CONCISE COMMUNICATION

Evaluation of Methicillin-Resistant *Staphylococcus aureus* Skin and Soft-Tissue Infection Prevention Strategies at a Military Training Center

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Military trainees are at high risk for skin and soft-tissue infections (SSTIs), especially those caused by methicillin-resistant *Staphylococcus aureus* (MRSA). A multicomponent hygiene-based SSTI prevention strategy was implemented at a military training center. After implementation, we observed 30% and 64% reductions in overall and MRSA-associated SSTI rates, respectively.

Infect Control Hosp Epidemiol 2013;34(8):841-843

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major cause of skin and soft-tissue infections (SSTIs), and its importance as a community-associated (CA) pathogen has increased.[1] Certain groups are known to be at high risk for CA-MRSA infections, including athletes, inmates, and military personnel. The abundance of purported SSTI risk factors, including crowded living conditions, inadequate personal hygiene, skin injury, and environmental contamination, contributes to sustained CA-MRSA transmission in these groups.[2]

As MRSA colonization appears to be associated with subsequent disease, decolonization has been targeted as a prevention strategy. The effectiveness of antibiotics and topical antiseptics (eg, mupirocin and chlorhexidine) in eradicating *S. aureus* from the nose, axilla, and other skin surfaces has been assessed.[3,4] MRSA prevention strategies have been evaluated in healthcare settings[5] and, to a lesser extent, in community-based settings.[6] Few studies have been conducted among military personnel.[3,4]

Among military personnel, MRSA-associated SSTI risk is highest among new trainees.[2] Rates of endemic SSTI at one military training center prompted the command to implement a multicomponent SSTI prevention program. Here, we assess the impact of this program on rates of overall and MRSA-associated SSTI.

METHODS

Study population. The military training center is located in the southeastern United States. The training center was divided into 4 battalions, and each battalion was composed of 3 to 4 companies. Each battalion had its own battalion aid station where trainees could seek care, but they could also seek care at the center's solitary health clinic. The training population averaged 4,778 (range, 2,479–7,436) recruits per week, with the highest number of recruits entering in the summer months for the 13-week training course. All trainees at this center were included in the study population.

Intervention. The program components were based on Navy Marine Corps Public Health Center (formerly the Navy Environmental Health Center) SSTI prevention guidelines.[7] The program was implemented in December 2005. On arrival, new trainees were instructed to take a 3–5-minute shower with 15 mL of 4% chlorhexidine gluconate–based body wash. During the course of their training, trainees were instructed to use the wash 6 additional times. Attempts were made to standardize trainees' personal hygiene practices; all received personal hygiene instruction, soap, adequate shower time, and first-aid kits. Instructors inspected trainees for wounds and SSTI. Both trainee and instructor populations were given educational materials on SSTI prevention.

Measured outcomes. Using a disease surveillance system maintained at the training center's main health clinic, we obtained aggregated medical record data from January 2003 through December 2009. The data were derived from medical encounter case reports and clinical microbiology laboratory reports. Case counts were aggregated weekly, and the weekly trainee census was used as the denominator.

The primary outcomes were rates of overall and MRSA-associated SSTI. We identified cases of SSTI through electronic medical record review, using *International Classification of Diseases, Ninth Revision* (*ICD-9*), codes 382.1, 680.6, 682.0–682.9, 683, 686.1, 686.8, and 686.9. MRSA-associated SSTI cases were identified through laboratory records using the following criteria: (1) clinically recognized SSTI (*ICD-9*) and (2) culture-positive MRSA. All culture specimens were processed and reported by a single laboratory.

Statistical analysis. Rates were calculated as the number of cases per 1,000 persons and stratified by preintervention (January 2003–December 2005) and intervention (January 2006–December 2009) periods. Rate differences were evaluated using independent-sample *t* test. SPSS, version 20.0, was used for all analyses.

RESULTS

A total of 12,233 overall and 3,090 MRSA-associated SSTI cases were reported. The average annual number of cases of overall and MRSA-associated SSTIs was 1,748 (range, 1,174–2,495) and 441 (range, 211–1,051), respectively (Figure 1). The average weekly recruit population was 4,778 overall and did not differ significantly by year (2003, $n = 4,842$; 2004, $n = 4,584$; 2005, $n = 4,827$; 2006, $n = 4,747$; 2007, $n =$

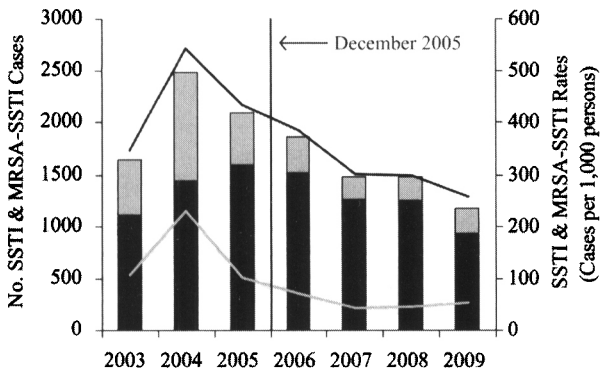

FIGURE 1. Skin and soft-tissue infections (SSTIs) and methicillin-resistant *Staphylococcus aureus* (MRSA)–associated SSTI cases and rates among trainees at the military training center from 2003 through 2009. The center black line represents program implementation in December 2005. Numbers of cases of non-MRSA-associated SSTI and MRSA-associated SSTI are represented by black and gray bars, respectively. Rates of overall SSTI and MRSA-associated SSTI are represented by black and gray lines, respectively.

