for this. First, soiling with organic matter and the presence of biofilms increases the resistance of microbes to disinfection. Second, certain organisms have lower susceptibility to a given disinfectant than do other organisms. An in vitro study showed that catalase-producing vegetative bacteria, including methicillin-resistant *Staphylococcus aureus* (MRSA) and *Acinetobacter baumannii*, had a lower susceptibility to hydrogen peroxide than did *Clostridium difficile* spores.[8] Third, although the concentration of contamination on hospital surfaces is usually in the 2-log range, higher levels of contamination have been reported.[9] Finally, our study showed incomplete distribution from one of the systems.[10] This means that some areas of a hospital room get a lower dose of hydrogen peroxide than do other areas, which could contribute to the fact that log reductions achieved in vitro are not realized in all parts of the room. There is perhaps a parallel with liquid cleaning and disinfectants, in which more than a 2-log reduction in vitro does not eradicate pathogens because of limitations in achieving adequate distribution and contact time.

Routine microbiological culture of the environment is time consuming and expensive. However, the inactivation of 6-log biological indicators provides a safe, practical means for validating the effectiveness of automated room disinfection systems and has been shown to correlate well with the elimination of pathogens from hospital surfaces.

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 0899-823X/2012/3303-0020$15.00. DOI: 10.1086/664044

REFERENCES

1. Roberts CG. Hydrogen peroxide vapor and aerosol room decontamination systems. *Infect Control Hosp Epidemiol* 2012;33: 312 (in this issue).
2. Holmdahl T, Lanbeck P, Wullt M, Walder MH. A head-to-head comparison of hydrogen peroxide vapor and aerosol room decontamination systems. *Infect Control Hosp Epidemiol* 2011; 32(9):831–836.
3. Dancer SJ. How do we assess hospital cleaning? a proposal for microbiological standards for surface hygiene in hospitals. *J Hosp Infect* 2004;56:10–15.
4. Barbut F, Menuet D, Verachten M, Girou E. Comparison of the efficacy of a hydrogen peroxide dry-mist disinfection system and sodium hypochlorite solution for eradication of *Clostridium difficile* spores. *Infect Control Hosp Epidemiol* 2009;30:515–517.
5. Shapey S, Machin K, Levi K, Boswell TC. Activity of a dry mist hydrogen peroxide system against environmental *Clostridium difficile* contamination in elderly care wards. *J Hosp Infect* 2008; 70:136–141.
6. Boyce JM. New approaches to decontamination of rooms after patients are discharged. *Infect Control Hosp Epidemiol* 2009;30: 515–517.
7. Boyce JM, Havill NL, Otter JA, et al. Impact of hydrogen peroxide vapor room decontamination on *Clostridium difficile* environmental contamination and transmission in a healthcare setting. *Infect Control Hosp Epidemiol* 2008;29:723–729.
8. Otter JA, French GL. Survival of nosocomial bacteria and spores on surfaces and inactivation by hydrogen peroxide vapor. *J Clin Microbiol* 2009;47:205–207.
9. Sexton JD, Tanner BD, Maxwell SL, Gerba CP. Reduction in the microbial load on high-touch surfaces in hospital rooms by treatment with a portable saturated steam vapor disinfection system. *Am J Infect Control* 2011;39:655–662.
10. Holmdahl T, Lanbeck P, Wullt M, Walder MH. A head-to-head comparison of hydrogen peroxide vapor and aerosol room decontamination systems. *Infect Control Hosp Epidemiol* 2011; 32: 831–836.

Analysis of Hip and Knee Arthroplasty Surgical Site Infection Data in Western Australia: Null Effect of Stratification by Procedure Type

To the Editor—In a recently published article on surgical site infection (SSI) following hip arthroplasty, Worth et al[1] recommended stratification between primary and revision procedures when reporting infection rates, to account for centers with divergent numbers of each procedure type. This recommendation was based on a review of cumulative data (2003–2010) collected by the Victorian Hospital Acquired Infection Surveillance System Coordinating Centre, showing a greater risk of SSI after revision hip arthroplasty, compared with the risk after primary hip arthroplasty.[1]

Healthcare Infection Surveillance Western Australia (HISWA) has collected SSI data for both hip and knee arthroplasty since its inception in 2005. Classification of procedure type as primary or revision is part of this data set. Data for infection rates (stratified by procedure type) are reported annually; however, a detailed comparative analysis of primary and revision SSI rates is not included in this report. In light of the recommendation of Worth et al,[1] a review of HISWA hip and knee SSI data was conducted.

For the analysis of hip SSI data, hospitals that had not conducted any revision procedures for the period 2005–2010 were excluded from the analysis, leaving data from 15 hos-

