

SHORT REPORT

Screening for methicillin-resistant *Staphylococcus aureus* (MRSA) in community-recruited injection drug users: are throat swabs necessary?

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SUMMARY

We examined and described colonization of MRSA in the anterior nares and throat from 184 community-recruited injection drug users. Thirty-seven (20%) were positive for MRSA: most (34, 92%) were carriers in the nares; while only three (8%) were carriers detected by throat swabs alone. The majority (29, 78%) of MRSA isolates were PVL positive.

Key words: Colonization, community, injection drug user, MRSA, screening.

Methicillin-resistant *Staphylococcus aureus* (MRSA) remains an important pathogen in the hospital setting and has become a well-established pathogen in a number of community settings [1–3]. Carriage of *S. aureus* in the anterior nares is common in the general population [4], and the anterior nares have generally been considered the most reliable colonization site when screening for MRSA. As such, collection of swabs from the anterior nares is considered standard practice for hospital infection control programmes that choose to screen routinely for MRSA colonization, and previous studies have demonstrated high sensitivity associated with this methodology [5, 6].

Recent studies, however, have indicated that additional throat swabs may be necessary to optimize detection of all carriers of *S. aureus* [7–9] and have demonstrated an increase in sensitivity of detection in MRSA carriers by 19% and 22% [7, 8]. In two

hospital-based studies, *S. aureus* colonization was more frequent in the throat (83% and 64%, respectively) than the anterior nares (61% and 50%, respectively) in MRSA isolates [8, 9].

In contrast, little is known about the sensitivity of throat swabs in community-based settings despite the high prevalence of MRSA in certain high-risk subpopulations [2]. The objective of our study was to determine whether throat swabs are necessary to increase detection of MRSA in a community-recruited sample of injection drug users (IDUs). This knowledge may facilitate establishing special isolation precautions (e.g. ‘contact precautions’) in the case of hospitalization and modification of empirical antibiotic treatment if an infection occurs.

From 7 July to 28 November 2008, a sub-study was conducted among the Vancouver Injection Drug User Study (VIDUS) and Scientific Evaluation of Supervised Injection (SEOSI) participants who were recruited during visits to the VIDUS research office [10]. All VIDUS and SEOSI participants were eligible for the sub-study, and participants within this sub-study provided additional informed consent [3].

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A brief questionnaire was completed, and the study physician or nurse collected swabs from both the anterior nares (by rotating the swab tip in both nostrils) and from the posterior wall of the oropharynx. The University of British Columbia–Providence Health Care Research Ethics Board approved this study.

Swabs were collected using separate Venturi Trans system culture swabs (Copan, Italy). In the microbiology laboratory, swabs were initially streaked onto 5% sheep blood agar (Oxoid, Canada; Nepean, Canada) and MRSAselect (Bio-Rad, France). Suspicious colonies were further tested using a combination of cefoxitin disk testing and automated susceptibility testing. Isolates were confirmed as MRSA by testing for the presence of *mecA* and *nuc* genes using polymerase chain reaction (PCR), as previously described [3]; all MRSA isolates were tested for Pantón–Valentine leukocidin (PVL) by detection of *lukS-PV* and *lukF-PV* genes by PCR [3]. Although there is not 100% correlation between PVL and USA300 strains, isolates found to be PVL positive were considered to belong to the pulsed-field gel electrophoresis (PFGE) type known as USA300 (CMRSA-10 in Canada), based on prior observed associations between USA300 and PVL showing a very high degree of correlation within our local environment [11, 12]. Statistical analyses were conducted using SAS 9.2 (SAS Institute Inc., USA) and OpenEpi 2.3.1 (Open Source Initiative, USA). All *P* values considered were two-sided. The definition of sensitivity was consistent with that used in previous studies and was defined as the number of positive samples divided by the number of MRSA carriers [6, 7]. A number-needed-to-screen calculation was also performed in order to determine the utility of additional throat swabs.

Of the 217 participants screened, 98 (45%) were carriers of *S. aureus*; 55 (25%) had methicillin-susceptible *S. aureus* (MSSA) and 43 (20%) had MRSA identified from the anterior nares. Of the 217 participants 184 (85%) were screened for both nares and throat colonization. The percentage of MRSA carriage from the anterior nares was not significantly different between the 33 (18%) participants without a throat swab compared to the 184 with a throat swab (20%, $P=0.798$). The median age of this sample of 184 participants was 40 years (interquartile range 34–45) and 31% were female. As shown in Table 1, of the 184 individuals with both throat and nares cultures, 49 (27%) and 37 (20%) were positive

for MSSA and MRSA, respectively. MRSA therefore accounted for 43% of the 86 *S. aureus* isolates, and 29 (78%) out of 37 MRSA isolates were PVL positive. MRSA colonization was most frequent in the anterior nares, detecting 34 (92%) of 37 MRSA cases and 27 (93%) of 29 of the PVL-positive MRSA cases. The remaining three (8%) of 37 MRSA isolates – of which two (7%) out of 29 were PVL positive – were not detected in the nares and were identified only in the throat.

