Infection Control & Hospital Epidemiology (2024), **45**, 910–912
doi:10.1017/ice.2024.42

SHEA

Letter to the Editor

"Wine"ing about blood culture bottles: using easy-to-follow visual cues to collect appropriate volumes

Marina Keller MD[1,2], Thai Nguyen MD[3], Jamie Palazzo[2], Kirsten Lawton[4], Matt Landers[4], Suzanne Hyatt[5] and Vishnu Chaturvedi PhD[5]

[1]Department of Infectious Diseases, Westchester Medical Center, Valhalla, NY, USA, [2]Department of Infection Prevention, Westchester Medical Center, Valhalla, NY, USA, [3]Department of Infectious Disease, Halifax Health Medical Center, Daytona Beach, FL, USA, [4]Department of Nursing, Westchester Medical Center, Valhalla, NY, USA and [5]Department of Pathology, Westchester Medical Center, Valhalla, NY, USA

Blood cultures are the key diagnostic test in the evaluation of bloodstream infections and sepsis. To increase the detection of bacteria and fungi in the blood culture bottle, a sufficient volume of blood must be assayed.[1–3] Patients with gram-negative septic shock may have less than 1 colony-forming unit of bacteria per mL of blood, so an increased volume of blood is needed to increase the threshold of detection.[1,4,5] The blood culture systems require a minimum volume for the instrumentation to detect changes in CO_2 accurately, which signals microbial growth. The minimum volume required for adult and pediatric patients weighing >11 kg is 5 mL; ideal volumes are more than 7 mL per bottle.[4,6] For pediatric patients weighing less than 11 kg, 1 bottle of 1–1.5 mL of blood is required for blood cultures.[4]

Therefore, it is crucial to fill a blood culture bottle with enough blood to maximize the detection of bacteremia. Current CLSI guidelines for adult blood culture collection recommend 2 sets, that is, 4 bottles of blood cultures, each filled with 10 mL of blood to maximize detection of bacteremia.[7] In practice, it is common to find poor bottle fill with many in the medical literature reporting that bottle fills less than 5 cc is a common problem.[8]

Blood culture bottles are labeled with rulers that are clearly marked at 1 mL increments. The rulers are positioned vertically along the length of the bottle and designed for bottles that are filled while held upright (Figure 1). However, for most blood culture draws, the bottles are held at approximately 45° to the patient's skin while filling the bottles, rendering the ruler challenging to use.

In the year prior to the project's onset, 40,419 adult blood culture specimens were drawn at our institution, 8,611 (21.0%) of which were drawn in the emergency room. The average blood volume per blood culture bottle was 1.7 mL (CI 1.7, 1.8) in October 2021. Since the first set of blood culture bottles is the most critical one for diagnosis, we decided to target our quality improvement intervention at the emergency room staff who see the patient first.

Many published quality improvement projects focused on increasing awareness of the importance of blood culture volume through education.[8–10] Sustainability at these sites was maintained through reminder education sessions and feedback from bottle volume data. The current project team brainstormed to find a way to not only educate the staff but to deliver the message in a way that would be hard to forget. After realizing that blood culture bottles have a similar shape and color to wine, the team decided that using wine bottles as a visual cue was impactful, memorable, and fun for the staff.

Over March and April of 2022, the team gave 5-minute informational sessions to emergency room staff at the time of shift change using two bottles of wine as a visual cue (Figure 1). End users were taught to fill the blood culture bottles with enough blood to turn the bottle the color of a cabernet wine. If the bottle was the

