Prevalence of USA300 colonization or infection and associated variables during an outbreak of community-associated methicillin-resistant *Staphylococcus aureus* in a marginalized urban population

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BACKGROUND: In 2004, an outbreak of the USA300 strain of methicillin-resistant *Staphylococcus aureus* (MRSA) was identified in persons with histories of homelessness, illicit drug use or incarceration in the Calgary Health Region (Calgary, Alberta). A prevalence study was conducted to test the hypotheses for factors associated with USA300 colonization or infection.

METHODS: Participants were recruited at sites accessed by this marginalized population. Health care staff administered a questionnaire and collected crack pipes and nasal, axillary and skin infection swabs. Pipes and swabs were cultured according to standard techniques. MRSA isolates were further characterized by polymerase chain reaction (*mec*A, Panton-Valentine leukocidin and Staphylococcal cassette chromosome *mec*) and typing methods (pulsed-field gel electrophoresis, staphylococcal protein A typing and multilocus sequence typing). Colonization or infection was determined by having any one of nasal, axillary, skin infection or pipe swabs positive for USA300. Colonized participants had one or more nasal, axillary or pipe swab positive for USA300; infected participants had one or more skin infection swab positive for USA300.

RESULTS: The prevalence of USA300 colonization or infection among 271 participants was 5.5% (range 3.1% to 9.0%). USA300 cases were more likely to report manipulation of skin infections (OR 9.55; 95% CI 2.74 to 33.26); use of crack pipes was not significant despite identification of the USA300 strain on two of four crack pipes tested. USA300 cases were more likely to report drug use between sex trade workers and clients (OR 5.86; 95% CI 1.63 to 21.00), and with casual sex partners (OR 5.40; 95% CI 1.64 to 17.78).

CONCLUSION: Ongoing efforts to promote the appropriate treatment of skin infections in this population are warranted. The association of USA300 colonization or infection and drug use with sexual partners suggest a role for sexual transmission of the USA300 strain of MRSA.

Key Words: *Homeless persons; Methicillin resistance; Prevalence; Sexual behaviour;* Staphylococcus aureus

Prévalence de la colonisation ou de l'infection à USA300 et variables associées à une éclosion extra-hospitalière de *Staphylococcus aureus* méthicillino-résistant dans une population urbaine marginalisée

HISTORIQUE : En 2004, une éclosion causée par la souche USA300 de *Staphylococcus aureus* méthicillino-résistante (MRSA) a été identifiée chez des personnes ayant des antécédents d'itinérance, de consommation de drogues illicites ou d'incarcération dans la région sanitaire de Calgary (Calgary, Alberta). Une étude de prévalence a été réalisée afin de vérifier les hypothèses quant aux facteurs associés à la colonisation ou à l'infection par la souche USA300.

MÉTHODES : Les participants ont été recrutés dans des sites que fréquente ou visite cette population marginalisée. Des professionnels de la santé ont administré un questionnaire et recueilli des pipes à crack; ils ont aussi effectué des frottis nasaux, axillaires et cutanés. Les pipes et les frottis ont été mis en culture, conformément aux techniques standard. Les isolats de MRSA ont été étudiés de plus près par des techniques de réaction en chaîne de la polymérase (*mec*A, leucocidine de Panton-Valentine et cassette chromosomique *mec* du staphylocoque) et de typage (électrophorèse en champ pulsé, typage de la protéine A du staphylocoque et séquençage multilocus). La colonisation ou l'infection a été déterminée par la présence confirmée de la souche USA300 dans les échantillons nasaux, axillaires, cutanés ou sur les pipes analysées. Les participants colonisés présentaient au moins un isolat d'USA300 au niveau des prélèvements nasaux, axillaires ou sur leur pipe à crack. Les participants infectés présentaient un isolat cutané ou plus infecté par la souche USA300.

RÉSULTATS : La prévalence de la colonisation ou de l'infection par la souche USA300 parmi les 271 participants a été de 5,5 % (entre 3,1 % et 9,0 %). Les cas d'infection par USA300 étaient plus susceptibles d'avoir été en contact avec l'infection cutanée (RR 9,55; IC à 95 % 2,74 à 33,26); le rôle des pipes à crack n'a pas été significatif, malgré l'identification de la souche USA300 sur deux des quatre pipes analysées. Les cas d'infection à USA300 étaient plus susceptibles de faire mention de consommation de drogues entre travailleurs du sexe et clients (RR 5,86; IC à 95 % 1,63 à 21,00) et avec des partenaires sexuels occasionnels (RR 5,40; IC à 95 % 1,64 à 17,78).

