The upsurge in bacteria that are resistant to many commonly used antimicrobials has led to growing concern among infectious disease specialists [1]. The increasing worldwide incidence of multidrug-resistant tuberculosis [2, 3], the emergence of quinolone-resistant strains of Neisseria gonorrhoeae [4], and reports of panresistant Acinetobacter baumannii infections requiring treatment with older antibiotics once set aside because of their toxicities [5] are but a few examples. Two of the more prominent antibiotic-resistant pathogens are methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE). According to a recent report from the National Nosocomial Infections Surveillance system of the US Centers for Disease Control and Prevention (CDC), MRSA accounted for nearly 60% of all nosocomial S. aureus infections in intensive care units (ICUs), whereas 29% of enterococcal infections in this population were caused by vancomycin-resistant species [6].

Infection with either pathogen leads to substantial morbidity and mortality, even compared with infection with their antibiotic-sensitive counterparts. MRSA infections have been associated with more prolonged hospitalizations, higher costs, and higher mortality than methicillin-sensitive S. aureus infections [7–10]. VRE, which is sometimes wrongly considered to be a minor pathogen, can also cause substantial morbidity. Bacteremia caused by VRE, after adjustment for severity of illness, is associated with higher recurrence, mortality, and excess costs than vancomycin-sensitive enterococcal infection [11–13].

Individuals can become colonized with the organisms in pathogen-specific niches: MRSA primarily in the nares and VRE in the intestinal mucosa. Although colonization precedes infection, not all colonized persons will develop MRSA or VRE infection. Persons colonized with either organism, however, can serve as a nidus for secondary transmission. The incidence of MRSA colonization, assisted in no small part by the epidemic of community-acquired MRSA, has markedly increased in many communities. In Nashville, for example, MRSA nasal carriage increased >10-fold in healthy children from 2001 to 2004 [14].

The increasing burden of colonization and disease caused by both pathogens has led to an increased emphasis on preventive strategies to reduce their transmission. In 2003, the Society for Healthcare Epidemiology of America (SHEA) released its guideline for preventing the nosocomial transmission of MRSA and VRE [15]. This document outlined a comprehensive set of strategies with 3 main foci. First, the guideline recommends the identification of hospitalized patients colonized with MRSA and VRE via active microbiologic screening of patients at high risk for carriage of either organism and the tracking of previously colonized or infected patients at readmission. Second, prevention of secondary transmission of these organisms via the use of contact precautions, patient cohorting, and emphasis on hand hygiene is suggested. Finally, the guideline includes the need to reduce factors responsible for the selection of these resistant pathogens by antibiotic stewardship. Once released, these recommendations caused consternation among some clinicians and led to a division among the traditionally tightly knit group of infection control professionals [16–18].

Although most infection control spe-
cialists endorse a majority of recommendations in the SHEA guideline, the role played by active culture surveillance of patients for colonization with VRE and MRSA is at the heart of the disagreement. Opponents of the SHEA guideline endorse the draft guideline of the CDC’s Healthcare Infection Control Practices Advisory Committee (HICPAC), which is, after some delay, scheduled for release in 2007 [19]. The HICPAC guideline offers a tiered approach toward preventing the transmission of multidrug-resistant organisms with intensified measures, including active surveillance, recommended only when or if baseline infection control measures fail to decrease pathogen transmission. The SHEA and HICPAC guidelines are often positioned as polar opposites [16–18]. In reality, they mirror each other in most recommendations. One key exception is the active culture screening of patients for MRSA and VRE.

Passions for and against each guideline run quite deep. Proponents of the SHEA guideline seemingly contend that the omission of active screening is tantamount to malpractice [18, 20]. Opponents argue that, despite the presence of numerous published observational and quasi-experimental studies, the practice of active surveillance has not been satisfactorily demonstrated in itself to reduce MRSA colonization and infection in a nonoutbreak or non–academic center setting [18]. Even a multicenter, randomized trial designed to rigorously examine the issues surrounding active surveillance has not been spared, with critique of the trial occurring in print even before the data have been analyzed, presented, or peer reviewed [18, 21].

