Estimating the proportion of community-associated methicillin-resistant *Staphylococcus aureus*: two definitions used in the USA yield dramatically different estimates

D.V. Folden, J.A. Machayya, A.E. Sahmoun, J.R. Beal, G.S. Holzman, S.D. Helgerson, T.S. Lo,*

*University of North Dakota School of Medicine and Health Sciences, Grand Forks, ND, USA
Infectious Disease Section, Veterans Affairs Medical Center, Fargo, ND, USA

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**Summary** The objective of this retrospective study was to compare the prevalence of community-associated methicillin-resistant *Staphylococcus aureus* (CAMRSA) and healthcare-associated MRSA (HAMRSA) using healthcare risk factor exposure criteria with that obtained using Centers for Disease Control and Prevention (CDC) criteria. Cases were defined as CAMRSA or HAMRSA based on the general CDC guidelines for nosocomial infections, and then re-assessed with healthcare risk factor exposure criteria using a medical chart review. One hundred MRSA cases occurred at a mid-Western veterans affairs medical centre from November 2001 to November 2003. The proportion of these cases classified as CAMRSA differed dramatically when classified by healthcare risk factor exposure criteria (5%) compared with CDC nosocomial infection criteria (49%). Estimating the role of healthcare-related exposures and developing strategies to control MRSA can be markedly affected by the criteria used to determine CAMRSA and HAMRSA.

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**Introduction**
Methicillin-resistant *Staphylococcus aureus* (MRSA) has been a common nosocomial pathogen since the 1960s. MRSA causes serious infection, accounting
for approximately 50% of nosocomial *S. aureus* isolates in the USA. Established risk factors for MRSA infection include residence in long-term care facilities, recent hospitalizations, surgery and intravenous drug use. Recently, however, MRSA infections have been found in people without established risk factors. These infections are thought to be acquired in the community and are referred to as community-associated MRSA infections (CAMRSA). Some of these CAMRSA infections have resulted in hospitalization and even death. Morbidity and mortality from MRSA have been associated with inappropriate empirical antimicrobial therapy selection.

The Centers for Disease Control and Prevention (CDC) have established broad guidelines for determining the presence and classification of nosocomial infections. It is these criteria that a mid-West medical centre used to determine healthcare-associated MRSA (HAMRSA) infection rates. However, an alternative way to classify HAMRSA infections is based on the presence of healthcare-associated risk factors for acquisition including those prior to a current hospitalization. Thus, two sets of criteria can be used for the diagnosis of HAMRSA infections.

The objective of this retrospective study was to compare the prevalence of CAMRSA and HAMRSA isolates using a local application of the CDC guidelines for nosocomial infections with the prevalence obtained when using criteria that utilize healthcare risk factor exposure.

### Methods

The study was conducted at the veterans affairs medical centre (VAMC) in a mid-Western city. Our VAMC provides health care to retired members of the US military service. It is a general medical, surgical and psychiatric facility with a total of 60 operating and 50 restorative care unit beds. The VAMC serves approximately 90 000 veterans residing in North Dakota, South Dakota and Minnesota. We had 25 287 unique patients in 2004 and more than 95% were white males. All new laboratory-confirmed MRSA isolates among patients treated at this facility between November 2001 and November 2003 were evaluated using the patients’ medical records.

Cases had been defined as CAMRSA or HAMRSA by the institution’s classification system, which relied on the general CDC guidelines for nosocomial infections. Based on these criteria, an infection associated with a complication or extension of an infection(s) already present on admission would not be considered nosocomial and therefore could be defined as a ‘community-acquired’ infection. These cases were re-assessed with healthcare risk factor exposure criteria using a medical chart review. Healthcare-associated MRSA cases were defined as patients with: (1) an MRSA infection identified 48 h or more after admission to a hospital; (2) a history of hospitalization, surgery, dialysis or residence in a long-term care facility within one year of the MRSA culture date; (3) a permanent indwelling catheter or percutaneous medical device (e.g. tracheostomy tube, gastrostomy tube or Foley catheter) present at the time of culture; or (4) a known positive culture for MRSA prior to the current admission. Cases that had none of the above features were classified as community associated. Demographic and clinical information was obtained for both CAMRSA and HAMRSA cases. The cases (or isolates) included both infection and colonization.

