was a statistically significant variation between the primary and total SSI rates at a particular site in the future, annual stratification by procedure type for this individual facility would be considered. This further underlines the need to regularly review reporting procedures; indeed, one size does not fit all.

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Universal Methicillin-Resistant *Staphylococcus aureus* (MRSA) Screening: Comparison of Anatomic Screening Sites for Patients with High and Low Prevalence of MRSA Carriage

To the Editor —The incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) infection and colonization is increasing rapidly worldwide.[1] Colonized patients are important reservoirs in hospitals, but 35%–84% of them can be missed by relying on diagnostic clinical samples.[1] Hence, active screening is a pivotal component of MRSA control programs in acute care hospitals.[1,2] Universal screening at hospital admission is the most effective surveillance strategy,[2] and a combination of screening and barrier precautions results in cost savings by preventing healthcare-associated MRSA infections.[1] Controversy still exists as to which body sites are the most effective for MRSA surveillance.[3] Nasal screening identifies only 80% of individuals with MRSA colonization; obtaining screening samples from additional body sites increases sensitivity to over 90%.[1-4] Carriage is common in wounds and throat.[5,6] Intestinal carriage has also been reported in various patient groups.[7] Although data suggest that multisite screening improves detection,[1-4,8] there have been no comparative studies of dermatology patients and patients with human immunodeficiency virus (HIV) infection, among whom the prevalence of MRSA colonization is high.

We compared the sensitivities of anatomic sampling sites for patients associated with high and low prevalence of MRSA carriage as a basis for universal screening protocols. Universal MRSA screening at hospital admission with a combined swab sample of nares, axillae, and groin is adopted in our hospital. We evaluated data from a prospective MRSA surveillance study and compared the effectiveness of additional screening sites (throat, perianal region, and wound) in 3 patient groups: dermatology patients, patients with HIV infection, and patients with general infectious diseases (excluding HIV infection). From January 1, 2009, through December 31, 2010, a total of 2,243 patients with unknown MRSA status were screened at admission to the Communicable Disease Centre (CDC) at Tan Tock Seng Hospital, a tertiary care hospital and the national referral center for HIV infection and emerging infectious diseases in Singapore. The CDC also provides inpatient care for dermatology patients from the National Skin Centre. In addition to the routine combined nares, axillae, and groin swab samples, throat and perianal samples were obtained for all patients, and if wounds were present, wound swab samples were also taken. Chromogenic agar media (MRSA*Select*; BioRad) was used for MRSA detection. Multivariate models were constructed, and odds ratios (ORs) and 95% confidence intervals (CIs) for relevant factors were calculated. The Wilcoxon rank-sum test was used for comparison of continuous variables.

The overall prevalence of MRSA carriage was 11.8%. MRSA carriers (median age, 61 years; interquartile range [IQR], 44–77 years) were older than noncarriers (median age, 46.1 years; IQR, 35.8–57.0 years; $P < .001$). Age greater than 70 years was an independent risk factor for MRSA colonization, regardless of patient group (adjusted OR [aOR], 3.51; 95% CI, 2.54–4.86). The prevalence of MRSA carriage was highest among dermatology patients (18.9%), followed by patients with HIV infection (10.5%) and those with general infectious diseases (2.7%). After adjustment for age, dermatology patients remained 1.4 and 5.3 times more likely than patients with HIV infection (aOR, 1.44; 95% CI, 1.07–1.94) and patients with general infectious diseases (aOR, 5.32; 95% CI, 2.99–9.43) to be colonized with MRSA. Moreover, patients

with HIV infection were 4.3 times (aOR, 4.29; 95% CI, 2.42–7.61) more likely than patients with general infectious diseases to be MRSA carriers. There was no difference in MRSA colonization with respect to sex after accounting for age (aOR for female sex, 1.15; 95% CI, 0.86–1.52).

