Effectiveness of Aseptic Stethoscope Barriers in Allowing Clean Contact for *Clostridioides Difficile*-Contaminated Stethoscopes

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Background

Healthcare-associated infections (HAIs), such as *C. difficile* colitis, pose a significant health risk. *C. difficile* is a spore-forming gram-positive anaerobic bacillus capable of surviving on various surfaces. While a strong emphasis has been placed on hand-washing and environmental cleaning with bleach products to limit the spread of *C.* difficile, stethoscope contamination has been poorly addressed.

Studies have demonstrated that the stethoscope diaphragm harbors similar levels and type of contamination to one's hands. While a non-alcohol-based solution is recommended for stethoscope hygiene in settings at risk for *C. difficile*, the use of an aseptic stethoscope diaphragm barrier has not been evaluated. Our purpose is to evaluate whether *C. difficile*-contaminated stethoscope diaphragms remain aseptic by the placement of an aseptic diaphragm barrier.

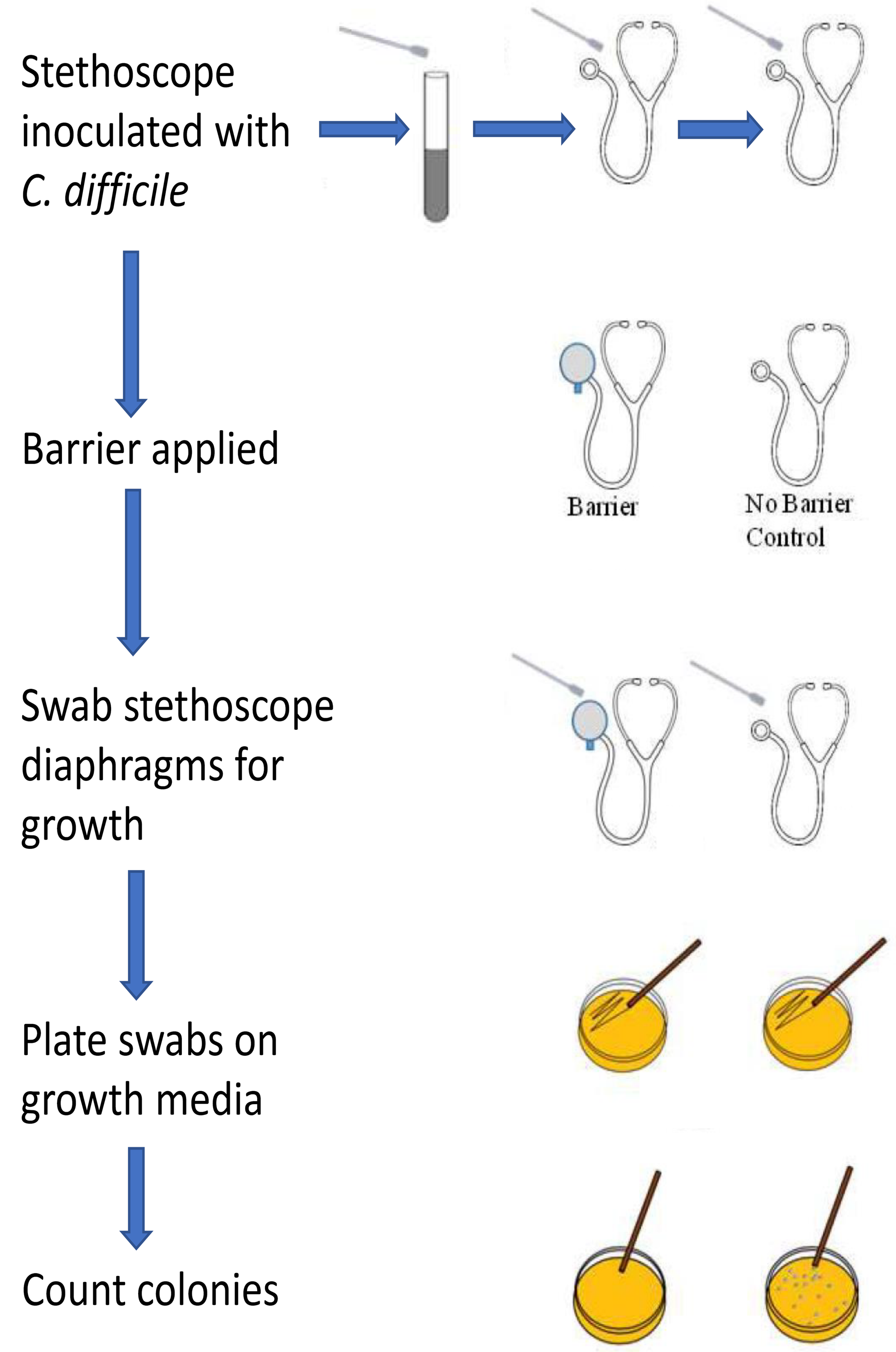

Figure 1. Flowsheet of method of stethoscope inoculation with barrier usage and subsequent culture.

Materials and Methods

Fresh cultures of *C. difficile* were diluted to 10^7 CFU/mL. After inoculating 16 stethoscope diaphragms with *C. difficile*, 8 had an aseptic diaphragm barrier applied, and 8 served as non-barrier controls. Contaminated stethoscopes were placed in an anaerobic incubator, then swabbed at 15 and 30 minutes, 2 and 4 hours, and 1, 2, 3, and 7 days after inoculation, and subsequently plated onto blood, chocolate, and cycloserine-cefoxitin fructose agar (Figure 1). These plates were incubated for 48 hours, and resulting colonies were manually counted. Statistical analysis was performed (RStudio version 1.0.153) by ANOVA (Analysis of Variance) with post-hoc Tukey HSD (Honestly Significant Difference).

Results

Overall, mean colony count was 33 CFU on the 8 stethoscope diaphragms without barriers, vs zero on those with barriers ($p \leq 0.05$). Growth rates were greatest at 48 hours, with colony counts as high as 160 (Figure 3). While stethoscope diaphragms without barriers had increasing rates of *C. difficile* culture growth, the presence of the barrier resulted in no growth in 100% of stethoscope diaphragms for up to 1 week after contamination (Figure 2).

