

Methicillin-resistant *Staphylococcus aureus* colonization among medical residents

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BACKGROUND: Medical residents may be at risk of becoming colonized by methicillin-resistant *Staphylococcus aureus* (MRSA) during their training. The occupational risk of this specific population is unknown. Furthermore, there are no data regarding MRSA colonization among health care professionals in Quebec.

OBJECTIVE: To determine the MRSA colonization rate in Laval University (Quebec City, Quebec) medical residents and compare it with the MRSA colonization rate of a control group.

METHODS: A controlled cross-sectional study of MRSA prevalence among medical residents of Laval University was performed. The control group consisted of Laval University undergraduate medical students without previous clinical rotations in their curriculum. After informed consent was obtained, participants were screened for MRSA with a nasal swab in both anterior nares. They also completed a questionnaire regarding relevant risk factors and demographic data.

RESULTS: A total of 250 residents of all residency levels from medical and surgical specialties and 247 controls were recruited between February and April 2010. One case of MRSA colonization was detected among the residents and none in the control group (prevalence of 0.4% versus 0.0%; $P=1.00$).

DISCUSSION: MRSA nasal carriage was very low among Laval University residents. This may reflect the decreasing rate of health care-associated MRSA in Quebec City. Young age and good health may also explain this low risk. The strict infection control policies for MRSA patients (including cohorting, use of gloves, gown and patient-dedicated equipment) may also contribute to prevent MRSA transmission.

CONCLUSIONS: Medical residents in Quebec City appeared to be at very low risk of contracting MRSA through professional activities.

Key Words: Colonization; Methicillin-resistant *Staphylococcus aureus*; MRSA; Occupational risk; Residents

Increasing bacterial resistance and patients' multiple comorbidities have led to a significant rate of methicillin-resistant *Staphylococcus aureus* (MRSA) colonization among health care system users. Consequently, health care workers are frequently exposed to patients colonized with MRSA. Physical contact with patients and their environment is a known risk factor for MRSA acquisition (1,2). Furthermore, health care workers are known vectors of MRSA transmission among patients (3-5).

The prevalence of MRSA nasal carriage among hospital employees has been associated with duration of work on a medical ward (6). Medical residents represent a significant population with daily patient contacts, but little is known about the prevalence of MRSA colonization in this specific population. The residents' occupational risk of acquiring MRSA is, thus, unknown. The objective of the present study was to determine the MRSA carriage rate in Laval University (Quebec City, Quebec) medical residents and compare it with the MRSA carriage rate of a control group.

La colonisation par le *Staphylococcus aureus* résistant à la méthicilline chez les résidents en médecine

HISTORIQUE : Les résidents en médecine peuvent être à risque d'être colonisés par le *Staphylococcus aureus* résistant à la méthicilline (SARM) pendant leur formation. On ne connaît pas le risque professionnel de cette population. De plus, il n'existe pas de données sur la colonisation par le SARM des professionnels de la santé au Québec.

OBJECTIF : Déterminer le taux de colonisation par le SARM des résidents en médecine de l'Université Laval (de Québec, au Québec) et le comparer à celui d'un groupe témoin.

MÉTHODOLOGIE : Les chercheurs ont mené une étude transversale contrôlée de la prévalence du SARM chez les résidents en médecine de l'Université Laval. Le groupe témoin se composait d'étudiants en médecine non spécialisés de l'Université Laval qui n'avaient pas encore fait de rotations cliniques dans leur cursus. Après avoir donné leur consentement éclairé, les participants ont subi un test de dépistage du SARM au moyen d'un prélèvement dans les deux narines. Ils ont également rempli un questionnaire au sujet des facteurs de risque pertinents et des données démographiques.

RÉSULTATS : Au total, les chercheurs ont recruté 250 résidents de toutes les années de résidence en spécialité de la médecine et de la chirurgie et 247 sujets témoins entre février et avril 2010. Ils ont dépisté un cas de colonisation par le SARM chez les résidents et n'en ont trouvé aucun dans le groupe témoin (prévalence de 0,4 % par rapport à 0,0 %; $P=1,00$).