More specifically, 25 [68%, 95% confidence interval (CI) 51–81] of the 37 MRSA-positive cases were carriers only in the nares, nine (24%, 95% CI 13–40) in the nares and throat and three (8%, 95% CI 2–21) only in the throat. Of the 29 MRSA cases harbouring PVL-positive isolates (corresponding to USA300), 22 (76%) were detected in the nares only, five (17%) in nares and throat, and two (7%) only in the throat. Overall for all *S. aureus* carriage, throat cultures identified an additional seven (8%) out of 86 cases not identified by screening of the anterior nares.

In our population, if 184 patients were screened, 34 MRSA carriers would be positive in the nares (19% positive results) with the number-needed-to-screen $n=5$ (95% CI 4–8); 12 MRSA carriers would be also be positive in the throat (7% positive results) with the number-needed-to-screen $n=15$ (95% CI 9–29). In addition to the 184 nasal swabs, 184 throat swabs must be performed in order to find another three MRSA carriers (2% exclusive throat positive results) not identified through nasal swabs, with the number-needed-to-screen $n=61$ (95% CI 21–297).

In our study population, 1/5 community-recruited IDUs was colonized with MRSA. Our results show that screening the anterior nares detected 92% of MRSA (all types) and 93% of MRSA PVL-positive USA300 strain carriers. Throat swabs alone detected only an additional three cases, which corresponds to an increase in sensitivity of 8% for MRSA (all strains) and 7% for MRSA (USA300 strain). To our knowledge, this is the only study to date comparing nose and throat MRSA screening in a community-recruited setting of IDUs.

MRSA microbiology and epidemiology are determined locally and probably depend on a multitude of factors including: strain-specific factors, host factors and environmental factors. Our community-recruited sample of IDUs had a higher prevalence of MRSA compared to the general population (<2%) [4, 13] and to individuals admitted to hospital (<8%) [2, 14].

Table 1. Prevalence and colonization sites of *Staphylococcus aureus* from the anterior nares and throat

<i>S. aureus</i> type	Number screened	Positive specimen (%)	Positive nares only (% positive)	Positive throat only (% positive)	Positive nares and throat (% positive)
MSSA	184	49 (27)	41 (84)	4 (8)	4 (8)
MRSA	184	37 (20)	25 (68)	3 (8)	9 (24)
PVL + MRSA	37	29 (78)	22 (76)	2 (7)	5 (17)

PVL, Pantone–Valentine leukocidin; MSSA, Methicillin-susceptible *Staphylococcus aureus*; MRSA, methicillin-resistant *Staphylococcus aureus*.

However, this high prevalence is probably related to our community-recruited sample that is known to carry MRSA [3] and is at high risk of acquisition and transmission of MRSA (especially USA300), due to high rates of skin and soft tissue infections [1, 3, 15], HIV-seropositive status [1, 14], history of drug use or incarceration [1, 3, 15], and frequent healthcare contact [1, 15].

In our community-recruited sample of IDUs, throat swabs alone identified carriage of MRSA in only a small proportion of subjects not already identified by swabs collected from the anterior nares. These findings differ from other recent reports in hospital-based settings where throat swabs alone identified a much higher proportion (nearly three times) of MRSA carriage [7, 8]. It has been reported that throat carriage of *S. aureus* may be more prevalent in healthy individuals with little exposure to healthcare settings [7]. If that is the case, we might expect a lower number of positive throat swabs given our community-recruited sample of IDUs have known compromised health and frequent contact with healthcare settings [15].

There are limitations to our study that warrant acknowledgment. First, the cross-sectional design of this study precludes temporal relationships to be drawn from our findings. Second, our results are from IDUs and based on a sub-sample of VIDUS participants, and therefore may not be representative of the injection drug-using community in this setting or elsewhere. Third, our study is limited in its sample size. Our results should be confirmed by an examination of MRSA prevalence and persistence of carriage over time, within a larger sample.

This study identified a high prevalence of MRSA carriage in a community-recruited sample of IDUs. Most detection of MRSA – and specifically MRSA PVL + USA300 strain – was in the anterior nares; only a very small number of cases were identified

when an additional throat swab was collected in our population. Further research on MRSA carriage in community-based high-risk subpopulations and elucidation of risk factors, including healthcare exposure, is required.

Our findings have implications for policy and planning of screening programmes for MRSA. The value of collecting an additional swab from the throat for MRSA screening depends on the setting. For example, in a community-recruited sample of IDUs or hospital setting that has a low prevalence of MRSA, the additional cost and coordination of a throat swab may be of benefit to improve sensitivity of detection. However, in a community or hospital setting that has a high prevalence of MRSA, detection of MRSA may be better improved by increasing the total number of individuals screened among those at high risk for MRSA rather than adding a throat swab to the nares screening swabs already performed.

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DECLARATION OF INTEREST

None.

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