CONCLUSION : Des efforts constants s'imposent afin de promouvoir le traitement approprié des infections cutanées dans cette population. Le lien entre colonisation et infection par USA300 et le partage de drogues entre partenaires sexuels évoque la possibilité d'une transmission sexuelle de la souche USA300 du MRSA.

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There is growing concern about the current epidemic of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) infections globally. The USA300 strain of MRSA (the CMRSA10 strain by Canadian nomenclature), in particular, has emerged as a dominant clone and public health threat (1,2) in the United States (3-5) and Canada (6). This strain has caused numerous outbreaks among professional athletes (7), military recruits (8), men who have sex with men (9), prison inmates (10), homeless youth (11) and tattoo recipients (12). The USA300 strain can cause severe disease including sepsis, necrotizing pneumonia and necrotizing fasciitis (13-15). This strain has unique genetic characteristics, including carriage of the type IVa staphylococcal cassette chromosome *mec* (SCC*mec*), and toxin and virulence factors including the Panton-Valentine leukocidin (PVL) genes, which may explain the severity of associated disease and the strain's ability to affect diverse populations (16,17).

In 2004, an outbreak of USA300 MRSA infections in the Calgary Health Region (CHR), Calgary, Alberta, was investigated, which centred on an urban population with histories of illicit drug use, homelessness or incarceration (6). Based on this investigation, other relevant studies and biological plausibility, four main hypotheses were identified for transmission of the USA300 strain in this population – residence in group living facilities (ie, homeless shelters and prisons), as suggested by outbreaks among soldiers and prison inmates (8,18); membership in a cocaine- or crack cocaine-using social network through drug use in unhygienic settings (ie, crack houses) or sharing crack pipes, as suggested by evidence for similar transmission of *S aureus* and our isolation of *S aureus* from crack pipes (6,19,20); injection drug use, through sharing needles or other equipment (11,21); and manipulation of USA300 skin infections (eg, squeezing, popping, or cutting of one's own or someone else's skin infection) (18,22).

During 2005, a cross-sectional prevalence study was conducted in this marginalized population. The objectives of the present study were to measure the prevalence of colonization or infection with the USA300 strain of MRSA, to test the hypotheses for transmission and to identify additional factors associated with USA300 colonization or infection.

METHODS

Sample size

A sample size of 137 individuals allows for estimating colonization or infection with USA300 with 80% power and 95% confidence based on an expected 5% to 10% prevalence of USA300 in the study population (EpiInfo6 version 6.04, Centers for Disease Control and Prevention, USA). The present study attempted to recruit 300 individuals to improve the ability to detect associations between colonization or infection with USA300 and variables studied.

Recruitment

Between February and May 2005, participants were recruited at five types of study sites in Calgary – an outreach needle-exchange van; homeless shelters; detoxification centres and residential substance treatment programs; an inner-city medical clinic; and new admissions to a local corrections facility. All individuals at the study sites were eligible, except at the medical clinic in which potential participants were assessed by a clinic nurse, and only included if they had a history of at least one of illicit drug use, homelessness or incarceration in the previous six months. There were no exclusion criteria. All participants provided verbal consent and were offered a $5 grocery store voucher to facilitate participation. Ethics approval for the present study was obtained from the Conjoint Health Research Ethics Board of the University of Calgary, Calgary, Alberta.

Data collection

A questionnaire was designed to test the hypotheses and to collect additional data, which was piloted with members of the study population. The questionnaire was transcribed into a personal digital assistant database application using Pendragon Forms 4.0 and Distribution Toolbox 4.0 (Pendragon Software Corporation, USA). Trained health care providers at each site administered the questionnaire. After instruction, participants self-collected one swab of both anterior nares and one swab of both axillae, and interviewers collected one to two swabs of any skin infections meeting clinical criteria for MRSA infection – wounds with purulent drainage; pustules, vesicles or boils with or without purulent drainage; or two of localized pain or tenderness, swelling, redness or heat at an infected site. In the midpoint of the study period, a nonrandom sample of used crack pipes was collected from a small number of participants.