EXPOSÉ : Le portage nasal du SARM était très faible chez les résidents de l'Université Laval. Ce constat peut refléter le taux décroissant de SARM associés aux soins de santé dans la ville de Québec. Un jeune âge et une bonne santé peuvent également expliquer ce faible risque. Les politiques de contrôle des infections rigoureuses liées aux patients ayant un SARM (y compris le regroupement en cohortes, le port des gants et l'utilisation d'une blouse et de matériel réservés au patient) peuvent également contribuer à prévenir la transmission du SARM.

CONCLUSIONS : Les résidents en médecine de la ville de Québec semblaient très peu à risque de contracter un SARM à cause de leurs activités professionnelles.

METHODS

A controlled cross-sectional study of MRSA prevalence in Laval University residents of all medical and surgical fields was performed. The study was performed in three teaching hospitals in Quebec City, representing a total of more than 2150 beds. In all three hospitals, systematic contact precautions, including gown and gloves, are added to standard precautions when a patient is colonized with MRSA. A total of 728 residents were in training at the time of the present study. The control group consisted of Laval University undergraduate medical students without previous clinical rotations in their curriculum. The institution ethics committee approved the study protocol.

From February to April 2010, participants were recruited on a voluntary basis during their regular departmental activities. Informed consent was obtained. Participants completed a questionnaire regarding demographic data (sex, level of training and specialty as appropriate) as well as relevant risk factors. The selected risk factors were antibiotic use within the previous three months, presence of sinusitis, otitis,

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TABLE 1
Participant characteristics

	Medical students	Residents	P
Male sex,	68 (27.5)	87 (34.8)	0.082
Age, years, median (IQR)	21 (2)	26 (3)	
Hospitalization in previous 3 years	18 (7.3)	22 (8.8)	0.622
Gym or sports team	146 (59.1)	110 (44.0)	0.001
Antibiotics use			
Ongoing	7 (2.8)	5 (2.0)	0.574
In the previous 3 months	25 (10.1)	37 (14.8)	0.135
Dermatitis	32 (12.0)	35 (14.0)	0.570
Sinusitis, rhinitis	18 (7.3)	37 (14.8)	0.016
External otitis	0 (0)	0 (0)	
Cystic fibrosis	0 (0)	0 (0)	

Data presented as n (%) unless otherwise indicated. IQR Interquartile range

rhinitis, dermatitis, cystic fibrosis or other chronic condition, hospitalization within the previous three years, history of MRSA colonization or infection, and frequent visits to a sports centre. Subjects were then trained to self-perform a nasal sampling of both their anterior nares with a double applicator swab (Starswab II, Starplex Scientific, Canada). The first author personally supervised the sampling. Samples and questionnaires were coded with a resident or student number. All collected data were anonymous.

Swabs were sent to the microbiology laboratory at the Hôtel-Dieu de Québec, Centre Hospitalier Universitaire de Québec (Quebec City, Quebec). An enrichment broth (brain heart infusion broth) was first inoculated and incubated 24 h at 35°C. A MRSA-selective chromogenic agar plate (MRSA select, BioRad, USA) was then inoculated from the broth and incubated for an additional 24 h at 35°C to 37°C. Pink colonies were confirmed as MRSA with a positive agglutination test (Staphaurex, Remel, USA), antibiotic susceptibility testing according to the Clinical and Laboratory Standards Institute standards (M02-A10) and penicillin binding protein 2A detection (PBP2' test, Oxoid, Canada).

The recruitment goal was 250 participants in each group, considering 0.0% prevalence in the control group and an increase to 4.5% in the study group as significant, accepting β error of 0.80 and α error of 0.05. Data analysis was performed using SPSS (IBM Corporation, USA). The χ^2 test and Fisher's exact test were used for categorical variables, and the Mann-Whitney test was used for continuous variables.

