Q&A column

Editor: Frederick L. Kiechle, MD, PhD

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Q. Are there established benchmarks for such transfusion services quality monitors as C:T ratio, blood product waste, and cancellation of suboptimal specimens?

A.February 2022—Unfortunately, there are few studies that meet the strictest definition of benchmarking within transfusion medicine.[1] In addition, we have not found a source that provides suggested transfusion medicine quality improvement monitors with associated target benchmark values.

There are member-based organizations that provide benchmarking databases that allow health care institutions to compare their key performance measures against those of similar-sized organizations or against national aggregated data. Alternatively, institutions can perform their own auditing of key performance measures to detect potential inefficiencies or inappropriate use of resources.[2,3] Below are findings from several studies that provide individual or aggregated multi-institutional data with benchmarks for quality monitors in transfusion medicine.

Crossmatch to transfusion (C:T) ratio. This metric assesses the efficiency of a clinical team's blood-ordering practices versus its use of blood. Ideally the C:T ratio should be 1:1. However, most studies endorse a goal C:T ratio of less than 2 or 2.5 to provide a safety margin for unexpected hemorrhage.[4,5] A study of transfusion practices at more than 1,600 institutions revealed that the top 10 percent of institutions had a C:T ratio of less than 1.5, while the lowest performers had a C:T ratio of greater than 2.4. Based on the results, the authors of the study recommended a C:T ratio of less than 2.[6]

A C:T ratio of greater than 2 for a clinical service line or per surgical procedure type would be flagged as potentially inappropriate and should prompt the transfusion service to discuss with the clinical service whether to modify ordering and transfusion practices.

Crossmatch to issue (C:I) ratio. This quality indicator, first proposed by Lin, et al., assesses how often a crossmatched unit is issued. It is evaluated independently of the clinical services' utilization and is not linked to disposition of the blood (whether it is wasted, returned, or transfused). This metric reflects how the transfusion service manages and uses blood inventory.[7]

An international survey of 52 institutions noted that the C:I ratio differed among institutions based on the predominant testing method used (electronic crossmatch versus serologic crossmatch) and whether crossmatching was performed when the product order was received or when the product was issued. Based on the results, the authors proposed a target C:I ratio benchmark of less than 1.15.[8]

Blood product waste. There are many ways to measure and calculate waste, so an institution should define the metric it wants to use. The transfusion service should decide whether to include or separate out expired units caused by inventory mismanagement and determine the desired method of calculation. These decisions will allow the institution to compare similar benchmark measures. Several studies provide data on waste rates for blood components for comparison purposes.[6,9,10]

A red blood cell waste rate of less than one percent generally is achievable and is a reasonable benchmarking goal.[6,11] A CAP Q-Probes study differentiates expired blood components from other sources of waste. This study proposed that institutions adopt a goal expiration rate of less than one percent and a waste rate of less than 0.5 percent.[6]

Another CAP Q-Probes study focused on the expiration rate of plasma and platelets. The study reported that top-performing institutions had an expiration rate for plasma and platelets of less than 0.6 percent, while lower-performing institutions had an expiration rate of greater than 13.8 percent. Likewise, high performers had a waste rate of less than 0.5 percent and low performers had a waste rate of greater than 6.8 percent. This study concluded that institutions can achieve plasma and platelet expiration rates below one percent.

Expiration and waste rates can differ between small and large hospitals[10] and based on the type of patient population. For example, hospitals that serve patient populations with a higher incidence of emergencies that involve massive bleeding, such as during childbirth or with trauma, may have a higher rate of waste.[12,13] Therefore, the size of a hospital, blood inventory levels, and patient populations should be taken into account when determining appropriate expiration and waste rates for benchmarking.[7]

Cancellation of suboptimal specimens. How often a specimen is rejected by a laboratory as unacceptable ranges from 0.2 to 0.75 percent.[14-16]

In transfusion medicine, the most worrisome samples are those that are improperly labeled or contain blood belonging to another patient (wrong blood in tube, or WBIT). A study of 30 institutions determined that mislabeled specimens occurred at a rate of 7.4 per 1,000 specimens and WBIT occurred in 0.43 per 1,000 specimens submitted. Institutional findings ranged from zero occurrences of mislabeled specimens and WBIT to more than 18 mislabeled and two WBIT specimens for every 1,000 specimens received by the blood bank.[17] Because of the severe consequences associated with these inappropriate specimens, the goal should be zero per 1,000 mislabeled samples and WBITs. An institution should use quality metrics and processes to identify and reject these types of specimens.

1. Heddle NM, Barty R. Benchmarking: applications to transfusion medicine. *ISBT Science Series*. 2013;8(1):93–99.
2. Bhatnagar NM, Shital S, Gajjar M, Shah M, Shah S, Patel V. Performance indicators: a tool for continuous quality improvement. *Asian J Transfus Sci*. 2016;10(1):42–47.
3. Yazer MH. Auditing as a means of detecting waste. *ISBT Science Series*. 2018;13(1):29–34.
4. Boral LI, Henry JB. The type and screen: a safe alternative and supplement in selected surgical procedures. *Transfusion*. 1977;17(2):163–168.
5. Zewdie K, Genetu A, Mekonnen Y, Worku T, Sahlu A, Gulilalt D. Efficiency of blood utilization in elective surgical patients. *BMC Health Serv Res*. 2019;19(1):804.
6. Novis D, Renner S, Friedberg R, Walsh MK, Saladino AJ.

