Preventing Infections in the ICU
One Size Does Not Fit All
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Healthcare-associated infections remain an important and potentially modifiable source of morbidity and mortality in the intensive care unit (ICU). Notable successes in this arena have centered on “bundles” to prevent central line–associated bloodstream infection and ventilator-associated pneumonia.1,2 More recently, several studies have demonstrated the benefits of chlorhexidine bathing, both to prevent bloodstream infections and to decrease acquisition of drug-resistant organisms.3-4 The evidence for other measures is less clear, including active surveillance for antibiotic-resistant organisms and expanded contact precautions.5 Given the central role of the hands and clothing of health care workers in the spread of antibiotic-resistant organisms, the potential value of universal glove and gown use to prevent infection is intriguing, yet evidence to support this approach is lacking.

In this issue of JAMA, Harris and colleagues6 report the results of a cluster randomized trial assessing the efficacy of universal use of gloves and gowns to reduce acquisition of methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant Enterococcus (VRE) colonization. During the 9-month study, investigators enrolled 26,180 patients from 20 medical and surgical ICUs across the United States. In the intervention units, health care workers wore gloves and gowns for all patient contact and when entering any patient room. In the control units, health care workers wore gloves and gowns based on Centers for Disease Control and Prevention guidelines—only for patients with clinically identified antibiotic-resistant bacteria.

Universal glove and gown use did not appear beneficial in preventing MRSA or VRE acquisition (the primary outcome); the rates of MRSA or VRE acquisition per 1000 patient-days decreased from 21.4 at baseline to 16.9 during the study period in the intervention ICUs, whereas acquisitions in the control ICUs decreased from 19.0 at baseline to 16.3 during the study period (between-group difference, −1.71; 95% CI, −6.15 to 2.73 acquisitions per 1000 patient-days; P = .57). Among the secondary outcomes, the investigators observed a lower risk of MRSA acquisition in the intervention ICUs (between-group difference, −2.98; 95% CI, −5.58 to −0.38 acquisitions per 1000 patient-days; P = .046), although this finding requires replication.

Even though this well-executed trial did not demonstrate evidence to support the use of universal gloves and gowns, several aspects deserve careful consideration. One reason for the absence of benefit may be related to the lack of effect on preventing VRE acquisition. As the authors suggest, variations in the biology of VRE and MRSA may have played a role. Although this is a matter of speculation, errors with the ascertainment of baseline VRE colonization are one possibility. Given the established relationship between antimicrobial exposure and the density of VRE colonization in the gastrointestinal tract, some patients with low levels of VRE may have been misclassified due to a false-negative baseline culture.7 Compared with rates of MRSA, rates of VRE acquisition were approximately 2-fold higher in both groups, lending additional support to the possibility that some of the VRE “acquisitions” simply reflect false-negative screening tests. The investigators did not measure the effect of gloves and gowns on acquisition of other organisms, including increasingly important multidrug-resistant gram-negative pathogens such as carbapenem-resistant Enterobacteriaceae.

Despite efforts to match ICUs by MRSA and VRE acquisition rates, intervention units had higher baseline levels of MRSA acquisition than did control units with a mean rate of 10.03 vs 6.98 acquisitions per 1000 patient-days. In reconciling the larger decrease in MRSA acquisition observed in intervention units, the question of regression to the mean does arise. However, when the authors performed a secondary analysis adjusting for the percentage of patients colonized with MRSA on admission, the results remained statistically significant. Also, previous work supports the notion of higher “colonization pressure” resulting in an increased risk of transmission, particularly in the ICU.8,9 Mean colonization rates in both groups were relatively modest, raising questions of generalizability in settings where MRSA, VRE, and other resistant organisms are more ubiquitous. In some ICUs, rates of resistance are high enough that the units are functionally “universal” in terms of glove and gown use.

Another secondary but notable finding in the study by Harris et al is the lack of difference in adverse event rates between groups. This contrasts earlier work that highlighted safety concerns and unintended consequences associated with contract precautions including falls and pressure ulcers.10 Only a subset of patient charts was reviewed and specific details of adverse events were not included. Also, it is possible that harm was not measured in all relevant domains, such as whether, from the patient’s perspective, the routine use of gloves, gowns, and masks may have had an isolating effect on patients. Although the observation in the study by Harris et al that universal glove and gown use was not associated with adverse events requires replication, if confirmed, this is an instructive message. Questions can be asked about whether health care worker behavior has somehow changed in the decade since Stelfox et al10 first noted these concerns. Perhaps the overall emphasis on patient safety has transformed the way care is de-

Related article page 1571
The use of contact precautions was suboptimal. Climo et al found that daily bathing with chlorhexidine gluconate (CHG) reduced the risk of hospital-acquired bloodstream infections and also decreased acquisition of VRE but not MRSA. Milstone et al performed a similar study that involved critically ill children, reporting that daily CHG baths were associated with a lower incidence of bloodstream infection than was a standard bathing routine. In the Randomized Evaluation of Decolonization vs Universal Clearance to Eliminate MRSA (REDUCE MRSA) trial, Huang et al tested 3 approaches to prevent MRSA infection in 74 ICUs including active surveillance and isolation as well as targeted vs universal decolonization using CHG bathing and intranasal mupirocin. The authors found that universal decolonization was more effective than other strategies in reducing rates of MRSA clinical infections and bloodstream infections from any pathogen.

The evidence to support infection prevention efforts is a moving target; contact precautions and decolonization strategies are just a few components of an expanding armamentarium. When evaluating these individual interventions, one argument might be that the likelihood of harm (more than clear evidence of benefit) should drive the decision to implement. As such, perhaps it is not the lack of benefit for universal use of gloves and gowns in preventing VRE and MRSA acquisition that is the most noteworthy finding of the study by Harris et al but rather the suggested lack of harm in using this approach.

Even though the results of Harris et al failed to demonstrate an overall benefit of universal use of gloves and gowns to reduce acquisition of MRSA or VRE, this approach may be worth considering in some instances; for example, if MRSA transmission is prevalent in a high-risk setting such as a surgical ICU with a large number of patients with newly implanted medical devices. If implemented, gloving and gowning should be just part of an overall strategy that includes efforts to optimize hand hygiene and prudent use of antimicrobials. Given the strength of evidence from multiple studies, CHG bathing is being adopted at many institutions among patients at increased risk of bloodstream infections, particularly those with indwelling central catheters both in ICUs and in hematology-oncology units. Mupirocin use is also gaining favor. Although efficacious for MRSA decolonization, mupirocin does not affect emerging gram-negative organisms and resistance can develop, which remains a limitation to universal use. The relative ease of an intervention must also be considered. Although not specifically addressed in this study, wearing gloves and gowns for all patient care is burdensome, both physically and in terms of health care worker time. By comparison, bathing a patient using CHG is relatively simple. These and other trade-offs underscore the need to make decisions in a more holistic fashion.

Although it is appealing to believe there is a simple approach to what should and should not be done to prevent infection in the ICU, best practices are more nuanced and unfortunately, one size does not fit all. The final approach must be adapted to fit the epidemiology of specific ICUs and should also consider the type of resources available. The study by Harris et al serves as a poignant reminder that many questions remain for what constitutes best practice in the care of critically ill patients. Ongoing investment in these sorts of resource-intensive trials is essential for continued progress.