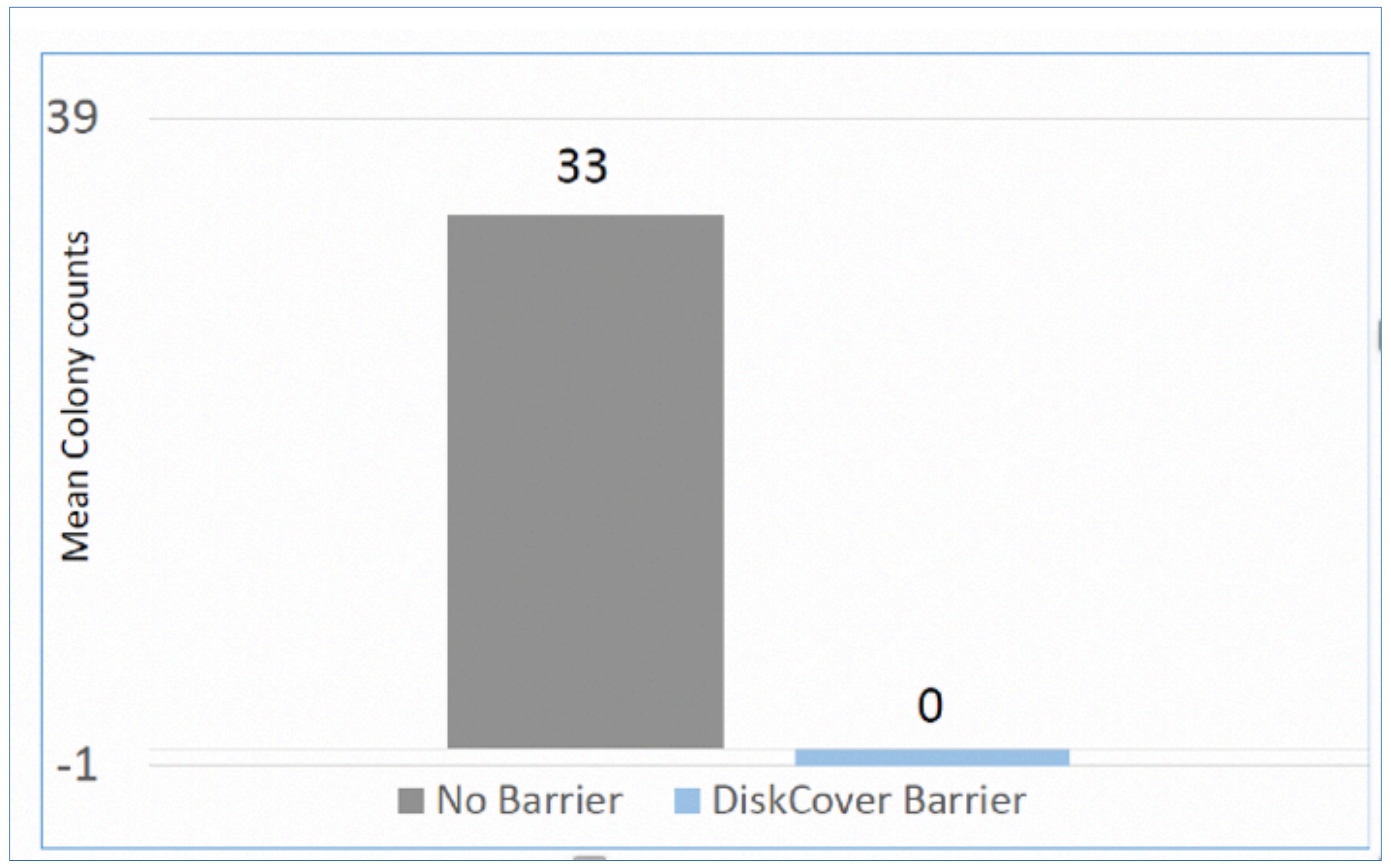

Figure 2. *C. difficile* cultures from stethoscope diaphragm with and without the disk cover