Quality indicators of blood utilization: three College of American Pathologists Q-Probes studies of 12,288,404 red blood cell units in 1639 hospitals. *Arch Pathol Lab Med*. 2002;126(2):150–156.

7. Lin DM, Goldfinger D, Lu Q, et al. Measuring trade-offs that matter: assessing the impact of a new electronic cross-match policy on the turnaround time and the cross-match workload efficiency. *Transfusion*. 2014;54(12):3075–3079.
8. Yazer MH, Alcantara R, Beizai P, et al. The crossmatch/issue ratio: use of a novel quality indicator and results of an international survey on RBC crossmatching and issuing practices. *Am J Clin Pathol*. 2016;146(2):238–243.
9. Yazer MH, Abraham S, Beckman N, Folléa G. International Society for Blood Transfusion international survey on blood product wastage in hospitals. *ISBT Science Series*. 2016;11(1):24–31.
10. Novis D, Renner S, Freidberg RC, Walsh MK, Saladino AJ. Quality indicators of fresh frozen plasma and platelet utilization: three College of American Pathologists Q-Probes studies of 8981796 units of fresh frozen plasma and platelets in 1639 hospitals. *Arch Pathol Lab Med*. 2002;126(5):527–532.
11. Zoric L, Daurat G, Demattei C, et al. Blood wastage reduction: a 10-year observational evaluation in a large teaching institution in France. *Eur J Anesthesiol*. 2013;30(5):250–255.
12. Dunbar NM, Olson NJ, Szczepiorkowski ZM, et al. Blood component transfusion and wastage rates in the setting of massive transfusion in three regional trauma centers. *Transfusion*. 2017;57(1):45–52.
13. Yazer MH, Dunbar NM, Cohn C, et al. Blood product transfusion and wastage rates in obstetric hemorrhage. *Transfusion*. 2018;58(6):1408–1413.
14. Karcher DS, Lehman CM. Clinical consequences of specimen rejection: a College of American Pathologists Q-Probes analysis of 78 clinical laboratories. *Arch Pathol Lab*

Med. 2014;138(8):1003–1008.
15. Jones BA, Meier F, Howanitz PJ. Complete blood count specimen acceptability: a College of American Pathologists Q-Probes study of 703 laboratories. *Arch Pathol Lab Med*. 1995;119(3):203–208.
16. Zarbo RJ, Jones BA, Friedberg RC, et al. Q-Tracks: a College of American Pathologists program of continuous laboratory monitoring and longitudinal performance tracking. *Arch Pathol Lab Med*. 2002;126(9):1036–1044.
17. Novis DA, Lindholm PF, Ramsey G, Akorn KW, Souers RJ, Blond B. Blood bank specimen mislabeling: a College of American Pathologists Q-Probes study of 41333 blood bank specimens in 30 institutions. *Arch Pathol Lab Med*. 2017;141(2):255–259.

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Q. If we collect only enough blood to inoculate one blood culture bottle, should we inoculate the aerobic or anaerobic bottle?

A.Let us assume that the patient is an adult and that 10 mL of blood was collected to fill a single aerobic or anaerobic blood culture bottle. A single aerobic bottle containing 10 mL of blood for detecting bacteremia has a clinical sensitivity of about 60 percent, according to one modern study that used a continuous monitoring system. The clinical sensitivity of a single anaerobic bottle with the same volume of blood would be even lower because anaerobic media would not recover obligate aerobes, such as *Pseudomonas* species.

For this example I would recommend performing a second venipuncture to collect an additional 30 mL of blood to achieve a total of at least 40 mL. This would increase the sensitivity to about 90 percent. The blood should be distributed equally between the aerobic and anaerobic bottles. Patel and colleagues showed that inoculating an aerobic bottle plus an anaerobic bottle may provide a better yield than would inoculating two aerobic bottles. Finally, a second venipuncture is widely recommended for evaluating whether a potential contaminating organism,

such as *Staphylococcus epidermis* or *Bacillus* sp., recovered during a blood draw is a contaminant or the cause of bacteremia.

My advice is to make every effort to collect enough blood to inoculate both the aerobic and anaerobic bottles. I don't think there are many situations where obtaining more blood is impossible.

Clinical and Laboratory Standards Institute. M47: Principles and Procedures for Blood Cultures; Approved Guideline, 1st ed.; 2007.

Doern GV, Carroll KC, Diekema DJ, et al. Practical guidance for clinical microbiology laboratories: a comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. *Clin Microbiol Rev.* 2019;33(1):e00009-19.

Patel R, Vetter EA, Harmsen WS, Schleck CD, Fadel HJ, Cockerill FR III. Optimized pathogen detection with 30- compared to 20-milliliter blood culture draws. *J Clin Microbiol*. 2011;49(12):4047–4051.

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