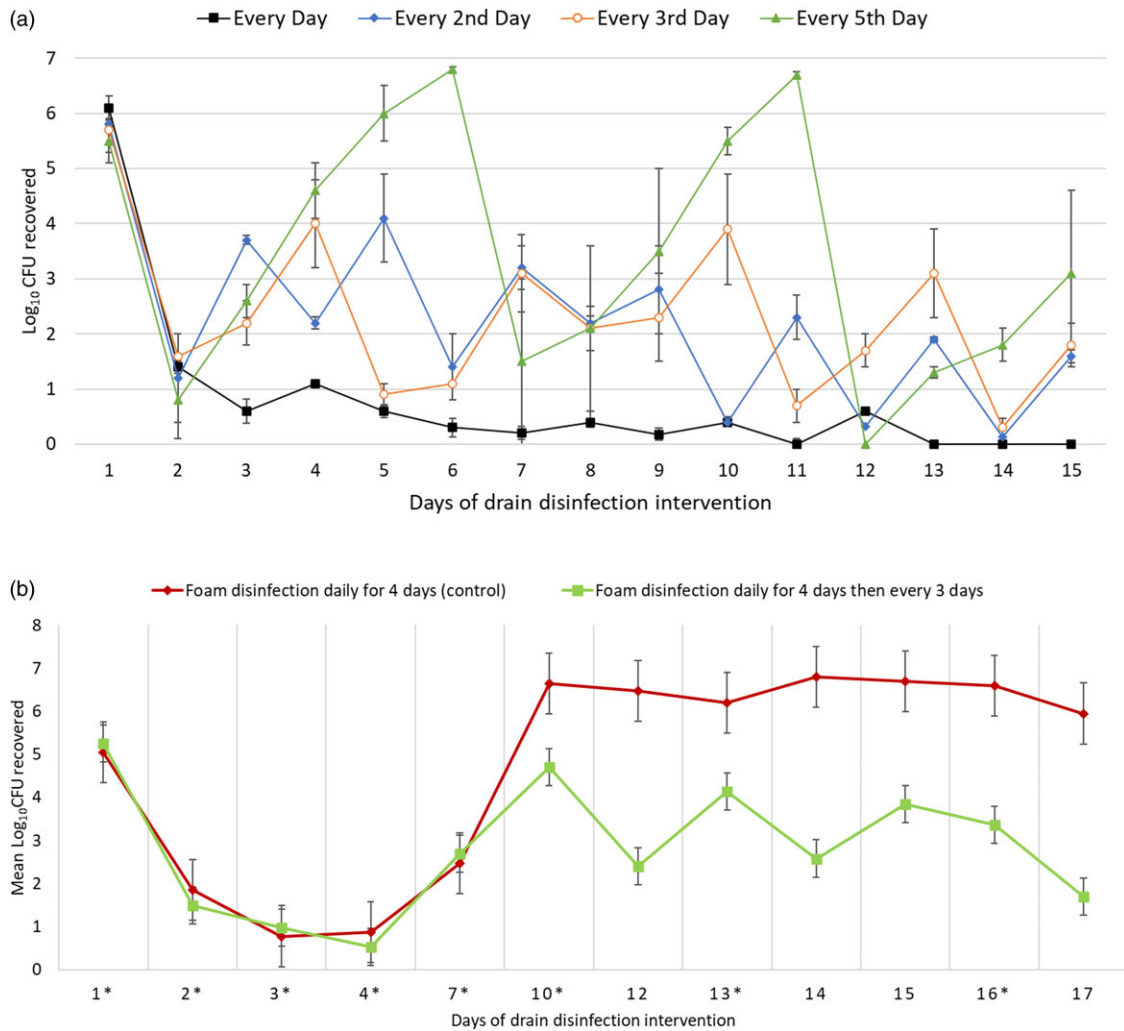


Figure 1. Effect of different frequencies of foam disinfectant applications on the burden of gram-negative bacilli recovered from sink drains colonized with *Pseudomonas aeruginosa*. (a). Sinks (6 per group) received foam disinfection daily, every second day, every third day, or every fifth day. (b). Sinks ($N = 11$) received foam disinfection daily for 4 days followed by every third day for 4 treatments ($N = 7$ sinks) or no further foam application ($N = 4$ sinks). *, foam application. Note. CFU, colony-forming unit. Error bars indicate standard error.

disinfectant every 2 days resulted in a downward trend in drain contamination, but suppression to below $2 \log_{10}$ CFU only occurred after the sixth application.