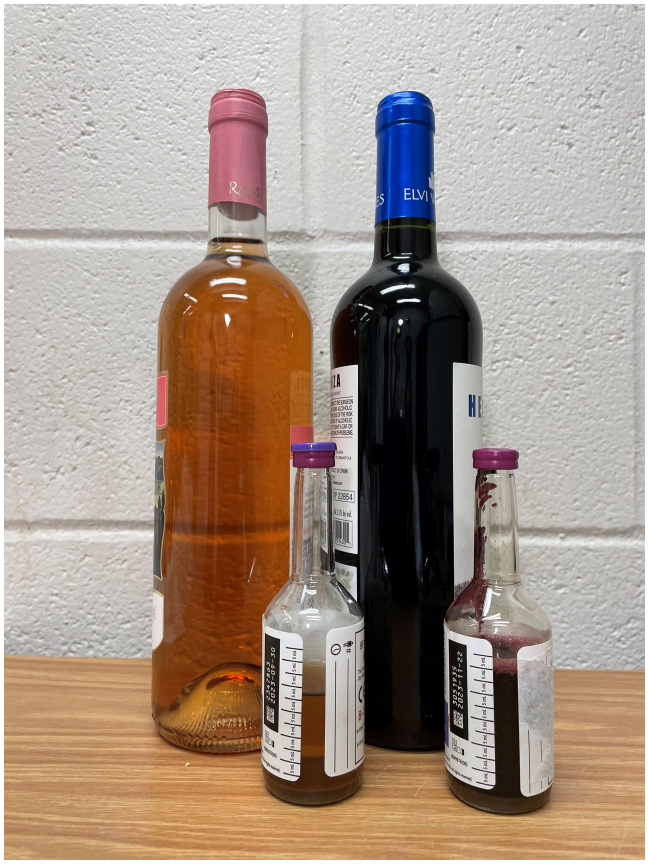

Figure 1. Light-colored wine next to an empty blood culture bottle with dark-colored wine near a properly filled blood culture bottle. Note the ruler marking off 5 mL increments along the vertical axis of the blood culture bottles.

Corresponding author: Marina Keller; Email: marina.keller@wmchealth.org

Cite this article: Keller M, Nguyen T, Palazzo J, *et al.* "Wine"ing about blood culture bottles: using easy-to-follow visual cues to collect appropriate volumes. *Infect Control Hosp Epidemiol* 2024. 45: 910–911, doi: 10.1017/ice.2024.42

© The Author(s), 2024. Published by Cambridge University Press on behalf of The Society for Healthcare Epidemiology of America.

https://doi.org/10.1017/ice.2024.42 Published online by Cambridge University Press

color of a rosé wine, then there was not enough blood in the bottle. In addition to it being an amusing teaching tool, the bottles of wine served as easy-to-remember visual cues. Seven educational sessions were conducted with verbal reinforcement of the blood culture bottle fill concept by the nursing leadership throughout the emergency department.

In only 4 months, the average adult blood culture bottle fill went to 4.3 mL (CI 3.9, 4.6). Over the subsequent year, the emergency room leadership received monthly reports of average bottle fill volumes. They used this data to further reinforce the volumes needed for blood culture bottle fill. After the end of a year of the project, the bottle volumes reached 5.8 mL (CI 5.5, 6).

Several centers have reported on successful performance improvement projects aimed at increasing blood culture bottle fill.[8–10] In a 10-hospital, 40-month project, average fill volumes increased from 2.3 mL to 8.6 through a multitude of methods.[8] Education using posters and presentations were directed at areas of the hospital that drew the most blood cultures such as the emergency department, and stickers or markers were placed on the bottles to indicate how much to fill the bottles.

The unique feature of the current project was the striking visual that had the staff talking about the educational sessions. This is an easy-to-implement educational tool that spurred a larger conversation about blood culture technique in general. The emergency room staff requested additional sessions on how best to obtain cultures to reduce contamination and how to optimize pediatric blood culture draws as well. A year later, the wine bottle visual cue is still being talked about in the emergency room, and blood culture volumes continue to rise.

Acknowledgments. None.

Financial support. No financial support was received for this project.

Competing interests. None of the authors have any conflicts to report.

