CONCISE COMMUNICATION

Variable Screening and Decolonization Protocols for *Staphylococcus aureus* Carriage Prior to Surgical Procedures

Susan Kline, MD, MPH;[1] Maya Highness, MD, MSc;[2] Loreen A. Herwaldt, MD;[3] Trish M. Perl, MD, MSc[4]

We surveyed the Society for Healthcare Epidemiology of America Research Network, the Minnesota Association for Professionals in Infection Control and Epidemiology, and the Minnesota Hospital Association to assess presurgical *Staphylococcus aureus* screening and decolonization practices. The practices varied widely among responding facilities. The majority of respondents (63%) did not screen for *S. aureus* preoperatively.

Infect Control Hosp Epidemiol 2014;35(7):880-882

Staphylococcus aureus causes approximately 25% of healthcare-associated infections (HAIs) and 20% of surgical-site infections (SSIs). *S. aureus* carriage before operations increases the risk of surgical-site *S. aureus* infection by 2–14-fold. Eradicating MSSA and MRSA (methicillin-susceptible and methicillin-resistant *S. aureus*, respectively) carriage before scheduled surgical procedures, a practice recommended by recent guidelines, could significantly decrease the risk of postoperative SSIs and HAIs caused by these pathogenic bacteria.[1,2] However, many healthcare providers and institutions remain uncertain regarding the merits of preoperative screening for *S. aureus* carriage and of decolonizing carriers. Numerous studies have assessed whether nasal decolonization with mupirocin, sometimes combined with chlorhexidine gluconate (CHG) bathing, reduces SSIs. However, few of these studies were adequately powered, and many were nonrandomized.[3-9] A few randomized controlled trials had negative results, but the results of some studies suggested that decolonization might be beneficial.[3-9] Most of the studies focused on inpatients. However, now the focus for screening and decolonization of preoperative patients is shifting to the outpatient arena. Strategies to decolonize patients before surgical procedures can be challenging to operationalize in the outpatient setting. We hypothesized that presurgical *S. aureus* screening and decolonization practices vary substantially, and as the first step toward improving practice, we assessed current screening and decolonization practices across numerous healthcare institutions and settings.

METHODS

We developed a questionnaire that asked participants about their practices for screening patients for *S. aureus* and decolonizing carriers preoperatively. Using an internet-based survey tool (Survey Monkey), we solicited responses from 179 members of the Society for Healthcare Epidemiology of America Research Network, representing 207 institutions in 39 US states and 20 countries; the 314 members of the Minnesota chapter of the Association of Practitioners in Infection Control and Epidemiology; and the 145 member hospitals of the Minnesota Hospital Association, between February and March of 2012.

RESULTS

We received 132 responses (20.7%) from 638 potential respondents. The respondents were from 26 US states and 10 countries; 63 (47.7%) respondents were from Minnesota. Other states and countries represented were (respondent numbers): California and Texas (6); Pennsylvania and Wisconsin (5); Massachusetts (4); Indiana, Missouri, Oregon, and Washington (3); Alabama, Arizona, Florida, Maryland, Nebraska, New Jersey, North Carolina, and North Dakota (2); Illinois, Iowa, Louisiana, New Hampshire, New Mexico, Ohio, Rhode Island, and Wyoming (1); Canada (5); and Australia, Brazil, Egypt, India, Israel, Mexico, the Republic of Korea, and Singapore (1); 6 respondents listed both a US state and another country. The majority of respondents (84/131; 64.1%) identified themselves as infection preventionists, 38 (29%) as infectious disease physicians and 34 (26%) as hospital epidemiologists. Others identified themselves as hospital administrators, microbiologists, other physicians, public health professionals, and nurses. Many identified themselves with more than one title, such as infectious disease physician and hospital epidemiologist. Denominators varied slightly by question because some respondents skipped questions. The size of the communities served ranged from less than 100 to more than 1 million people; "more than 1 million" was the most common response. The largest group of respondents represented community hospitals, followed by teaching and public hospitals. Hospital sizes varied from very small (0–24 beds) to very large (>1,000 beds); the most common size was 150–299 beds. The number of operations performed per facility annually varied from less than 100 to more than 100,000.