Now groups outside of the infection control profession have latched onto the issue of active surveillance. Earlier this year, legislation was introduced mandating the active screening of all hospitalized patients for MRSA carriage in Illinois and for MRSA and VRE carriage in Maryland [22, 23]. In addition, the Consumer’s Union, which recently championed the issue of mandatory public reporting of hospital infection rates, has now placed MRSA legislation front and center. Providing a template letter that citizens can send to their state legislators that asks for hospital-specific MRSA prevention plans and advocates “universal surveillance” for MRSA carriage [24]. Of concern with each of these initiatives is the morphing of the recommendation in the SHEA guidelines for active screening of high-risk patients into a one-size-fits-all universal screening strategy for all hospitalized patients. Thus, active screening of patients for carriage with MRSA and VRE is a hot-button issue that will probably intensify in the near future.

In this issue of the Journal of Infectious Diseases, Huang et al., from the CDC’s Epicenters Program, provide important data about the impact of active surveillance for MRSA and VRE in high-risk patients on assessing the burden of colonization [25, 26]. In 2 separate studies purposefully similar in design, the Epicenter investigators have insightfully examined the role played by active screening in MRSA surveillance in 12 ICUs and in VRE surveillance in 14 patient-care units. By a retrospective examination of 1 year’s worth of data, measurements of monthly prevalence, admission prevalence, prevalence density, incidence, and incidence density were assessed both with and without the inclusion of data obtained via active surveillance (i.e., only using data from cultures obtained during clinical care). Predictors of increased admission prevalence and incidence, the impact of active surveillance on the total number of days patients were placed in contact precautions, and the persistence of MRSA and VRE carriage were also determined.

In the first study, which examined the impact of active screening of ICU patients for MRSA nasal colonization, data were collected from 5 academic medical centers encompassing 12 adult ICUs, >8000 admitted patients, and nearly 50,000 ICU patient-days [25]. The active surveillance policies differed slightly among ICUs: most collected screening nares cultures at the time of admission to the ICU and each week thereafter and did not place patients on contact precautions empirically while awaiting screening culture results. All ICUs collected screening cultures from patients already on contact precautions or known to have been previously infected or colonized with MRSA. Compliance with admission screening was >70% in most units, with 5 ICUs having ≥90% compliance.

For the second study, the impact of active screening of hospitalized patients for rectal colonization with VRE was evaluated in 14 patient-care units from 4 academic medical centers [26]. The units included 10 ICUs (including medical, surgical, burn, and cardiac) and 4 units that cared for immunocompromised hematology-oncology and transplant patients. The study population included >8266 admitted patients and nearly 61,000 hospital patient-days. Unit characteristics were similar, with the exception of a bone marrow–transplant unit, which had a longer median length of stay and lower total admissions. Again, active surveillance policies differed mildly among the units. Rectal screening cultures were collected at the time of admission in most areas, with follow-up cultures collected weekly during the hospitalization. One institution performed both culture and polymerase chain reaction testing of rectal specimens, which likely increased the detection of VRE. Precautions were not instituted empirically pending screening culture results. Compliance with admission screening was slightly lower than with MRSA screening, with most units reporting rates >80%. Compliance in 2 units was <60%, which possibly indicates the increased logistical difficulty ascribed to the collection of rectal-swab specimens.

Use of data from active surveillance resulted in increased prevalence and incidence estimates for both MRSA and VRE. Interestingly, the use of active surveillance made a substantially larger impact on the assessment of VRE colonization than on
MRSA carriage. Whether this is because VRE colonization is less likely to result in invasive infection or whether VRE infection may occur in sites less often routinely cultured during the workup of a febrile hospitalized patient (e.g., abdominal abscess) is mere conjecture. The burden of MRSA and VRE colonization varied widely among the study units, which suggests that not all high-risk patient units may be "high risk" in terms of MRSA or VRE carriage.

Not unexpectedly, active surveillance resulted in an 18.4% and 137% increase in MRSA and VRE contact precaution days, respectively. The suboptimal utility of using only clinical cultures to identify persons colonized with MRSA or VRE was also reinforced [27], given that only 30% of MRSA carriers and 13% of VRE carriers had subsequent positive clinical cultures during their hospitalization. The use of active surveillance also prevented the errant misclassification of carriage incidence. Persons who, on the basis of clinical microbiologic data, would have been considered to be incident carriers were appropriately reclassified as carriers at the time of admission when active surveillance data were included. Specifically, active surveillance prevented the misclassification of nearly 17% of MRSA carriers and 43% of VRE carriers who would have been identified on the basis of clinical cultures alone.

Another important aspect of both these studies is the emphasis on the exclusion of persons known to carry MRSA or VRE in the denominator for determinations of carriage incidence. That is, when determining the actual incidence of a condition, it is important to include only those at risk of acquiring that condition in the population (to exclude those persons already colonized with MRSA or VRE at admission). Such methods should be included in the tool kit of facilities examining colonization with either of these 2 important pathogens using an active screening strategy.