4,902; 2008, $n = 4{,}972$; 2009, $n = 4{,}575$; $P = .51$). Annual SSTI rates were highest in 2004 (544 per 1,000 persons) and, following the December 2005 implementation, steadily declined thereafter to 257 per 1,000 persons in 2009. Overall SSTI rates in the intervention period (2006–2009) were 30% lower than those in the nonintervention period (2003–2005; $P < .001$; Figure 2). Similarly, rates of MRSA-associated SSTI in the intervention period were 64% lower than those in the nonintervention period ($P < .001$; Figure 2). Analyses of weekly incidence data demonstrated similar trends of decreased rates in the intervention period (data not shown).

DISCUSSION

We observed significant reductions in rates of overall and MRSA-associated SSTI in a military training center following the implementation of a multicomponent hygiene-based prevention program. Our findings suggest that a program consisting of education, standardized hygiene practices, and a chlorhexidine shower regimen may be an effective SSTI prevention strategy in similar high-risk congregate settings.

Within the hospital setting decolonization of *S. aureus* nasal carriers has been shown to prevent *S. aureus* surgical site infections,[8] and within the community setting a household-based decolonization strategy was effective at reducing SSTI.[6] Conversely, studies of SSTI prevention in the military setting have yielded mixed results. Two prospective controlled trials among military trainees, one of nasal mupirocin administered to MRSA-colonized individuals[3] and a second employing chlorhexidine-impregnated body cloths,[4] demonstrated an impact on MRSA colonization but no effect on disease.

Other studies have employed multicomponent prevention strategies, not only for MRSA-associated infections and MRSA outbreaks in other closed settings but also for other contact-transmissible infections (ie, respiratory illnesses).[9] These studies demonstrated the effectiveness of standardized hygiene practices in combination with prevention education. It is difficult to determine, however, which component was most effective in preventing infection.

This study has several strengths. First, as all care was provided within a single military health system, the likelihood of missing SSTI cases or clinical culture specimens was minimized. Second, multiyear surveillance permitted a thorough evaluation of disease trends before and after program implementation. Third, the program was command directed. Trainees and instructors were ordered to follow the program, making compliance with the measures universal in principle.

There are limitations to the study. First, although command involvement could be perceived as a strength, it could also be viewed as a limitation. It is possible that the desire to demonstrate the effectiveness of the prevention program may have influenced practices on the trainee, instructor, and/or healthcare-provider level. Second, cases of MRSA-associated SSTI may have been missed due to varying culture practices over the study period. Third, it is possible that the observed decrease in SSTI, especially those due to MRSA, were not attributable to the intervention but, rather, to secular trends in disease. For example, in an analysis of military health system data, Landrum et al[10] reported a significant decrease in rates of MRSA-associated SSTI from 2005 through 2010.

It is often recommended that SSTI prevention strategies should include multiple hygiene-based measures as well as educational components.[7] Among high-risk military recruits, significant reductions in SSTI rates followed the implementation of a multicomponent hygiene-based intervention. The

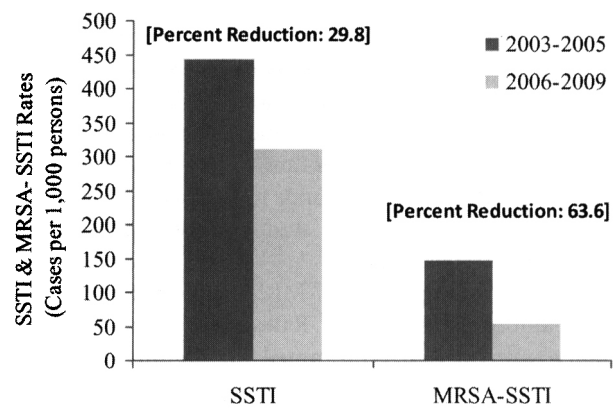

FIGURE 2. Skin and soft-tissue infections (SSTIs) and methicillin-resistant *Staphylococcus aureus* (MRSA)–associated SSTI rates among trainees at the military training center. Black and gray bars represent average annual rates of SSTI and MRSA-associated SSTI in the preintervention (2003–2005) and intervention (2006–2009) periods. Rate differences were significant ($P < .001$).

https://doi.org/10.1086/671278 Published online by Cambridge University Press

findings of this retrospective observational study suggest that randomized controlled evaluations of hygiene-based SSTI prevention strategies are warranted.

ACKNOWLEDGMENTS

We thank the Recruit Training Command and the Medical Command for permitting us to perform analyses and report the findings of this study. Additionally, we appreciate all the assistance the EpiData Center provided in running secondary analyses.

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.

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Presented in part: 5th Decennial International Conference on Healthcare-Associated Infections; Atlanta, Georgia; March 19th, 2010.

The opinions expressed are those of the authors and should not be construed to represent those of US Army, the Department of Defense (DoD), or any designated DoD or military organization.

Received January 2, 2013; accepted March 26, 2013; electronically published June 27, 2013.

 0899-823X/2013/3408-0013$15.00. DOI: 10.1086/671278

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