Letters to the Editor

Nasal Carriage of Methicillin-Susceptible and Methicillin-Resistant *Staphylococcus aureus* Among Paramedics in the Sedgwick County Emergency Medical Service in Wichita, Kansas

To the Editor:

Staphylococcus aureus is frequently found as part of normal human microflora, with the primary carriage site being the anterior nares. Nasal carriage can be classified as persistent or intermittent. Persistent carriage typically involves the long-term maintenance of a single strain, whereas intermittent carriage typically involves different strains during discontinuous periods of carriage. Approximately 20% of individuals are persistent carriers, 60% are intermittent carriers, and 20% are noncarriers.[1] The incidence of nasal carriage is approximately 30% for the general population, and is similar for healthcare workers and patients tested on admission to and during stays in hospitals, nursing homes, and residential facilities.[1]

Methicillin-resistant *S. aureus* (MRSA) strains were first detected in the early 1960s and have since become widespread.[2,3] Infections caused by methicillin-susceptible *S. aureus* (MSSA) and MRSA are a growing concern, particularly among patients in intensive care and surgical units, immunocompromised patients, and elderly patients in hospitals and nursing homes.[1] Nasal carriage is a significant contributor to the epidemiology and pathogenesis of these healthcare-associated infections. The epidemiologic pathways include endogenous spread, postoperative surgical wound infections, contaminated environmental surfaces,[4] and patient-to-patient spread, frequently from patient to healthcare worker to patient.[1] Moreover, there is now increasing evidence of the appearance of MRSA in the community.[5]

TABLE
PULSED-FIELD GEL ELECTROPHORESIS PROFILES OF THE PARAMEDICS

Paramedic	PFGE Type: Initial	PFGE Type: Follow-up	Persistent?	Relatedness to Strain A
1	A	A	Yes	Identical
2	A	Not available	?	Identical
3	Negative	A	No	Identical
4	A_1	A_1	Yes	2-band difference
5	A_2	A_2	Yes	4-band difference
6	A_3	B	No	4-band difference
7	A_3	Negative	No	4-band difference

PFGE = pulsed-field gel electrophoresis.

The topical application of mupirocin has been effective in eradicating MSSA and MRSA nasal colonization. It has been recommended for the preoperative eradication of *S. aureus* from patients undergoing cardiac surgery,[6] patients with human immunodeficiency virus,[7] and patients undergoing hemodialysis and continuous ambulatory peritoneal dialysis.[1,8] However, considerable controversy exists as to whether attempts to control the asymptomatic carriage of *S. aureus* are productive. The goals of our study were to determine the incidence of MSSA and MRSA nasal carriage among the personnel of the Sedgwick County Emergency Medical Service (EMS) and to suggest possible risk factors associated with carriage in this population.

In March 1999, nasal swab samples were taken from 109 of 116 Sedgwick County EMS paramedics to determine MSSA and MRSA nasal carriage. A second sample was taken 1 year later from 85 individuals in the original test group and from 13 new individuals. These samples were processed to determine the carrier state of each individual and the overall incidence of carriage for the service as a whole. *S. aureus* identification was performed using standard procedures.[9] All of the *S. aureus* samples were tested for methicillin resistance using the E-test method (AB Biodisk, Piscataway, NJ). The MRSA isolates were sent to the Centers for Disease Control and Prevention (CDC) for DNA typing by pulsed-field gel electrophoresis (PFGE) of *Sma*I restriction digests to determine relatedness among the strains. The CDC confirmed that all of the isolates were oxacillin resistant, vancomycin susceptible, and carried the *mec*A gene.

Of 109 paramedics sampled initially, nasal carriage was detected in 59 (54.1%); 6 (10.2%) of these isolates were MRSA. In the second sampling conducted approximately 1 year later on 98 paramedics, the incidences were 49.0% for MSSA and 10.4% for MRSA. Eighty-five paramedics participated in both samplings. Of these, 70.5% maintained their initial carriage status. Seven paramedics carried MRSA strains. PFGE was performed on all MRSA samples. Each of the PFGE profiles had the same number of bands, with at least 50% of the bands common to all profiles.

In addition to the testing of the paramedics, a total of nine nasal samples were obtained from immediate family members of four of the MRSA carriers to determine their carriage status. None of the family members were MRSA carriers, and only one was an MSSA carrier. On the basis of the interpretive criteria for determining relatedness set forth by Tenover et al.,[10] the MRSA strains isolated from the paramedics in the Sedgwick County EMS are possibly related. More sophisticated population genetic tools would be needed to resolve this issue (Table).

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Chi-square and discriminate function analysis tests were performed to evaluate the possible contribution of the following factors to the incidence of carriage: age, gender, chronic health conditions, frequency of antibiotic use, total number of calls, and number of nursing home calls responded to per year. Neither analysis indicated any significant relationship between *S. aureus* nasal carriage and the surveyed factors ($P > .05$). Statistical analyses were not performed on the MRSA data because the sample size was too small to provide reliable interpretation.

