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CONCISE COMMUNICATION

Discontinuation of Reflex Testing of Stool Samples for Vancomycin-Resistant Enterococci Resulted in Increased Prevalence

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Discontinuation of reflex testing of stool submitted for *Clostridium difficile* testing for vancomycin-resistant enterococci (VRE) led to an increase in the number of patients with healthcare-associated VRE bacteremia and bacteriuria (0.21 vs 0.36 cases per 1,000 patient-days; $P < .01$). Cost-benefit analysis showed reflex screening and isolation of VRE reduced hospital costs.

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Vancomycin-resistant enterococci (VRE) cause infections that result in increased cost and hospital length of stay.¹ Earlier studies have reported a substantial proportion of patients with *Clostridium difficile* infection who are cocolonized with VRE.^{2,3} On the basis of these data, a “reflex” testing program was initiated at our hospital in the 1990s to limit VRE transmission. Reflex testing was a policy whereby any stool submitted to the laboratory for *C. difficile* toxin testing from an inpatient was also tested for VRE using selective media (VRE Agar; Remel). Patients identified by reflex testing, routine clinical culture, or records from an outside facility as being VRE colonized or infected were placed under contact precautions.

In 2010, concerns were raised about the cost benefit of reflex testing. Healthcare-associated VRE rates both within the hospital and nationally over the previous decade had been stable.^{4,5} On the basis of a lack of clear evidence that it was affecting VRE epidemiology, reflex testing was discontinued. The purpose of this study is to examine the effect of discontinuation of this VRE reflex testing program on healthcare-associated VRE transmission.

METHODS

Barnes-Jewish Hospital is a 1,250 bed academic tertiary care hospital in Saint Louis, Missouri. There are 1,160 patient rooms, of which 741 can be semi-private. Hospital policy is to place patients with VRE colonization or infection under contact precautions in a private room. Reflex testing for VRE was discontinued in July 2010. Physicians were notified of this change. Clinicians could still order stool or perirectal

cultures for VRE testing at their discretion. No additional interventions targeting VRE were implemented at the time.

To determine the effect of discontinuing reflex testing on VRE transmission, the healthcare-associated VRE rate was evaluated from January 2009 to December 2011. All hospitalized patients with a urine or blood culture positive for VRE were identified. A healthcare-associated VRE case was defined as the first positive specimen per patient for whom VRE was detected in blood or urine more than 48 hours after admission. A VRE case was considered present at admission if VRE first was detected in blood or urine 48 hours or less after admission. VRE cases were expressed per 1,000 patient-days.

Rate trends were evaluated using interrupted time series modeling (SPSS, ver 18.0; IBM SPSS). Segmented regression analysis was performed to assess the effect of the discontinuing VRE reflex testing on healthcare-associated VRE rates.⁶ We hypothesized that there would be a delay between discontinuation of the testing and resulting change in acquisition rates, because the effect of increased colonization pressure would not be immediately seen.⁷ Therefore, we used a 1-month delay for evaluating the post-discontinuation segment. Monthly VRE prevalence at hospital admission was included in the model to account for any change during the study period. Institutional review board approval was obtained from Washington University.

RESULTS

In the 18 months before discontinuation of reflex testing, 9,652 stool specimens underwent VRE testing (mean, 536 stool specimens per month). In the 18 months after reflex testing was stopped, 2,974 stool specimens were tested (mean, 165 stool specimens per month; a 69% decrease; $P < .01$). The monthly mean number of patients with a VRE-positive stool culture decreased from 136 to 45 (a 67% decrease; $P < .01$).

There were 92 cases of healthcare-associated VRE during 433,855 patient-days (0.21 cases per 1,000 patient-days) in the reflex testing period compared with 159 cases in the 444,092 patient-days after discontinuation (0.36 cases per 1,000 patient-days; Figure 1). The full regression model showed no baseline trend in healthcare-associated VRE ($P = .772$) and no trend change after discontinuation of reflex testing ($P = .727$). There was no significant trend in rates of VRE present at hospital admission (0.16 cases per 1,000 patient-days before discontinuation vs 0.22 cases per 1,000 patient-days after discontinuation; $P = .704$). There was a significant change in the y-intercept, with the monthly healthcare-associated VRE rate increasing by 0.17 cases per 1,000 patient-days ($P = .04$) when VRE reflex testing was discontinued.