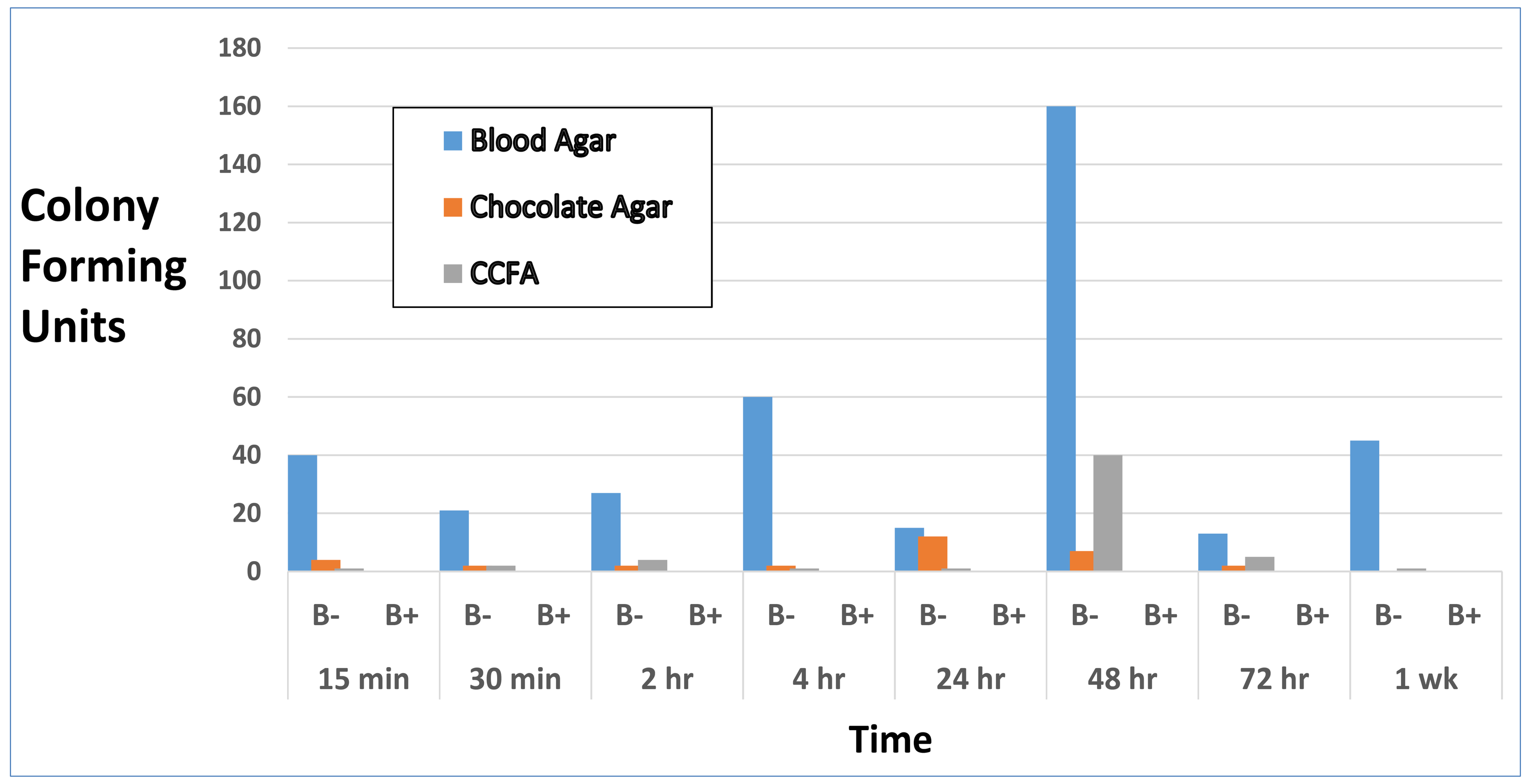

Figure 3. Longitudinal assessment of stethoscope diaphragm colony growth

Conclusion

Stethoscope diaphragm barriers will reduce the potential for transmission of *C. difficile* during examinations, reducing the risk of transmission of highly resistant bacterial spores to patients. In critical care environments, the use of disposable single-patient stethoscopes significantly impairs the quality of the physical exam due to the poor audio quality of these stethoscopes. Disposable stethoscope diaphragms allow not only for clean auscultation of patients, but safe usage of a provider's personal stethoscope that ensures optimal auscultation quality and the highest standard of care.

References

1. Lessa FC,Mu Y, Bamberg WM, et al. Burden of Clostridium difficile infection in the United States. N Engl J Med. 2015;372(9):825-834. doi:10.1056/NEJMoa1408913
2. Ma GK, Brensinger CM,Wu Q, Lewis JD. Increasing incidence of multiply recurrent Clostridium difficile infection in the United States: a cohort study. Ann Intern Med. 2017;167(3):152-158. doi:10.7326/M16-273
3. Rutala WA, Weber DJ, HICPAC HICPAC. Guideline for disinfection and sterilization in healthcare facilities. *Cent Dis Control Prot*. 2017:161. doi:10.1086/423182
4. Fenelon L, Holcroft L, Waters N. Contamination of stethoscopes with MRSA and current disinfection practices. *J Hosp Infect*. 2009;71(4):376-378. doi:10.1016/j.jhin.2008.11.009
5. Jones JS, Hoerle D, Riekse R. Stethoscopes: A Potential Vector of Infection? *Ann Emerg Med*. 1995;26(3):296-299. doi:10.1016/S0196-0644(95)70075-7