Laboratory methods

The interior and exterior of the crack pipes were swabbed and plated on to a blood agar plate and a mannitol salt plate without oxacillin. Pipe and other swabs were inoculated into an overnight tryptic soy broth with 6.5% sodium chloride, and were then subcultured to mannitol salt agar without oxacillin. *S aureus* colonies were identified using standard microbiology techniques. Oxacillin-resistant *S aureus* isolates were identified using cefoxiten and oxacillin disk diffusion tests (23), and were confirmed as MRSA by testing for penicillin-binding protein 2a production (MRSA-Screen Corporation, Limited; Denka Seiken, Tokyo). The polymerase chain reaction assays were used to further confirm methicillin resistance (*mecA* gene), detect the presence of PVL (*lukS-PV* and *lukF-PV* genes) and classify according to SCC*mec* type (24,25). Typing was performed using pulsed-field gel electrophoresis (26), staphylococcal protein A (*spa*) typing (27), and multilocus sequence typing (MLST) (28). The identification of MRSA isolates matching the USA300 strain was based on the similarity of pulsed-field gel electrophoresis patterns and the presence of PVL, SCC*mec* type IVa, *spa* type t008 and MLST type ST8.

Data analysis

Participants were described as colonized if any one of a nasal, axillary or pipe swab was positive for USA300, and were described as infected if an infection swab was positive for USA300. Cases were defined as individuals colonized or infected with USA300, and all other participants were controls (while risk factors for colonization and infection may differ, this approach was chosen to identify participants with any exposure to the USA300 strain). Data were downloaded from personal digital assistants and exported to SPSS version 12.0.1 (Apache Software Foundation, USA) for analysis. Participants with missing questionnaire or laboratory data were excluded from the analysis. Univariate analysis was performed using Pearson's χ^2 or Fisher's exact test for categorical data, and independent samples *t* test or Wilcoxon's rank sum test for

TABLE 1
Microbiological results by study participant

Swab type or study classification	Participants† (n)	MSSA			Any MRSA strain*			USA300 strain		
		Participants (n)	Per cent	95% CI	Participants (n)	Per cent	95% CI	Participants (n)	Per cent	95% CI
Swab type‡										
Skin infection	48	15	31.3	–	7	14.6	–	5	10.4	–
Nasal	271	95	36.0	–	13	4.8	–	10	3.7	–
Axillary	267	32	12.0	–	7	2.6	–	5	1.9	–
Pipe	4	0	0.0	–	2	50.0	–	2	50.0	–
Study classification‡										
Skin infection	271	15	5.5	3.1–9.0	7	2.6	1.0–5.2	5	1.8	0.6–4.3
Colonization	271	98	36.2	30.4–42.2	16	5.9	3.4–9.4	13	4.8	2.6–8.1
Colonization and/or infection	271	99	36.5	30.8–42.6	20	7.4	4.6–11.2	15	5.5	3.1–9.0

**Includes USA300 strain (15 participants), USA400 strain (Panton-Valentine leukocidin [–], multilocus sequence typing [ST1], staphylococcal protein A typing [t128], staphylococcal cassette chromosome* mec *IVa; three participants), not classifiable (two participants); †Number of participants contributing swabs for analysis (swab type) or eligible for classification; ‡Not mutually exclusive. MRSA Methicillin-resistant* Staphylococcus aureus*; MSSA* Methicillin-susceptible S aureus

continuous data. ORs and exact binomial 95% CIs were calculated. The level of statistical significance was set at P<0.05.

To determine if results were unique to the USA300 strain, analysis was repeated defining cases by colonization or infection with any strain of MRSA and any strain of methicillin-susceptible *S aureus* (MSSA). For each analysis, the remainder of participants served as controls.

RESULTS

Recruitment

Overall, 274 individuals were recruited; three were excluded due to missing data (net participation 271). Recruitment by site was 105 (38.7%) from homeless shelters, 84 (31.0%) from the outreach needle-exchange van, 40 (14.8%) from the local corrections facility, 32 (11.8%) from detoxification centres and residential substance treatment programs, and 10 (3.7%) from the inner-city medical clinic. There were no significant differences in the distribution of USA300 cases by recruitment site (data not shown).

Laboratory results (Table 1)

Colonization or infection with the USA300 strain of MRSA was detected in 15 participants, for an overall prevalence of 5.5% (95% CI 3.1% to 9.0%); the prevalence of colonization or infection with the USA300 strain was 4.8% and 1.8%, respectively. Four crack pipes were collected for analysis. Of these, two of four (50.0%) were positive for the USA300 strain of MRSA (one of the positive pipes came from a participant negative for USA300 at other sites). All USA300 isolates were positive for SCC*mec* type IVa and PVL, and were *spa* type t008 and MLST type ST8.