The cost-benefit analysis was completed for the first 12

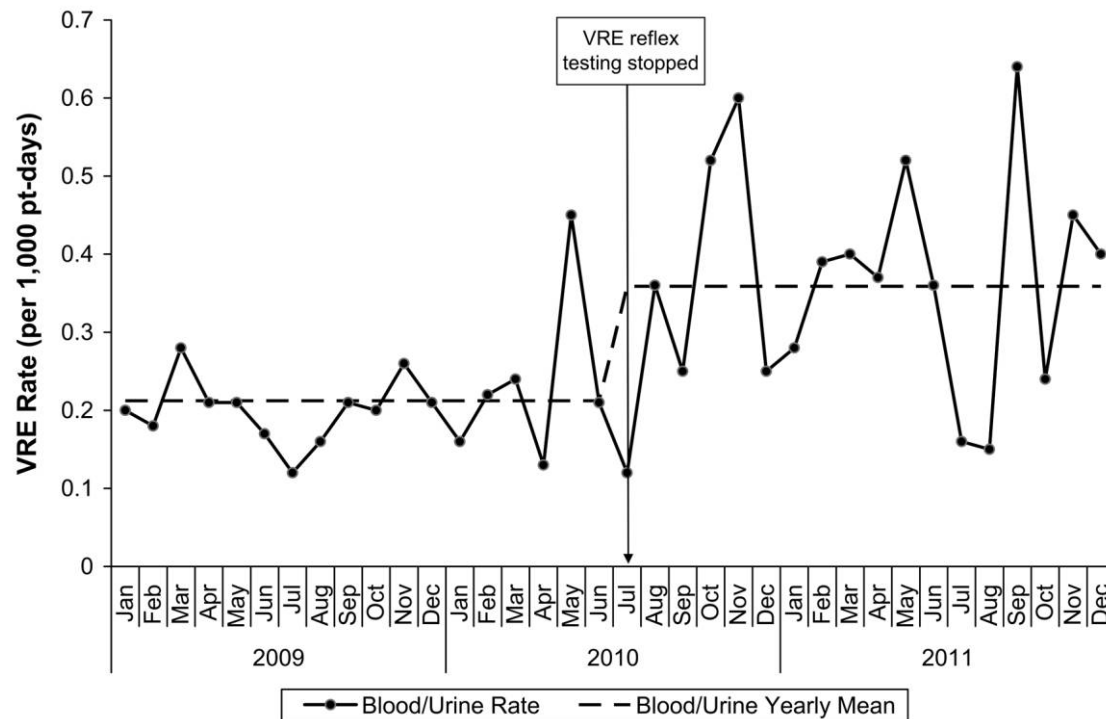


FIGURE 1. Monthly incidence of healthcare-associated vancomycin-resistant enterococci (VRE), January 2009–December 2011. pt, patient.

months after discontinuation. Assuming reflex testing had been continued and the rate of healthcare-associated VRE was the same as the preintervention rate, we would have expected 14 fewer patients with VRE bacteremia and 26 fewer patients with bacteriuria. During the discontinuation period, the institution saved \$20,920 in laboratory costs (\$4 per VRE test, 5,230 fewer tests). Isolation bed avoidance saved approximately \$95,788 (\$77 per isolation bed-day, 1,244 fewer days of VRE isolation). On the basis of estimates in the literature, the cost of treating the excess cases of VRE bacteremia was approximated at \$139,286 (\$9,949 per case of bacteremia, 14 excess cases of bacteremia), resulting in an excess cost of at least \$22,578 per year without reflex testing.¹

CONCLUSION

The role of routine active surveillance in the control of antimicrobial-resistant organisms in hospitals remains unclear.^{8,9} Previous studies have demonstrated the benefit of active surveillance cultures to control VRE transmission in hospitals; however, these were generally done during an outbreak in which multiple interventions were introduced simultaneously.^{10,11} We found that discontinuation of reflex VRE testing of stool submitted for testing for *C. difficile* resulted in an approximately 71% increase in the endemic healthcare-associated VRE rate. Strengths of the study include that no other infection prevention measures were implemented when reflex testing was stopped and that the VRE

rate was stable before discontinuation. We hypothesize that the discontinuation of VRE reflex testing resulted in decreased identification and isolation of patients with VRE colonization, which resulted in increased VRE colonization pressure throughout the hospital and a subsequent increased risk of VRE transmission.

The cost of laboratory testing was a consideration in the decision to discontinue the VRE reflex testing program. Microbiological cultures performed for inpatients for the purpose of screening cannot be submitted to Medicare for reimbursement. Therefore, the cost of active surveillance must be absorbed by the facility. Our cost analysis suggests that savings gained from reduced laboratory and isolation bed cost were nullified by the increased cost of treating patients with VRE bacteremia.

There are limitations to this study. We used a quasi-experimental study design. Therefore, we cannot rule out the possibility that unmeasured variables, such as underlying patient characteristics, may have changed during the study period and affected our findings. The VRE rate increased when reflex testing was discontinued even after controlling the data for incoming colonization pressure (ie, patients who had VRE detected in blood or urine within 48 hours of admission). Laboratory methods for identifying VRE from urine and blood cultures did not change during the study period. This study was done in a large academic medical facility, and the results may not be generalizable to other healthcare facilities

with differing endemic VRE rates. We did not determine the cost associated with the treatment of VRE infections other than bacteremia, although we would anticipate that these would further increase the benefits of reflex testing. Finally, we examined cost from a hospital, rather than societal, perspective, although hospitals bear the direct cost of an active surveillance program.

In conclusion, we found that discontinuation of reflex testing of stool specimens submitted to the laboratory for *C. difficile* testing for VRE resulted in a hospitalwide increase in cases of healthcare-associated VRE and was not cost effective. On the basis of these results, reflex testing was reinstated at our facility. Additional studies in a variety of healthcare facilities are needed to determine whether this screening strategy is effective in other settings.

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