The range of impact of the use of active surveillance in the study units is rather striking. Although each assessment of MRSA colonization burden increased with the inclusion of carriers detected by active surveillance, the proportional benefit of their inclusion was 18.7%–63.5% for average monthly prevalence, 29.8%–135.1% for average monthly admission prevalence, and 6.7%–156.5% for average monthly incidence of MRSA carriage. MRSA precaution days increased from as low as 10.7% in some ICUs to as high as 91.2% in others. In addition, some ICUs noted minimal benefit from active surveillance for MRSA. As noted earlier, the benefit of active surveillance on measurements of the burden of colonization with VRE was much greater than that for MRSA. Variability in impact occurred across the units, with increases in carriage prevalence of 220%–1350% and in incidence of 330%–1540%.

This marked variability in the effect of active surveillance is noteworthy. It would be interesting to know more details about the units in which active surveillance made a larger impact. Is there a plateau effect for the impact of active surveillance for MRSA, given that those units in which active surveillance for MRSA had been ongoing before the study period showed no reduction in the colonization incidence of MRSA? Or does this show the effectiveness of early placement of carriers on contact precautions? In addition, in many units, although the incidence of MRSA and VRE colonization decreased during the study period, the net decrease was mild, at 0.23% and 0.22% per month, respectively. No mention is made of the trends of VRE incidence in non-ICU areas.

Although Huang et al. note that no change in infection control practices and no other special infection control programs to reduce MRSA and VRE were altered at any institution during the study period, other interventions not directly targeted at MRSA and VRE—such as a standardized central venous catheter insertion program, which was in the final years of implementation at one study institution [28], and a hand-hygiene campaign at the primary author’s institution that began in July 2002 [29]—may have also affected the incidence of MRSA and VRE. Given that thousands of culture specimens were collected and thousands of days were spent on contact precautions, the opponents of active surveillance may argue whether the juice gained from active surveillance was truly worth the squeeze.

These studies do have some important limitations, many of which are inherent in a retrospective investigation. Persons who had been identified previously as a carrier of either pathogen at a health-care facility outside of each Epicenter’s health system but not at the time of admission may have errantly been considered to be incident cases. Use of only nares culture for MRSA (as opposed to including cultures from other colonization sites, such as the axilla) may have underestimated the true burden of colonization. In addition, the use of broth enrichment culture for nares cultures increases the sensitivity of the test [30]. If these facilities did not include broth enrichment in their standard nares culture procedure, this may have led to an underestimation of the MRSA burden. Rectal-swab culture for VRE has a sensitivity of only 58%, with lower sensitivities in patients with a lower density of VRE in stool [31]. Thus, the true burden of VRE colonization may have been underestimated. The authors also used colonization incidence to reflect hospital-associated transmission. Without molecular typing of the MRSA and VRE isolates to detect clonal spread, it is not known whether all incident cases of new colonization are due to hospital-acquired transmission. It must also be emphasized that the impact of active surveillance on health-care–associated infections caused by these pathogens is not described.

In short, these studies have something for both sides of the active surveillance debate. For proponents, these well-designed studies support the notions that active surveillance allows for a more accurate assessment of the burden of MRSA and VRE colonization, reduces the misclassi-
fication of hospital-acquired colonization or infection, and appropriately increases contact precaution days. For opponents, the mild impact on carriage incidence in only some of the units, coupled with the logistics of mounting an active surveillance program, argues against routine surveillance. Nonetheless, both sides must agree that the studies by Huang et al. are important and scientifically sound additions to the debate.

One other key aspect of these studies must be noted. These investigations highlight the power of a multicenter collaborative study aimed at examining issues in the field of infection control—an area that has traditionally been underfunded in terms of extramural support. Such continued collaborative and methodologically sound investigations are essential to tackling the many important questions yet to be answered about infection control practices, especially as interest in the prevention of health-care–associated infections increases both within and outside health-care facilities. One hopes that the divide among infection control professionals created by the SHEA guideline will resolve, because the infection control community has too many challenges in the years ahead that will require a cohesive approach.

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References

21. Farr BM. What to think if the results of the National Institutes of Health randomized trial of methicillin-resistant Staphylococcus aureus and vancomycin-resistant Enterococcus control measures are negative (and other advice to young epidemiologists): a review and an au revoir. Infect Control Hosp Epidemiol 2006; 27:1096–106.