ORIGINAL RESEARCH

Infection Control Practices and Methicillin-Resistant *Staphylococcus aureus* Skin Infections: A Survey of Students in US Chiropractic Programs

Jonathon T. Egan, DC, MPH, PhD

ABSTRACT

Objective: The purpose of this study was to assess the incidence of self-reported history of physician-diagnosed methicillin-resistant *Staphylococcus aureus* (MRSA) skin and soft tissue infection (SSTI) among chiropractic students and any association with infection control behaviors (hand and table hygiene, sharing gowns, and sharing lotion) and initiation of patient care.

Methods: Questionnaires were obtained from 312 students attending half (9/18) of US chiropractic campuses. The questionnaire was derived from earlier studies led by Bearman in 2010 and Evans in 2007. Associations were assessed with Fisher exact test. Crude odds ratios were calculated for each of the variables. Two logistic regression models were produced.

Results: Attendance at 1 campus was associated with postmatriculation MRSA SSTI in univariate analysis ($P = .010$). The logistic regression model was significant ($P < .05$), but the composing variables were not.

Conclusions: Fewer than 5 cases of MRSA SSTI were detected overall, revealing a low rate of reported postmatriculation MRSA SSTI among these students. There was a univariate association with postmatriculation MRSA SSTI at 1 chiropractic college. (J Chiropr Med 2018;17:75-81)

Key Indexing Terms: *Methicillin-Resistant* Staphylococcus aureus*; Staphylococcal Skin Infections; Chiropractic; Students; Hygiene; Infection Control; Soft Tissue Infections; Cross-Sectional Studies*

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is the most common cause of cultured skin and soft tissue infection (SSTI) in US emergency rooms[1,2] and primary care clinics.[3] Half (53.9%) of US hospital *S. aureus* isolates are resistant,[4] and invasive MRSA is one of the most important causes of US infectious disease mortality.[5-7] It is not clear if the rate of MRSA infection in the United States is decreasing, despite efforts to address these infections.[8] Hygiene-related behaviors have been implicated in MRSA transmission.[9-18] Hygiene guidelines are often followed poorly across health care professions and settings.[19]

Risks for MRSA exposure and transmission in medical settings are documented.[6,7,19-22] Despite parallel MRSA environmental contamination rates in chiropractic[23-27] and medical[28] settings, there has not been a study of MRSA infection history in chiropractic settings. This lack of study of MRSA infection in chiropractic is remarkable, given the size of the chiropractic profession,[29] the treatment and training provided via skin contact[30,31] in millions of patient visits,[32,33] and hundreds of hours of skin contact during student training[31,34] —all in an era of antibiotic-resistant organisms such as MRSA.

Although there have been prior studies of clinical hygiene infection control behaviors among chiropractic students,[35,36] none has linked these behaviors to a health outcome, and none of the behaviors have been re-assessed in several years. Although there have been prior studies of MRSA nasal carriage in US health care students,[37-42] none that the author is aware of has specifically screened for postmatriculation infection history, though others have generally inquired about past MRSA infection.[42] This study sought to determine the rates of prematriculation and postmatriculation MRSA SSTI in a sample of chiropractic students and any association with hygiene-related behaviors and initiation of patient care.

Los Angeles College of Chiropractic, Southern California University of Health Sciences, Whittier, California.

Corresponding author: Jonathon T. Egan, DC, MPH, PhD, Los Angeles College of Chiropractic, Southern California University of Health Sciences, 16200 Amber Valley Drive, Whittier, CA 90604. Tel.: +1 315 694 6375.
(e-mail: *eganjonathon@gmail.com*).

Paper submitted January 10, 2018; in revised form March 20, 2018; accepted March 21, 2018.

1556-3707

https://doi.org/10.1016/j.jcm.2018.03.001

Methods

All US chiropractic colleges except the author's employer at the time of the study were invited to participate, and 9 agreed. This resulted in an invited pool of about 40% of all US chiropractic students (the exact number of students on each campus or in total will not be revealed to prevent identification of participating campuses, which were promised complete confidentiality). Students were excluded if they were not currently enrolled as a chiropractic student, if they were 17 years of age or younger or 65 years of age or older, or if they attended the author's college. The enrolled sample of respondents included 312 students from all 9 campuses, at which approximately 3945 chiropractic students attended.

