Infection Monitoring in Dialysis Units: A Plea for "Cleaner" Data

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Vascular access–related infection in patients on dialysis meets all of the criteria that define a good metric for a quality monitoring program. Infections are a leading cause of morbidity and mortality, care practices in the dialysis unit influence their occurrence (*e.g.*, central vascular catheter removal, use of rope ladder versus buttonhole cannulation of arteriovenous fistulas [1]), and bloodstream infection can be defined objectively in the laboratory. The requirement for all Medicare-licensed outpatient dialysis facilities to report access-related infections to the National Health Safety Network (NHSN; the country's largest infection surveillance program) as of 2012 and the addition of bloodstream infection as a Centers for Medicare and Medicaid Services performance measure in 2014 are important steps toward reducing access-related infections in patients on dialysis and the high morbidity and costs that accompany these events.

In this issue of the *Clinical Journal of the American Society of Nephrology*, Ngyuen *et al.* (2) report on the data submitted by 6005 (94%) Medicare-licensed outpatient dialysis facilities nationwide to the NHSN Dialysis Event (DE) program in 2014. This is the first truly national report of the NHSN DE (prior reports are on the basis of voluntary participation of a small number of units) and the first year that bloodstream infection rates affected facility reimbursement. There are several important findings. (*1*) Central venous catheters exponentially increase the risk of all three events monitored (bloodstream infections; intravenous antibiotic starts; and pus, redness, or increased swelling of a vascular access) as well as the risks for drug-resistant pathogens and hospitalization as a result of the event. (*2*) Rates of bloodstream infections and localized vascular access infections seem to have declined compared with prior years, although disproportionately, antibiotic starts have not. (*3*) *Staphylococcus aureus* is the most common blood-borne pathogen isolated (31%) followed by *Staphylococcus epidermidis* and other coagulase-negative *Staphylococcus* (25%), with Gram-negative organisms accounting for 12.5% of isolates. (*4*) Thirty-nine percent of *S. aureus* is methicillin resistant, and (*5*) vancomycin is the antimicrobial started in 76% of intravenous antibiotic initiations. There is a vast literature showing adverse outcomes with catheters (3), and the NHSN DE data lend further support to the "Catheter Last" campaign. The high rates of bloodstream infections with methicillin-resistant *S. aureus* and coagulase-negative *Staphylococcus* certainly justify the initiation of vancomycin, the "go to" antibiotic in most dialysis units, although 60% of *S. aureus* isolates are not methicillin resistant. The frequency of vancomycin overutilization is not able to be discerned from these data but could be if the antibiotic continued was also reported. This addition would seem to be important in light of a recent meta-analysis that estimates that one of every eight patients on dialysis treated with vancomycin in the prior 1–12 months is colonized with vancomycin-resistant enterococcus and that colonization imparts a 22-fold higher risk for vancomycin-resistant enterococcus infection (usually a bloodstream infection) (4). Mandatory reporting of the reason for initiation and continuing antibiotics may be considered as an additional strategy to curtail overutilization of vancomycin and antimicrobials in general (5).

The large (nearly 50%) decline in rates of bloodstream and localized vascular access infections from 2006 to 2014 reflects improved practices, such as the reduction in central vascular catheter use during this timeframe (6); however, under-reporting of events is suspected given that (*1*) the intravenous antibiotic initiation rate is unchanged; (*2*) the combined number of bloodstream infections ($n=29{,}516$) and pus, redness, and swelling of vascular access events (38,310) accounts for fewer than one half of antimicrobial starts ($n=149{,}722$); and (*3*) 13% of facilities reported no bloodstream infections in 2014. A separate study (7), in which data completeness of bloodstream infection (for methicillin-resistant *S. aureus*) events identified in the NHSN was compared with that reported by trained personnel to the Centers for Disease Control and Prevention's Emerging Infections Program, also suggests gross under-reporting. Of the 694 methicillin-resistant *S. aureus* bloodstream infections that were identified by the Emerging Infections Program, only 11% matched to a methicillin-resistant *S. aureus* bloodstream infection in the NHSN, an additional 11% matched to a *S. aureus* bloodstream infection in the NHSN, and 19% matched an antibiotic start in the NHSN. These data are on the basis of sampling of a small number of selected counties but if representative, would suggest that approximately 60% of bloodstream infections are not being reported to the NHSN.

The major problem is that event reporting to the NHSN is on the basis of an honor system—dialysis units report their own data. There is no cross-validation,

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audit, or other reconciliation process to ensure that events are reported accurately. This Quality Improvement Project measure (bloodstream infections) places more burden on the dialysis unit staff to identify and report than any of the other measures, including following up on blood culture results, investigating the reason for continuing intravenous antibiotics in a patient returning from hospital, keeping track of events and entering them into the database. However, there is also a financial disincentive with identifying bloodstream infections. We suspect that there are "less innocent" reasons for missing data and that some dialysis units may have gone so far as to implement policies and procedures to reduce the likelihood of diagnosing a bacteremia in the unit (for example, by instructing staff not to draw blood cultures at the unit but to send all patients with fever to the emergency room or prescribing a course of antimicrobials without drawing cultures). Delaying the start of antibiotics, treating with ineffective antibiotics, or administering a prolonged course of antibiotics unnecessarily is "bad medicine" and puts patients at even greater risk for serious complications. The inaccuracies of the data, whether by error or intention, undermines the Quality Improvement Project, reduces opportunities for quality improvement, penalizes those who have been honest and taken care to collect their data accurately, and perversely, may have put patients at more risk if efforts are being made to reduce the diagnosis of a bloodstream infection.