Our study has some limitations. Testing was conducted in one facility and all sinks were colonized with *P. aeruginosa*. Additional studies are needed in other facilities and for sinks colonized with carbapenem-resistant Enterobacterales which have been associated with many outbreaks linked to sinks.¹ We tested a single 5-minute daily application of the foam as recommended by the manufacturer. It is possible that longer exposure times might have greater efficacy. A reduction to $2 \log_{10}$ CFU was deemed effective. However, the level of reduction required to minimize the risk of dispersal of organisms is uncertain. We did not detect any obvious adverse effects of repeated foam application on the sinks. However, additional studies are needed as the duration of treatment was relatively short. We did not perform a cost analysis but estimated that the cost of the disinfectant for each application was $< \$2.00$. Finally, studies are needed to determine if application of the foaming disinfectant will be effective in controlling outbreaks linked to sink colonization.

Acknowledgments. We thank the Cleveland VA Engineering Department for helpful discussions.

Financial support. This work was supported by the Department of Veterans Affairs.

Competing interests. C.J.D has received research grants from Clorox, Pfizer, and Ecolab. All other authors report no conflicts of interest relevant to this article.

References

- Volling C, Ahangari N, Bartoszko JJ, *et al.* Are sink drainage systems a reservoir for hospital-acquired gammaproteobacteria colonization and infection? A systematic review. *Open Forum Infect Dis* 2020;8:ofaa590.
- Dandalides PC, Rutala WA, Sarubbi FA Jr. Postoperative infections following cardiac surgery: association with an environmental reservoir in a cardiothoracic intensive care unit. *Infect Control* 1984;5:378–384.
- Kotay S, Chai W, Guilford W, Barry K, Mathers AJ. Spread from the sink to the patient: in situ study using green fluorescent protein (GFP) expressing-*E. coli* to model bacterial dispersion from hand washing sink trap reservoirs. *Appl Environ Microbiol* 2017;83:e03327–16.

4. Hajar Z, Mana TSC, Cadnum JL, Donskey CJ. Dispersal of gram-negative bacilli from contaminated sink drains to cover gowns and hands during hand washing. *Infect Control Hosp Epidemiol* 2019;40:460–462.
5. Cadnum JL, Livingston SH, Gestrich SA, Jencson AL, Wilson BM, Donskey CJ. Use of a stop valve to enhance disinfectant exposure may improve sink drain disinfection. *Infect Control Hosp Epidemiol* 2019;40:254–256.
6. Jones LD, Mana TSC, Cadnum JL, *et al*. Instillation of disinfectant behind a temporary obstruction created by an inflated urinary catheter balloon improves sink drain disinfection. *Am J Infect Control* 2019;47:1522–1524.7.
7. Jones LD, Mana TSC, Cadnum JL, Jencson AL, Silva SY, Wilson BM, Donskey CJ. Effectiveness of foam disinfectants in reducing sink-drain gram-negative bacterial colonization. *Infect Control Hosp Epidemiol* 2020;41:280–285.
8. Ramos-Castaneda JA, Faron ML, Hyke J, *et al*. How frequently should sink drains be disinfected? *Infect Control Hosp Epidemiol* 2020;41:358–360.
9. Glowicz JB, Landon E, Sickbert-Bennett EE, *et al*. SHEA/IDSA/APIC Practice recommendation: strategies to prevent healthcare-associated infections through hand hygiene: 2022 update. *Infect Control Hosp Epidemiol* 2023;44:355–376.