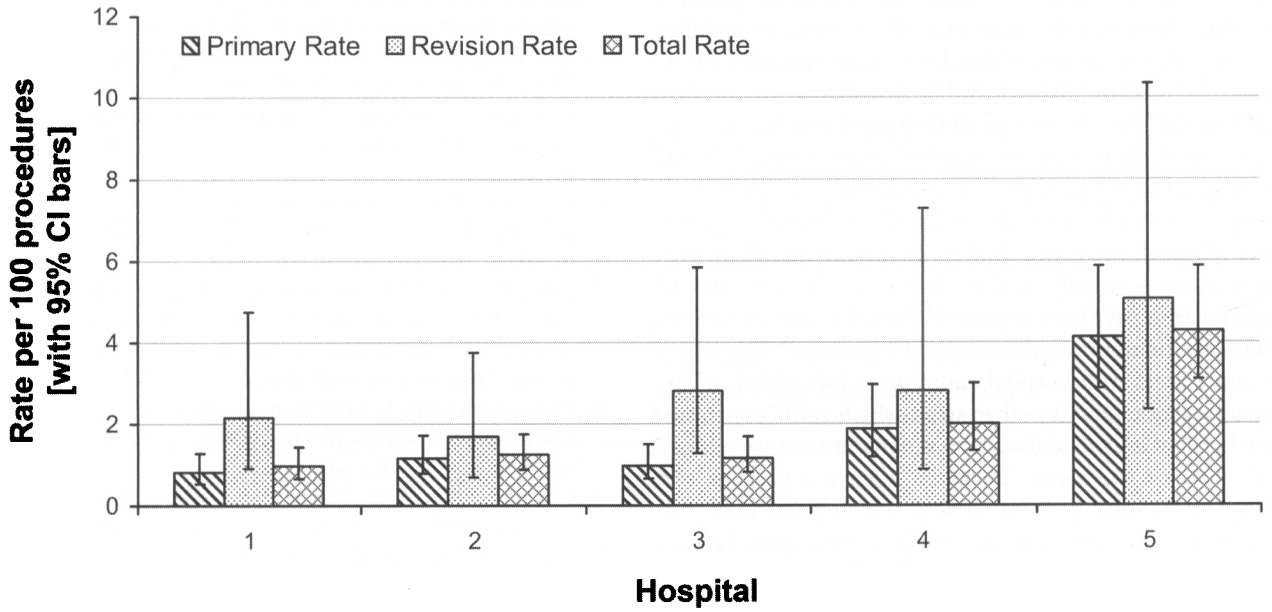

FIGURE 1. Cumulative hip arthroplasty surgical site infection rates for the 5 Healthcare Infection Surveillance Western Australia hospitals performing the greatest number of procedures, July 2005 through December 2010. CI, confidence interval.

pitals to be analyzed. This HISWA data set captured a total of 12,944 hip arthroplasty procedures, 11,499 (89%) of which were primary and 1,445 (11%) of which were revision procedures. Eight of the 15 hospitals reported higher SSI rates associated with revision procedures than with primary procedures. These 8 hospitals performed 92% of all revision hip procedures (1,324 of 1,445 procedures).

Although higher hip revision SSI rates were only observed in approximately half of Western Australian hospitals (8 of 15 hospitals), when data from all 15 hospitals were combined to produce an aggregate rate, the revision rate of 2.63 infections per 100 procedures was higher than the primary rate of 1.57 infections (odds ratio, 1.7; 95% confidence interval, 1.2–2.4; $P < .01$). HISWA data, therefore, follow the expected trend of higher SSI rates for hip revision procedures than for primary procedures.

In relation to the concern raised in the report by Worth et al,[1] that "higher infection rates will be reported in healthcare facilities that perform a large number of revisions,"[1(p297)] analysis was undertaken of the 5 HISWA sites that performed the largest number of revision hip arthroplasties, to determine whether this was the case in Western Australia.

These 5 sites all demonstrated higher SSI rates associated with revision procedures than with primary procedures. However, the combined primary and revision (total) SSI rates remained similar to the primary SSI rates alone. When χ^2 (Pearson uncorrected) comparison was performed for primary versus total rates, revision versus total rates, and primary versus revision rates, there was no statistically significant variation between the primary SSI rates and the total SSI rates for these 5 sites or for any of the 15 hospitals ($P > .05$). This was demonstrated even when there was statistically significant ($P \leq .05$) variation between the revision and total rates and/or primary and revision rates, as was seen for hospitals 1 and 3 (Figure 1).

The same analysis was conducted on the 5 sites that performed the most knee revision procedures. Although revision knee SSI rates were higher in 4 of the 5 sites, there was no statistically significant ($P > .05$) variation between primary and total SSI rates for any of these 5 sites nor for any of the other sites that perform knee arthroplasty.

As both hip and knee revision rates were demonstrably higher at the majority of hospitals (9 of 10 hospitals) performing the largest number of procedures, consideration should be given as to the reasons for this apparent paradox. Our data suggest that this was attributable to the relatively low proportion of revision procedures performed at all hospitals and the statistical similarity between all 3 rates observed at the majority of individual sites. The mean percentage of primary hip arthroplasties performed at the 15 hospitals was 92% (range, 84%–98%), compared with 8% for revision procedures. For primary knee procedures, the mean percentage performed was 95% (range, 87%–99%), compared with 5% for revision procedures.

Annual HISWA reports currently only include aggregated primary and revision SSI data. The relatively low number of revision procedures and infections recorded by HISWA would indicate that routine reporting of these 2 separate rates for each site is currently not warranted. If a change occurred in the proportion of revision procedures performed, or if there

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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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 0899-823X/2012/3303-0021$15.00. DOI: 10.1086/664059

REFERENCE

1. Worth LJ, Bull AL, Richards MJ. Reporting surgical site infections following primary and revision hip arthroplasty: one size does not fit all. *Infect Control Hosp Epidemiol* 2011;32(3):296–297.

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