A combined nares, axillae, and groin swab sample detected the highest proportion of MRSA colonizers in all 3 patient groups (dermatology group, 83.1%; HIV group, 77.1%; infectious diseases group, 78.6%; Table 1). For dermatology patients, among whom there is a high prevalence of MRSA colonization, the addition of a perianal swab sample increased the sensitivity of MRSA detection by 11.7%, whereas throat and wound swab samples increased detection by only 4.5% and 3.2%, respectively. In patients with HIV infection, perianal and throat screening separately increased detection by 12.5%. For patients in the infectious diseases group, among whom there is a low prevalence of MRSA infection and carriage, throat screening increased detection sensitivity by 14.3%, but perianal screening did not provide an additional diagnostic yield. Compared with patients in the dermatology group, patients in the HIV group and the general infectious diseases group were 3.4 (aOR, 3.38; 95% CI, 1.11–10.25) and 3.8 (aOR, 3.81; 95% CI, 0.68–21.34) times more likely to have a positive throat culture result when combined nares, axillae, and groin screening was negative. However, the point estimate for patients in the general infectious diseases group did not reach statistical significance because of the small sample size ($n = 14$).

The prevalence of MRSA carriage among patients in the dermatology group (12.5%) was higher than previously reported (3.1%–7.9%),[5] but MRSA prevalence among patients in the HIV group (10.5%) was comparable to prevalences documented elsewhere (10%–17%).[9] The higher prevalence observed among our dermatology patients could be attributable to their older age. Our observation that age was a risk factor for MRSA colonization is consistent with international literature.[1,3] Additional MRSA isolates identified in samples from throat (4.5%–14.3%) and perianal (11.7%–12.5%) sites in patients without nares, axillae, and groin colonization suggests that there is value in adding these as screening sites. This finding is consistent with other studies.[4,6-8] Furthermore, we observed that, for patients in the dermatology and HIV groups, among whom there is a high prevalence of MRSA carriage, perianal sampling provided increased sensitivity. For patients in the general infectious diseases group, among whom there is a low prevalence of MRSA carriage, throat swab samples had greater yield.

Many MRSA surveillance programs limit the number of anatomic screening sites because of resource constraints. Hence, a cost-effective universal screening program is crucial. We recommend that perianal sampling be included in routine MRSA screening for all 3 patient groups. This would increase MRSA detection sensitivity to 95% and 90% for dermatology patients and patients with HIV infection, respectively, both of which groups are associated with a high prevalence of MRSA carriage. Although perianal swab specimens can be obtained together with groin swab samples and pooled with nares, axillae, and groin swab samples for testing at no additional cost, patient refusal of perianal screening can be a significant issue. Screening for throat carriage should be in-

TABLE 1. Diagnostic Yield of Different Methicillin-Resistant *Staphylococcus aureus* (MRSA) Screening Anatomic Sites for 3 Patient Groups

Anatomic sites screened for MRSA, by patient group	Proportion (%) of patients with positive results
Dermatology patients	
Nares, axillae, and groin	128/154 (83.1)
Perianal	113/154 (73.4)
Throat	37/154 (24.0)
Nares, axillae, groin, and perianal	146/154 (94.8)
Nares, axillae, groin, and throat	135/154 (87.7)
Patients with HIV infection	
Nares, axillae, and groin	74/96 (77.1)
Perianal	56/96 (58.3)
Throat	35/96 (36.5)
Nares, axillae, groin, and perianal	86/96 (89.6)
Nares, axillae, groin, and throat	86/96 (89.6)
Patients with infectious diseases[a]	
Nares, axillae, and groin	11/14 (78.6)
Perianal	7/14 (50.0)
Throat	5/14 (35.7)
Nares, axillae, groin, and perianal	11/14 (78.6)
Nares, axillae, groin, and throat	13/14 (92.8)

NOTE. HIV, human immunodeficiency virus.

[a] Excluding patients with HIV infection.

cluded for patients with HIV infection and those with other infectious diseases, because it further increases MRSA detection rates to 100% and 93%, respectively. This would cost an additional US$25 per patient. If resources are constrained, screening for throat carriage of MRSA can be excluded for dermatology patients, because the additional yield is modest. In Singapore, the excess hospitalization costs of a MRSA infection are estimated at more than US$13,000.[10] This warrants additional studies on the cost-effectiveness of our universal MRSA screening program.

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