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Abstract

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Introduction

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Materials and Methods

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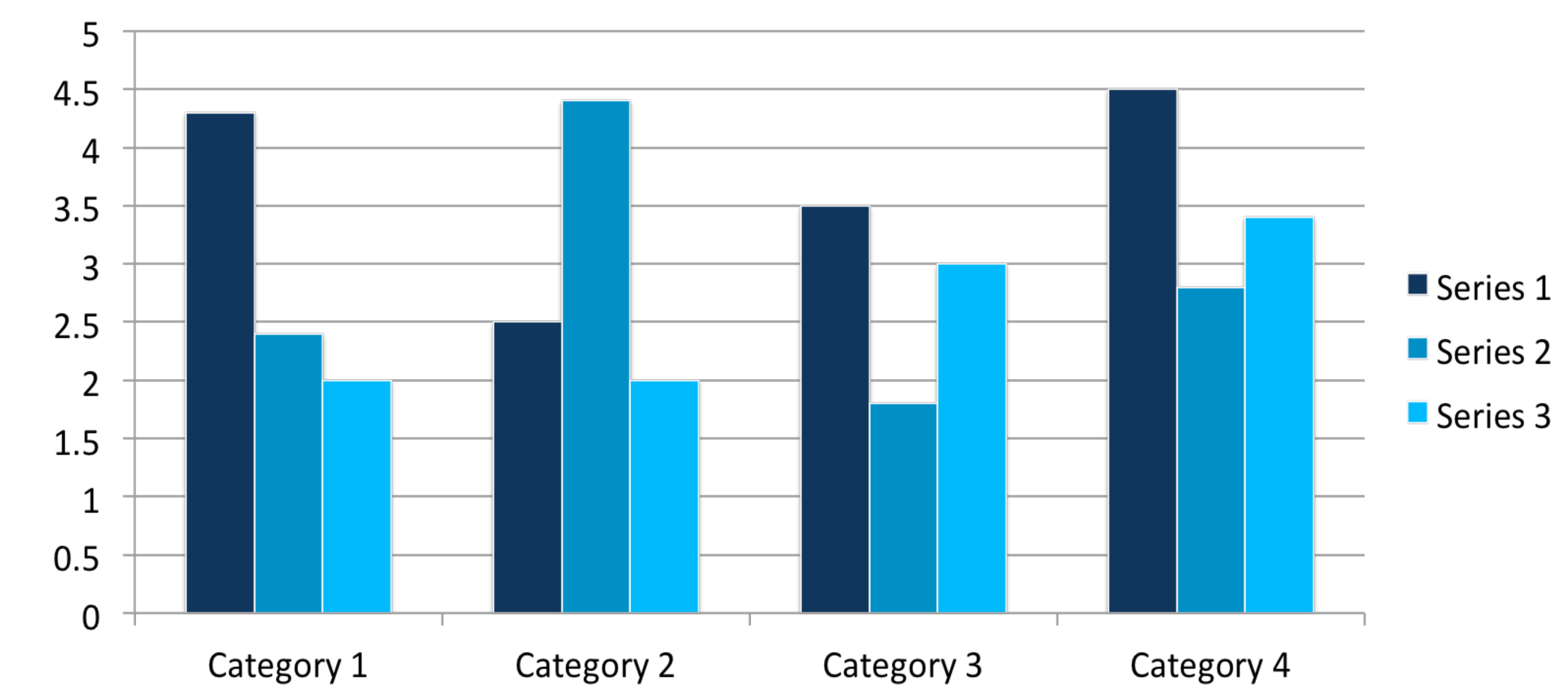

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Conclusion

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References

[1] R. M. Gupta, I. Newton, I. Sutherland, and Y. R. Wang, "The impact of decentralized configurations on networking," IBM Research, Tech. Rep. 746-13, Dec. 1999.

[2] H. Simon and E. Nehru, "A case for the World Wide Web," in Proceedings of the Workshop on Data Mining and Knowledge Discovery, July 2005.

[3] R. Agarwal, "A methodology for the simulation of e-commerce," in Proceedings of the Symposium on Game-Theoretic Technology, Nov. 2004.

[4] R. Needham and G. Zhou, "Decoupling DNS from access points in suffix trees," in Proceedings of NOSSDAV, Jul. 1991.

[5] F. G. Nehru, "Alamode: Pseudorandom, ubiquitous technology," in Proceedings of the WWW Conference, Jan. 1996.

[6] N. Sasaki, "Probabilistic, optimal symmetries," in Proceedings of PODS, Oct. 1997.