The prevalence estimates for MSSA and any strain of MRSA were 36.5% (95% CI 30.8% to 42.6%) and 7.4% (95% CI 4.6% to 11.2%), respectively. The majority of individuals were exclusively colonized or infected with only one of the USA300 strain, MSSA or any MRSA strain, with the exception of three individuals who were colonized or infected with USA300 and also nasally colonized with MSSA.

Study participants (Table 2)

Overall, 149 of 271 (55%) study participants had a history of homelessness and 258 of 271 (95.2%) had a history of illicit drug use. The majority had been residents in the CHR for longer than one year (20 of 268 participants [7.5%] had been residents for less than three months). Cases were more likely to self-report a diagnosis of hepatitis C (OR 5.90; 95% CI 1.29 to 26.94). No other significant differences were identified.

TABLE 2
Description of study participants

Characteristic	Total sample*, n (%)
Sex (n=269)	
Male	198 (73.6)
Female	71 (26.4)
Mean age, years (range)	37.0 (16–75)
Ethnicity (n=270)	
Caucasian	181 (67.0)
Aboriginal†	80 (29.6)
Other	9 (3.3)
Employment (n=267)	
Unemployed	145 (54.3)
Part-time or casual	73 (27.3)
Full-time	49 (18.4)
Duration of residence in the CHR (n=268)	
≤1 year	57 (21.3)
>1 year	211 (78.7)
Any history of (over the past six months)‡ (n=271)	
Homelessness (lived in a shelter or on the street)	149 (55.0)
Illicit drug use§ (any route)	258 (95.2)
Illicit drug use by injection	133 (49.1)
Illicit drug use by smoking¶	205 (75.6)
Self-reported ever being diagnosed by physician with (n=244)	
Hepatitis C	128 (52.5)
HIV	22 (9.0)

**For participants with available data; †Based on self-identification as an Aboriginal person; ‡Not mutually exclusive; §Includes cocaine, crack cocaine, heroin, illicitly obtained morphine or other prescription narcotics, crystal methamphetamine, marijuana and other drugs; ¶Excludes marijuana. CHR Calgary Health Region (Calgary, Alberta)*

Hypothesis testing (Table 3)

Residence in crowded or group living facilities, cocaine or crack cocaine use, borrowing crack pipes, using drugs at crack houses or injection-related behaviours were not found to be

TABLE 3
Analysis of variables associated with a priori hypotheses

Characteristic (over the past six months)	Total sample, n (%)	USA300 cases, n (%)	Controls, n (%)	OR (95% CI) or P
Residence				
Homeless shelter	112/271 (41.3)	4/15 (26.7)	108/256 (42.2)	0.50 (0.16–1.61)
Halfway or transition house	21/271 (7.7)	2/15 (13.3)	19/256 (7.4)	1.92 (0.40–9.14)
Detoxification centre or residential treatment program	38/271 (14.0)	3/15 (20.0)	35/256 (13.7)	1.58 (0.42–5.88)
Jail	53/271 (19.6)	3/15 (20.0)	50/256 (19.5)	1.03 (0.28–3.79)
Any group living facility*	152/271 (56.1)	8/15 (53.3)	144/256 (56.3)	0.89 (0.31–2.53)
Drug most often used				
Cocaine (any route)	13/254 (5.1)	0/13 (0.0)	13/241 (5.4)	P=1.0
Crack cocaine (any route)	97/254 (38.2)	6/13 (46.2)	91/241 (37.8)	1.41 (0.46–4.34)
Crack cocaine (by smoking)	85/256 (33.2)	5/14 (35.7)	80/242 (33.1)	1.13 (0.37–3.47)
Borrowed pipe (if any drugs are smoked)	173/243 (71.2)	9/13 (69.2)	164/230 (71.3)	0.91 (0.27–3.04)
Used drugs at a crack house	30/255 (11.8)	2/14 (14.3)	28/241 (11.6)	1.27 (0.27–5.96)
Borrowing used needles for injection	16/122 (13.1)	1/7 (14.3)	15/115 (13.0)	1.11 (0.12–9.90)
Borrowing used equipment (filters and spoons) for injection	93/122 (76.2)	3/7 (42.9)	26/115 (22.6)	2.56 (0.54–12.20)
Manipulation of infections (squeezing and cutting or popping a skin infection)				
By self	61/215 (28.4)	5/15 (33.3)	56/200 (28.0)	1.29 (0.42–3.93)
By others	15/216 (6.9)	5/15 (33.3)	10/201 (5.0)	9.55 (2.74–33.26)