References

1. Riedel S, Carroll KC. Blood cultures: key elements for best practices and future directions. *J Infect Chemother* 2010;16:301–316.
2. Gonzalez MD, Chao T, Pettengill MA. Modern blood culture: management decisions and method options. *Clin Lab Med* 2020;40:379–392.
3. Lin HH, Liu YF, Tien N, Ho CM, Hsu LN, Lu JJ. Evaluation of the blood volume effect on the diagnosis of bacteremia in automated blood culture systems. *J Microbiol Immunol Infect* 2013;46:48–52.
4. Huber S, Hetzer B, Crazzolara R, Orth-Höller D. The correct blood volume for paediatric blood cultures: a conundrum?. *Clin Microbiol Infect* 2020;26:168–173.
5. Gonsalves WI, Cornish N, Moore M, Chen A, Varman M. Effects of volume and site of blood draw on blood culture results. *J Clin Microbiol* 2009;47:3482–3485.
6. Lamy B, Sundqvist M, Idelevich EA; ESCMID Study Group for Bloodstream Infections, Endocarditis and Sepsis (ESGBIES). Bloodstream infections - Standard and progress in pathogen diagnostics. *Clin Microbiol Infect* 2020;26:142–150.
7. Clinical & Laboratory Standards Institute. *Principles and Procedures for Blood Cultures*, 2nd ed. CLSI guideline M47. Vol. 42. Wayne, PA: Clinical and Laboratory Standards Institute; 2022, pp. 1–98.
8. Khare R, Kothari T, Castagnaro J, Hemmings B, Tso M, Juretschko S. Active monitoring and feedback to improve blood culture fill volumes and positivity across a large integrated health system. *Clin Infect Dis*. 2020;70:262–268.
9. Birkhamshaw E, Winzor G. Increasing the volume of blood received in adult paired blood culture bottles at a regional public health laboratory: results of a quality improvement project to optimise the diagnosis of bacteraemia. *Infect Prev Pract* 2019;1:100007.
10. Kirby RS, Meloni JM, Naik KB, Minnear MD, Pettengill MA. Using individual collector blood culture volume data to improve fill volume. *Microbiol Spectr* 2023;11:e0210623. doi: 10.1128/spectrum.02106-23.

Not all consequences should be accepted: Letter to the Editor Reply to "Reportable infections following colon surgery in a large public healthcare system in New York City: the consequences of being a level 1 trauma center"

Preeti Mehrotra MD MPH[1,2], Ashley Dauphin MPH CIC[2], Matthew S. Lee MD[1,2] and Patrick S. Gordon DNP RN CIC[2]

[1]Division of Infectious Diseases, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA and [2]Division of Healthcare Quality, Beth Israel Deaconess Medical Center, Boston, MA, USA

To the Editor,

We were pleased to see the publication by Fornek et al,[1] "Reportable infections following colon surgery in a large public healthcare system in New York City: The consequences of being a level 1 trauma center." The authors describe the colorectal surgery surgical site infection (SSI) surveillance experience of the New York City Health and Hospital system. In their detailed descriptive analysis, the authors note that patients at level 1 trauma centers had significantly increased American Society of Anesthesiology (ASA) scores, durations of surgery, rates of delayed wound closure, and rates of class 4 (dirty) wounds, resulting in higher standardized infection ratios (SIRs) when compared to the other hospitals.[1] The authors go on to discuss the lack of appropriate risk adjustment for traumatic versus non-traumatic colorectal surgeries in current models used by the National Healthcare Safety Network (NHSN) and conclude that the associated financial and reputational penalties exacerbate inequities and create perverse incentive structure in health care.

Corresponding author: Preeti Mehrotra; Email: pmehrotr@bidmc.harvard.edu

Cite this article: Mehrotra P, Dauphin A, Lee MS, Gordon PS. Not all consequences should be accepted: Letter to the Editor Reply to "Reportable infections following colon surgery in a large public healthcare system in New York City: the consequences of being a level 1 trauma center". *Infect Control Hosp Epidemiol* 2024. 45: 911–912, doi: 10.1017/ice.2024.41

© The Author(s), 2024. Published by Cambridge University Press on behalf of The Society for Healthcare Epidemiology of America.