One proposed solution is to require mandatory reporting by laboratories of positive blood cultures originating in outpatient dialysis facilities or drawn within 48 hours of hospitalization to the NHSN. Hospitals are familiar with this setup, because they have been required to report hospital-acquired infections (including bloodstream infections occurring >48 hours after admission) to the NHSN since 2011 (8). It would be important for laboratories outside of hospitals (*e.g.*, the central laboratories of national dialysis providers) to be included in the mandatory reporting policy, because they often receive blood cultures from outpatient dialysis units. Direct reporting by the laboratory would provide the additional benefits of greater consistency in the determination of a contaminant from an infection (which is currently subject to interpretation by the treating physician) and more complete culture and sensitivity data, the latter being important for assessing variations in organisms and susceptibilities by region and over time and the appropriateness of antimicrobial use. An alternate approach would be to conduct random audits on a wider scale than is currently performed under the Emerging Infections Program.

Although we have made several suggestions for improving data quality, we recognize the utility of the NHSN data, even in their current form. This was illustrated in a recent study (9) that identified and targeted the bottom 20% of performers on the bloodstream infection measure in the US Renal Data System Network 13 for an intensive staff and patient education program. Implementation of the quality initiative led to improvements in hand hygiene and an increase in patient engagement in the infection control process, and this was associated with statistically significant ($P<0.001$) reductions in bloodstream infections.

Having accurate data are also important, because they provide opportunities for research, including the potential to conduct large-scale pragmatic studies, with the NHSN DE serving as a platform for collecting data. Several unanswered questions remain, including whether outcomes are superior with catheter removal/replacement versus treating through, whether replacement over a wire is equivalent, and whether antibiotic locks have any role to play. Having accurate data on practices and outcomes in a large national population would enable more rigorous analyses than have been done previously (10) and the ability to conduct risk-benefit analyses by organism and host characteristic(s).

In closing, we make a plea to the dialysis community to clean up the data, so that the Quality Improvement Project is fairer for all, and enable the full potential of these data for both improving care now and generating evidence to provide future opportunities to improve care and outcomes to be realized.

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References

1. MacRae JM, Ahmed SB, Atkar R, Hemmelgarn BR: A randomized trial comparing buttonhole with rope ladder needling in conventional hemodialysis patients. *Clin J Am Soc Nephrol* 7: 1632–1638, 2012
2. Ngyuen, Shugart A, Lines C, Shah AB, Edwards J, Pollock D, Sievert D, Patel PR: *Clin J Am Soc Nephrol* 12: 1139–1146, 2017
3. Ravani P, Palmer SC, Oliver MJ, Quinn RR, MacRae JM, Tai DJ, Pannu NI, Thomas C, Hemmelgarn BR, Craig JC, Manns B, Tonelli M, Strippoli GF, James MT: Associations between hemodialysis access type and clinical outcomes: A systematic review. *J Am Soc Nephrol* 24: 465–473, 2013
4. Zacharioudakis IM, Zervou FN, Ziakas PD, Rice LB, Mylonakis E: Vancomycin-resistant enterococci colonization among dialysis patients: A meta-analysis of prevalence, risk factors, and significance. *Am J Kidney Dis* 65: 88–97, 2015
5. D'Agata EM: Antimicrobial use and stewardship programs among dialysis centers. *Semin Dial* 26: 457–464, 2013
6. United States Renal Data Systems 2016 Annual Data Report, Volume 2, Chapter 4. Available at: https://www.usrds.org/2016/view/v2_04.aspx. Accessed May 12, 2017
7. Nguyen DB, See I, Gualandi N, Shugart A, Lines C, Bamberg W, Dumyati G, Harrison LH, Lesher L, Nadle J, Petit S, Ray SM, Schaffner W, Townes J, Njord L, Sievert D, Thompson ND, Patel PR: Completeness of methicillin-resistant staphylococcus aureus bloodstream infection reporting from outpatient hemodialysis facilities to the National Healthcare Safety Network, 2013. *Infect Control Hosp Epidemiol* 37: 205–207, 2016
8. Available at: https://www.cdc.gov/nhsn/acute-care-hospital/clabsi/index.html Accessed May 12, 2017
9. Ball LK, George CA, Duval L, Hedrick NN: Reducing blood stream infection in patients on hemodialysis: Incorporating patient engagement into a quality improvement activity. *Hemodial Int* 20[Suppl 1]: S7–S11, 2016
10. Aslam S, Vaida F, Ritter M, Mehta RL: Systematic review and meta-analysis on management of hemodialysis catheter-related bacteremia. *J Am Soc Nephrol* 25: 2927–2941, 2014

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