### Results

One hundred MRSA isolates were obtained from patients at the VAMC from November 2001 to November 2003. The proportion of these cases classified as CAMRSA differed dramatically when classified by healthcare risk factor exposure criteria (5%) compared with the prevalence obtained using the CDC nosocomial infection criteria (49%). Similarly, the proportion classified as HAMRSA varied when healthcare risk factor exposure criteria (95%) were used compared with the nosocomial infection criteria (51%) (Figure 1).

### Discussion

This study found a marked difference in the prevalence of CAMRSA as determined by local use of the CDC criteria for nosocomial infections compared with our analysis based on the absence of healthcare risk factor exposures at the same institution. Data from the VAMC observed the prevalence of CAMRSA to be 49% over the past 24 months. Our assessment suggested that the proportion of CAMRSA was only 5% over the same time period, suggesting that 90% of all patients previously defined as CAMRSA at the VAMC had one or more healthcare-associated risk factors.

A recent meta-analysis reported the same discrepancy in prevalence. The prevalence of CAMRSA among hospital MRSA cases was 30% in 27
retrospective studies (in which six different definitions were used) and 37% in five prospective studies (using three different definitions). Of all the patients with CAMRSA in these studies, 85% had one or more healthcare-associated risk factors, which could negate the CAMRSA classification. This suggests that the prevalence of MRSA among people without risks (true CAMRSA) remains very low, which is consistent with the findings of this study.

The criteria used by the VAMC to define CAMRSA are based on the CDC definitions for nosocomial infections. This definition is used by healthcare facilities around the USA for determining internal nosocomial infection rates, which are reported to insurance companies and other contracting agencies. For example, a veteran patient seeking specialized care at a community hospital may be discharged without signs of infection. If the patient subsequently develops a symptomatic MRSA infection after being discharged and seeks care from his provider at the VAMC, the cultured MRSA is documented as community associated and would go unnoticed and undocumented at the healthcare facility at which the infection was probably contracted. This method of classifying MRSA drastically increases the number of CAMRSA infections and underestimates the number of HAMRSA infections compared with classification using criteria that recognize a range of healthcare risk factors.

Although this study found the prevalence of CAMRSA to be quite low, there is emerging evidence of MRSA strains in the community, apparently not influenced by prior receipt of health care or intense exposure to antibiotics. These CAMRSA strains harbor a specific staphylococcal cassette chromosome (SCCmec) type IV and contain a Panton-Valentine leukocidin toxin, a virulence factor related to skin and soft tissue infection. Additionally, most CAMRSA isolates are susceptible to several antimicrobial agents and are resistant to beta-lactams alone. Clinicians should be aware of the above CAMRSA features, and select empirical antimicrobial treatment with care as these infections may not routinely require the use of vancomycin.

A limitation of our investigation was its retrospective design. We were not able to contact patients with CAMRSA to verify any hospitalization or clarify risk factors that might have been missing in the VAMC medical records. We were also unable to enquire about family members with risk factors typical of MRSA. It is therefore possible that additional patients defined as CAMRSA would be redefined as HAMRSA and decrease the overall prevalence of CAMRSA to less than 5% according to risk factor criteria.

This study has identified a potential problem related to the estimates of CAMRSA prevalence at healthcare institutions using the CDC criteria for determining nosocomial infections. Established risk factors can be used to distinguish isolates that are CAMRSA from those that are likely to be HAMRSA. It is feasible to apply these risk factor criteria to the development of CAMRSA estimates. Consistent use of clear terminology and criteria is important to allow comparisons of results among investigations. In addition, strategies to control MRSA may be markedly affected by the criteria used to determine CAMRSA and HAMRSA.

References

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