**Includes homeless shelter, halfway or transition house, detoxification centre or residential treatment program, or jail*

TABLE 4
Other variables associated with colonization and/or infection with the USA300 strain

Characteristic (over the past six months)	Total sample, n (%)	USA300 cases, n (%)	Controls, n (%)	OR (95% CI) or P
Any drug use with a STW or as a STW with a client	21/254 (8.3)	4/13 (30.8)	17/241 (7.1)	5.86 (1.63–21.00)
Any drug use with casual sex partner	30/254 (11.8)	5/13 (38.5)	25/241 (10.4)	5.40 (1.64–17.78)
Mainly use drugs with regular sex partner	65/254 (25.6)	7/13 (53.8)	58/241 (24.1)	3.68 (1.19–11.39)
Any drug use with strangers	51/254 (20.1)	7/13 (53.8)	44/241 (18.3)	5.22 (1.67–16.31)
Mainly use drugs in hotels or motels	15/252 (6.0)	3/14 (21.4)	12/238 (5.0)	5.14 (1.26–20.88)
Binge use of drugs	72/253 (28.5)	5/15 (33.3)	67/238 (28.2)	1.28 (0.42–3.87)
Number of binges	12 (median)	180 (median)	12 (median)	P=0.002
Average length of binge ≥5 days	30/72 (41.7)	5/5 (100.0)	25/67 (37.3)	P=0.010
Drug use many times a day	87/254 (34.3)	10/14 (71.4)	77/240 (32.1)	5.29 (1.61–17.41)
History of skin infection*	127/262 (48.5)	12/15 (80.0)	115/247 (46.6)	4.59 (1.26–16.67)
Observed skin infection	42/271 (15.5)	8/15 (53.3)	34/256 (13.3)	7.46 (2.54–21.90)
Sought medical attention for skin infection(s)	75/220 (34.1)	9/15 (60.0)	66/205 (32.2)	3.16 (1.08–9.24)
Used antibiotics from old prescription for skin infection(s)	17/248 (6.9)	3/14 (21.4)	14/234 (6.0)	4.29 (1.07–17.14)

**Described as 'pimples, boils, infected cuts or wounds'. STW Sex trade worker*

associated with colonization or infection with the USA300 strain. Cases were not more likely to report self-manipulation of any skin infections; however, cases were more likely to report that others had manipulated their skin infections (OR 9.55; 95% CI 2.74 to 33.26).

Other variables (Table 4)

Several variables describing the drug-use environment and drug-use frequency were found to be associated with colonization or infection with the USA300 strain. Cases were more likely to report any drug use with a sex trade worker (STW) or as a STW with a client (OR 5.86; 95% CI 1.63 to 21.00), with a casual sex partner (OR 5.40; 95% CI 1.64 to 17.78) or with a regular sex partner (OR 3.68; 95% CI 1.19 to 11.39). Cases were also more likely to report drug use with strangers (OR 5.22; 95% CI 1.67 to 16.31), or in hotels or motels (OR 5.14; 95% CI 1.26 to 20.88). While not more likely to report going on drug runs or binges, cases were more likely to report a greater number of binges (P=0.002), binges lasting five days or more (P=0.01) and drug use many times a day (OR 5.29; 95% CI 1.61 to 17.41).

Cases were also more likely to report recent skin infections (OR 4.59; 95% CI 1.26 to 16.67), have observable skin infections (OR 7.46; 95% CI 2.54 to 21.90), report self-treatment with antibiotics from an old prescription (OR 3.16; 95% CI 1.08 to 9.24) and report seeking medical attention for skin infections (OR 4.29; 95% CI 1.07 to 17.14).

There was no association found between colonization or infection with the USA300 strain and use of other illicit drugs or risk factors for nosocomial MRSA acquisition (data not shown).