Forty-nine (37%) of 132 respondents answered that their institutions screen for any *S. aureus* before operations (Table 1). Patients are screened most commonly before orthopedic and cardiovascular procedures. Eleven (52%) of 21 respondents reported that their facility screened patients for MSSA before cardiovascular procedures, and 10 (48%) reported screening patients for MSSA before orthopedic procedures. Thirty-four (83%) of 41 respondents reported screening patients for MRSA before orthopedic operations, and 28 (68%) reported screening patients for MRSA before cardiovascular operations (Figure 1). Of the institutions that screened before

https://doi.org/10.1086/676866 Published online by Cambridge University Press

TABLE 1. *Staphylococcus aureus* Screening Survey Results

Question	No. (%) of responses					
	Total		Minnesota		Other locations	
	Yes	No	Yes	No	Yes	No
Does your state have a mandated *S. aureus* screening policy?	47 (36)	82 (64)	18 (29)	44 (71)	29 (43)	38 (57)
Is there state-mandated *S. aureus* screening before surgery?	8 (6)	119 (94)	1 (2)	59 (98)	7 (10)	60 (90)
Do you screen for *S. aureus* colonization before surgery?	49 (37)	83 (63)	17 (27)	46 (73)	32 (46)	37 (54)
Does your healthcare facility have an institutional policy related to screening and decolonization for *S. aureus* in preoperative patients?	39 (30)	93 (70)	14 (22)	49 (78)	25 (36)	44 (64)
Do you screen for MSSA before surgery?	19 (39)	30 (61)	7 (41)	10 (59)	12 (38)	20 (62)
If you find carriers of MSSA, do you try to decolonize them?	17 (85)	3 (15)	5 (83)	1 (17)	12 (86)	2 (14)
Do you screen for MRSA before surgery?	44 (94)	3 (6)	14 (88)	2 (12)	30 (97)	1 (3)
If you find carriers of MRSA, do you try to decolonize them?	33 (75)	11 (25)	7 (54)	6 (46)	26 (84)	5 (16)

NOTE. MRSA, methicillin-resistant *S. aureus*; MSSA, methicillin-susceptible *S. aureus*.

orthopedic procedures, a large majority screened only before selected orthopedic procedures, such as total joint replacements, spinal fusions, and procedures in which hardware implants were placed. Some hospitals screened patients before neurosurgical, general, otolaryngologic (ENT), transplant, urologic, and obstetric/gynecologic procedures (Figure 1). The most common screening sites for MSSA and MRSA, respectively, were nares (21/21 [100%] and 45/45 [100%]) and throat (4/21 [19%] and 4/45 [9%]). Few (0–3) respondents reported that their institutions screened other body sites. The majority of respondents used cultures (70% for MSSA and 60% for MRSA); others screened with polymerase chain reaction.

Of the respondents, 36% reported that their state had a mandatory policy about *S. aureus* screening (Table 1). All of these, except one from Canada, mandated only MRSA screening. State-mandated MRSA programs varied from requiring screening of all hospitalized patients to requiring it only for intensive care unit patients or facility-designated high-risk populations.

Only 8 (6%) respondents reported that their state mandated screening surgical patients before operations (Table 1). Respondents' interpretations of state mandates varied: 8 replied that their state mandated preoperative *S. aureus* screening, but other respondents from those same locations replied they did not have state-mandated preoperative *S. aureus* screening. Only 2 respondents, both from Canada, indicated they had province-mandated screening for both MSSA and MRSA before surgery.