Epidemiologic studies are important because of the increasing number of both MSSA and MRSA infections, their multiple drug resistance, their increasing reservoirs, and their ability to cause community outbreaks. Our results indicate that the incidence of nasal carriage of *S. aureus* among the paramedics of the Sedgwick County EMS is approximately 50%; 10% of these strains are MRSA. This incidence remained high during the course of this study, and is higher than the 30% to 35% incidence cited for most other groups of healthcare workers.[1] Paramedics are unique in that they have brief but uncontrolled exposures to patients. In addition, they frequently transport patients to and from hospitals and nursing facilities, where MRSA is often endemic. The increased frequency of carriage in the paramedic population implies that it is not random and that there is a discrete, yet unknown, cause for this phenomenon. Results of the observations described here are provocative and suggest the need for more comprehensive studies, including identification of the point source of the MRSA strains. Also, similar studies of paramedics in communities that are demographically similar to Sedgwick County would help to determine whether our findings are unique to the paramedics of Sedgwick County or whether they reflect a higher incidence of carriage among EMS personnel in general. In addition, regular continuing medical education programs should be encouraged to reinforce the need for strict adherence to transmission-based precautions and to increase knowledge of pathogenic microorganisms.

REFERENCES

1. Kluytmans J, Van Belkum A, Verbrugh H. Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks. *Clin Microbiol Rev* 1997;10:505-520.
2. Jevons MP. Celbenin-resistant staphylococci. *BMJ* 1961;1:124-125.
3. Centers for Disease Control and Prevention. National Nosocomial Infections Surveillance Report. *Am J Infect Control* 2000;28:429-448.
4. Al-Barrak A, McLeod AJ, Embil J, Thompson G, Ashe F, Nicolle L. Putting out the fire: extinguishing an outbreak of methicillin-resistant *Staphylococcus aureus* (MRSA) on a burn unit. *Am J Infect Control* 1998;26:189.
5. Centers for Disease Control and Prevention. Four pediatric deaths from community acquired methicillin-resistant *Staphylococcus aureus*—Minnesota and North Dakota, 1997-1999. *MMWR* 1999;48:707-710.
6. Jakob HG, Borneff-Lipp M, Bach A, et al. The endogenous pathway is a major route for deep sternal wound infections. *Eur J Cardiothorac Surg* 2000;17:154-160.
7. Martin JN, Perdreau-Remington F, Kartaljia M, et al. A randomized clinical trial of mupirocin in the eradication of *Staphylococcus aureus* nasal carriage in human immunodeficiency virus disease. *J Infect Dis* 1999;80:896-899.
8. Mylotte JM, Kahler L, Jackson E. "Pulse" nasal mupirocin maintenance regimen in patients undergoing continuous ambulatory peritoneal dialysis. *Infect Control Hosp Epidemiol* 1999;20:741-745.
9. Kloos WE, Bannerman TL. *Staphylococcus* and *Micrococcus*. In: Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH, eds. *Manual of Clinical Microbiology*, 7th ed. Washington, DC: ASM Press; 1999:264-282.
10. Tenover FC, Arebit RD, Goering RV, et al. Interpreting chromosomal DNA restriction patterns produced by pulsed-field gel electrophoresis: criteria for bacterial strain typing. *J Clin Microbiol* 1995;33:2233-2239.

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Efficacy of Alcohol-Based Hand Sanitizers Against Fungi and Viruses

To the Editor:

The antimicrobial effectiveness of short-chain alcohols, mainly ethanol, against fungus and yeast has been well documented in the literature. In general, the most effective ethanol concentration range has been reported to be greater than 50%, acting in 1 minute.[1,2] However, no data are available on the efficacy of alcohols at contact times of less than 1 minute or on alcohol-based sanitizers.[1] Regarding the antiviral activity of alcohols, it is well established that alcohols are effective against lipophilic, enveloped viruses. The data suggest that alcohols inactivate enveloped viruses more easily than "naked" viruses[2]; however, there is no general agreement in the literature on the activity of alcohols against naked viruses. The results published to date suggest that alcohol is effective, but that the antiviral efficacy depends on the specific virus. Sattar et al., using the fingerpad method, recently found that the level of reduction of several naked viruses by an alcohol-based sanitizer was statistically significantly higher than that seen with a water control.[3]

To assess the antifungal and antiviral activity of an alcohol-based sanitizer, we conducted in vitro time-exposure kill evaluations of PURELL Instant Hand Sanitizer (GOJO Industries, Inc., Akron, OH), which contains 62% ethanol and emollients. Fifteen- and 30-second exposures were used for the fungal species and 30-second exposures for the viruses. The 15- and 30-second exposure kill studies were performed using selected challenge fungi and viruses. The challenge inoculum was introduced to the test product at time 0; a portion of the sample was removed and placed in neutralizing media at the appropriate time (15 or 30 seconds). Standard plate-counting techniques were used to enumerate viable challenge microorganisms.

The efficacy of the alcohol-based sanitizer against 7 fungal species is detailed in Table 1. It is apparent from Table 1 that the alcohol-based sanitizer was highly effective in 15 seconds against all of the fungal species investigated.

The efficacy of the alcohol-based sanitizer against viruses in 30-second exposure kill evaluations is detailed in Table 2. It is apparent that the alcohol-based sanitizer is effective against viruses in 30 seconds; however, the data show considerable variation, depending on the viral species.

The efficacy of alcohol as a bac-