Analysis using MRSA or MSSA

The analysis was repeated on variables listed in Tables 2, 3 and 4 using two other case definitions – colonization or infection with any strain of MRSA or with any strain of MSSA. Results using colonization or infection with MRSA were similar to

results using the USA300 strain only (data not shown). Using colonization or infection with MSSA as the outcome of interest, MSSA cases were found to be more likely to report histories of recent skin infections (OR 2.00; 95% CI 1.20 to 3.34) or to have observed skin infections (OR 2.44; 95% CI 1.25 to 4.75). MSSA cases were more likely to report most often smoking crack cocaine (OR 1.9; 95% CI 1.10 to 3.20), and less likely to report any drug use with or as a STW (OR 0.07; 95% CI 0.01 to 0.55). There were no significant associations between other variables and colonization and/or infection with MSSA (data not shown).

DISCUSSION

We found the prevalence of colonization or infection with the USA300 strain of MRSA in this marginalized urban population of the CHR to be 5.5%, approximately one year after its first appearance in this population (6). Most studies of MRSA population prevalence have not adopted a strain-specific approach; however, our prevalence of nasal colonization with any strain of MRSA (4.8%) is similar to estimates in other urban poor or injection drug using populations in North America (11,29-31). By contrast, the prevalence of nasal colonization with MRSA in the general population of the United States is estimated at 0.84% (32).

Of our original hypotheses, we identified manipulation of skin infections as a potential explanation for transmission of the USA300 strain. This may reflect increased severity of disease because patients were also more likely to report seeking medical attention and self-treatment with antibiotics from old prescriptions for skin infections (which is a concern because this may promote further antibiotic resistance in this population). We did detect the USA300 strain on crack pipes belonging to study participants; however, borrowing crack pipes, use of cocaine or crack cocaine, or smoking drugs was not significantly associated with colonization or infection. While the laboratory results suggest the plausibility of our hypothesis, sharing crack pipes did not appear to be a major route of transmission in the study population.

We identified new hypotheses for transmission. While we did not directly measure sexual activity in our study, we identified that drug use in a sexual context (eg, with STW or casual sex partners) was associated with colonization or infection with the USA300 strain. Participants colonized or infected with MSSA were less likely to report drug use with or as a STW – the study variable most closely connected to sexual activity – suggesting that this association may be unique to the USA300 strain. While we have no local data or published reports of genital colonization or infection of STW with community-associated MRSA, sexual transmission has recently been proposed as a route of transmission for the USA300 strain in a case series among heterosexual couples (33) and in an outbreak among men who have sex with men (9), either through skin-to-skin contact or direct genital transmission. Evidence in support of direct genital transmission includes an association between condom use and a decreased risk of infection (9), and that *S aureus* – including the USA300 strain – can be found among oral, vaginal and anal flora in women (33-35). Based on these recently published reports, it is plausible that sexual activity may be contributing to transmission of the USA300 strain in the CHR and may explain these findings. Future studies to test this hypothesis are warranted.

As with *S aureus*, the social environment of drug use likely plays an important role in the transmission of the USA300 strain in the study population (19). Cases were more likely to report drug use with strangers and in hotels or motels, and more frequent and longer binge use of drugs. The significance of these findings is unknown. These behaviours may be associated with high-risk sexual behaviours (eg, multiple sexual partners) or with poor personal hygiene practices, an identified risk factor for transmission of USA300 (36).

There are limitations to the present study. Control measures instituted before the study (including recommendations for improved infection control in group living facilities) may have limited our ability to test our hypotheses. We only collected four crack pipes, and discordance between nasal colonization and drug paraphernalia positivity for *S aureus* has been demonstrated (20). Misclassification of outcome is possible because pipes were not systematically solicited; however, our use of nasal, axillary and pipe swabs may have increased our overall ability to detect colonization with the USA300 strain and other *S aureus* strains. In addition, self-collection of nasal and axillary swabs may have affected test results despite observation by study interviewers. Finally, there are statistical limitations – the small number of cases precluded multivariate analysis, the sample size may have limited our ability to detect small associations and we conducted multiple comparisons, increasing the possibility of type I error.

The findings of the present study may be useful to public health officials and investigators involved with the care of similar populations elsewhere in North America. While our a priori hypotheses were for the most part not confirmed in the present study, our data supports continuation of efforts in the present population at the CHR to promote the appropriate care of skin infections and to caution against the use of expired antibiotic prescriptions. We have also identified an intriguing new hypothesis which suggests that sexual activity may be contributing to transmission of this specific strain of MRSA in this population. Evidence is emerging to support this mode of transmission for the USA300 strain. We are currently planning further studies in this population to explore this possibility.

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