The common decolonization methods included nasal mupirocin (MRSA: 32/34 [94%]; MSSA: 18/18 [100%]) and CHG bathing (MRSA: 31/34 [91%]; MSSA: 13/17 [77%]). Among facilities using nasal mupirocin to decolonize carriers, the treatment duration varied from 2 to 7 days. The frequency of daily CHG bathing varied from 1 to 7 days. Some institutions used CHG cloths preoperatively: 5 (29.4%) of 17 for

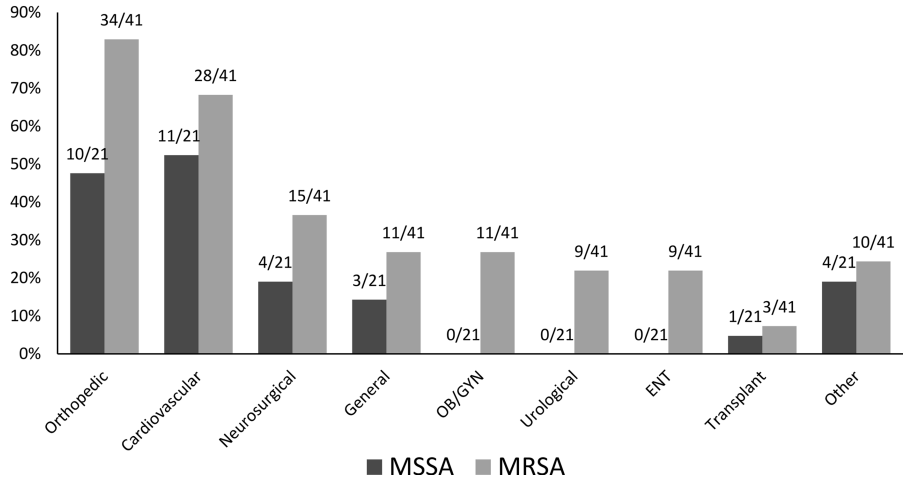


FIGURE 1. Preoperative *Staphylococcus aureus* screening practices at respondents' institutions. OB/GYN, obstetrics and gynecology; ENT, ear, nose, and throat; MRSA, methicillin-resistant *S. aureus*; MSSA, methicillin-susceptible *S. aureus*.

https://doi.org/10.1086/676866 Published online by Cambridge University Press

MSSA carriers and 18 (54.5%) of 33 for MRSA carriers. A few facilities used CHG mouth rinse: 2 (12%) of 17 for MSSA carriers and 6 (18%) of 34 for MRSA carriers. Respondents rarely reported using systemic antimicrobial therapy to decolonize *S. aureus* carriers.

DISCUSSION

Healthcare providers have focused SSI prevention efforts on decreasing variability in implementing evidence-based practices. Despite these efforts, our key finding is that current practices regarding preoperative *S. aureus* screening and decolonization vary widely. The majority of institutions do not screen preoperative patients, and screening and decolonization practices vary substantially among the institutions that do. These practices may vary because some healthcare workers, including infection preventionists and hospital epidemiologists, are unaware that *S. aureus* carriage significantly increases the risk for *S. aureus* SSIs, and they may not know which patient populations to screen preoperatively.

Diekema et al[10] surveyed infectious disease physicians in the Infectious Diseases Society of America's Emerging Infections Network (EIN); 60% of respondents reported that their institutions screened preoperative patients for *S. aureus*, whereas only 37% of our respondents reported that their institutions screened this population. Like our survey, the EIN survey found that screening and decolonization practices varied substantially. Our survey has some limitations. Respondents were from a variety of healthcare institutions, but nearly half of the respondents were from Minnesota. Thus, our findings may have been biased toward practices in Minnesota and may not be generalizable.