RESULTS

Between February and April 2010, 250 of 728 (34.3%) residents of all residency levels from medical and surgical specialties were recruited; 247 of 593 (41.7%) controls agreed to participate. As expected the mean age of the control group was lower. Sinusitis, participation on a sports team and gym attendance (risk factors for community-acquired MRSA [CA-MRSA]) were more frequent in the control group. All other MRSA colonization risk factors were comparable between groups (Table 1).

One case of MRSA colonization was detected in the residents group and none in the control group (prevalence of 0.4% versus 0.0%; $P=1.00$) (Table 2). The only case had an antibiotic susceptibility profile compatible with a hospital-acquired MRSA, considering that CA-MRSA in Quebec City remains usually sensitive to clindamycin. The colonized subject's risk factors included dermatitis and antibiotics use in the previous three months.

DISCUSSION

The main finding of the present study was that MRSA nasal carriage was very low among Laval University medical residents. The prevalence we found (0.4%) was comparable with the prevalence in the control group consisting of medical students not exposed to the hospital environment. In our setting, MRSA acquisition did not appear to

TABLE 2
Methicillin-resistant *Staphylococcus aureus* (MRSA) nasal colonization

	Medical students (n=247)	Residents (n=250)	P
MRSA colonization	0 (0.0)	1 (0.4)	1.00

be an occupational health hazard for this population. This finding was reassuring for medical residents in Quebec City, most of whom were previously convinced that they were colonized with MRSA. The prevalence observed in the present study was below the average prevalence of 4.6% reported in a review on MRSA in health care workers (1), although only one Australian study (7) included medical students in the 1990s and found no MRSA carriage among this population. More recently in Taiwan (8), MRSA carriage was similar in preclinical (2.4%) and clinical (1.9%) students. Two smaller studies involved house officers (9) and fellows (10), and reported MRSA prevalence rates of 5.0% and 4.2%, respectively. Other studies need to be conducted in other resident populations and non-health care workers to add to the literature in this area.

The very low prevalence of MRSA may be due to many factors. First, MRSA prevalence is low in Quebec City. In 2009/2010, the nosocomial MRSA incidence rate (colonization or infection) was 3.76 per 10,000 patient days in Laval University hospitals (unpublished data, Dr J Villeneuve, April 2010). This was the lowest rate since regional surveillance began in 2004. Relatively low exposure to MRSA may explain our findings. Also, CA-MRSA is less common in Canada than in the United States (11,12). Only a limited number of MRSA strains found in microbiology laboratories are CA-MRSA, and the majority of residents and medical students are probably not exposed to CA-MRSA in their personal life. Furthermore, the studied population was young and healthy and, thus, at lower risk of acquiring MRSA and possibly, promptly eliminating it instead of becoming colonized.

Systematic contact precautions are applied in all Quebec City hospitals for MRSA patients (including cohorting, use of gloves, and gown and patient-dedicated equipment). This may help to protect our residents from MRSA, even though it is obviously not the primary objective of this measure. Medical students are taught about standard practices and additional precautions at the beginning of their clinical formation and again before beginning residency. The reinforcement of these measures probably contributes to their application.

The two main strengths of our study were the large sample size and the inclusion of a control group. The use of an enrichment broth also helped to maximize MRSA detection (13). Possible limitations were that each participant was sampled only once and that samples were not obtained from multiple body sites. However, the nose is the most important MRSA reservoir (14) and we believe that many residents would have been reluctant to enroll in the study if multiple samples were requested. One may question the participant-collected specimen, but it has been previously demonstrated that agreement between provider- and patient-collected swab specimens is excellent (14).

Residents in Quebec City are at very low risk of contracting MRSA through professional activities. This may reflect the decreasing rate of health care-associated MRSA in Quebec City. Young age and good health may also explain this low risk. Finally, our strict infection control policies for MRSA patients (including cohorting, use of gloves and gown, and patient-dedicated equipment) may also contribute to prevent MRSA transmission.

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