Institutional review board ethics approval was obtained from Walden University on July 21, 2016 (Reference No. 07-21-15-0044721). Each participating college campus also individually gave permission for the study to be performed on the campus. The colleges emailed their students the study information and informed consent form for review. At least 48 hours later, the colleges distributed the first of 3 rounds of surveys; 2 subsequent survey emails were sent at least 4 days apart. The Web-based survey was secure and encrypted through Qualtrics (QLite version) (Qualtrics, Provo, Utah). Participation was voluntary. The data sets generated during and analyzed during the current study are confidential and not publicly available because of the sensitivity of the subject. Survey respondents and participating colleges were assured that raw data would remain confidential and would not be shared.

As there was no standard, accepted survey for MRSA risk factors,[43] the content for this survey stemmed from previously published sources[9,36] and the Centers for Disease Control and Prevention's 2013 case report form for Invasive Methicillin-Resistant-*Staphylococcus aureus* Active Bacterial Core Surveillance. Permission was received as needed to use and adapt the questionnaires. An excerpt of the study survey is provided in Supplementary Appendix A (available online). Table 1 reveals the literature-based demographics, infection control variables, and health care history variables assessed in the questionnaire. Data were collected between August and October 2015. Data were analyzed using Stata (Small Stata Version 14.1) (StataCorp, College Station, Texas) and IBM SPSS Statistics Premium (Version 21.0.0.0, IBM Corp, Armonk, New York). Incomplete surveys were not used.

Results

Complete questionnaires were received from 312 unique participants attending 9 US chiropractic college campuses. Respondents represented approximately 8% of all chiropractic students at these campuses (the precise total is obscured to preserve the confidentiality of participating colleges, which otherwise could easily be identified by using the total number of students on the campuses in concert with public Integrated Postsecondary Education Data System data). Figure 1 illustrates participant flow. Overall, 91.0% of students who entered the Qualtrics portal (QLite version) met inclusion criteria and completed the entire questionnaire.

Participant characteristics are reported in Table 1. Univariate analysis was conducted for all variables with Fisher exact test because of the limited number of cases, all of which were reported by students attending campus 6, and only attendance at campus 6 was significant (P = .010, 95% confidence interval = 4.711 to *, with Stata unable to provide the upper confidence interval because of the limited number of cases).

Crude odds ratios were calculated individually in Stata for the association between each of the hygiene variables and MRSA SSTI. Stratum-specific odds ratios and weighted Mantel-Haenszel odds ratios were calculated, but there were too few cases to produce meaningful statistics.

A binary logistic regression model was produced using the 5 infection control and main variables (hand hygiene, table hygiene, sharing gowns, sharing lotions, and initiating patient care) as well as 2 variables significant at $P < .20$ in univariate analysis (campus 6 and history of prior MRSA SSTI). Though the model was statistically significant (χ^2 (7) = 18.158, P = .011), none of the 7 composing variables was significant.

Last, an additional Fisher exact test for campus 6 and prematriculation MRSA SSTI was evaluated post hoc to determine if the univariate association with campus 6 might simply reflect a disproportionate distribution of students enrolling at that campus with a prior history of MRSA SSTI, which, if true, could lead to a recommendation for pre-enrollment MRSA history screening. However, there was no association between prior MRSA infection and attendance at campus 6 (P = 1.000 2-sided test).

Discussion

This study found that 32.7% of students were infrequent hand sanitizers, and 67% of students were infrequent table sanitizers. A prior study at 3 chiropractic colleges had reported that 22% of students were infrequent hand washers, and 71% infrequently cleaned their tables.[35] This suggests that the hand and table sanitation practices of chiropractic students are unimproved since the prior study. This study was conducted prior to the American Chiropractic Association's adoption of the Infection Control for Chiropractic Practice policy, revised in March 2017. This policy replaced a 2010 hygiene policy that was a recommendation. The prior 2010 policy did not appear to affect student hygiene practice, based on the results of this study at 9 campuses as compared with the prior study at 3 colleges published in 2009.[35] Poor compliance with mainstream infection control practices by these students does not appear to have been associated with MRSA SSTI, with few cases reported.