Our survey results suggest that many hospitals consider MRSA to be more important than MSSA, especially in the presurgical setting. Given that both organisms cause serious infections, we think that patients carrying either MRSA or MSSA should be included in future studies and in interventions, to prevent SSIs and enhance patient safety. If institutions do preoperative screening, they usually screen patients undergoing selected cardiovascular or orthopedic procedures. Future studies should evaluate the role of screening and decolonization before procedures in other surgical specialties, such as general surgery, neurosurgery, ENT, and urology, the importance of screening body sites other than the nares, and novel decolonization protocols.

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

Affiliations: 1. Department of Medicine, Division of Infectious Diseases and International Medicine, University of Minnesota Medical School, Minneapolis, Minnesota; 2. University of Minnesota Medical School, Minneapolis, Minnesota; 3. Department of Medicine, Infectious Disease Division, University of Iowa Carver College of Medicine, Iowa City, Iowa; and University of Iowa Hospital and Clinics and Department of Epidemiology, University of Iowa College of Public Health, Iowa City, Iowa; 4. Department of Medicine, Division of Infectious Diseases, Johns Hopkins University School of Medicine, Baltimore, Maryland.

Address correspondence to Susan Kline, MD, MPH, Department of Medicine, Division of Infectious Diseases and International Medicine, University of Minnesota Medical School, 420 Delaware Street SE, MMC #250, Minneapolis, MN 55455 (kline003@umn.edu).

Presented in part: IDWeek 2012; San Diego, California; October 17–21, 2012.

Received December 8, 2013; accepted February 26, 2014; electronically published May 20, 2014.

© 2014 by The Society for Healthcare Epidemiology of America. All rights reserved. 0899-823X/2014/3507-0016$15.00. DOI: 10.1086/676866

REFERENCES

1. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Surg Infect* 2013;14(1):73–156.
2. Schweizer M, Perencevich E, McDanel J, et al. Effectiveness of a bundled intervention of decolonization and prophylaxis to decrease Gram positive surgical site infections after cardiac or orthopedic surgery: systematic review and meta-analysis. *BMJ* 2013;346:f2743. doi:10.1136/bmj.f2743.
3. Rao N, Canella B, Crossett LS, Yates AJ Jr, McGough R III. A preoperative decolonization protocol for *Staphylococcus aureus* prevents orthopedic infections. *Clin Orthop Relat Res* 2008; 466(6):1343–1348.
4. Hacek D, Robb W, Paule S, Kuudrna JC, Stamos VP, Peterson LR. *Staphylococcus aureus* nasal decolonization in joint replacement surgery reduces infection. *Clin Orthoped Relat Res* 2008; 466(6):1349–1355.
5. Kalmeijer MD, Coertjens H, van Nieuwland-Bollen PM, et al. Surgical site infections in orthopedic surgery: the effect of mupirocin nasal ointment in a double-blind, randomized, placebo-controlled study. *Clin Infect Dis* 2002;35(4):353–358.
6. Kluytmans JA, Mouton JW, VandenBergh MFQ, et al. Reduction of surgical-site infections in cardiothoracic surgery by elimination of nasal carriage of *Staphylococcus aureus. Infect Control Hosp Epidemiol* 1996;17(12):780–784.
7. Bode LG, Klutymans JA, Wertheim HF, et al. Preventing surgical-site infections in nasal carriers of *Staphylococcus aureus. New Engl J Med* 2010;362(1):9–17.
8. Perl TM, Cullen JJ, Wenzel RP, et al. Intranasal mupirocin to prevent postoperative *Staphylococcus aureus* infection. *New Engl J Med* 2002;346(24):1871–1877.
9. Konvalinka A, Errett L, Fong IW. Impact of treating *S. aureus* nasal carriage on wound infections in cardiac surgery. *J Hosp Infect* 2006;64(2):162–168.
10. Diekema D, Johannsson B, Herwaldt L, et al. Current practice in *Staphylococcus aureus* screening and decolonization. *Infect Control Hosp Epidemiol* 2011;32(10):1042–1044.

https://doi.org/10.1086/676866 Published online by Cambridge University Press