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Identification of *Staphylococcus aureus* in nursing professionals who provide care to people with HIV/AIDS*

Identificação de Staphylococcus aureus *em profissionais de enfermagem que cuidam de pessoas com HIV/AIDS*

Identificación de Staphylococcus aureus *en profesionales de enfermería que atienden a personas con VIH/SIDA*

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Abstract

Objective: Evaluate the prevalence of colonization by *Staphylococcus aureus* in saliva and nasal secretion of nursing professionals who provide care to people with HIV/AIDS and identify measures of association between colonized and non-colonized professionals with demographic and professional variables. **Methods:** This is a cross-sectional study with nursing professionals from five health centers. Samples of saliva and nasal secretions were obtained in three stages. **Results:** The prevalence of *Staphylococcus aureus* was 43.0%. Storing the toothbrush in a closed/protected compartment was a risk factor for colonization. Knowledge of standard precautions and participation in training were a protective factor for non-colonization. **Conclusion:** The prevalence of *Staphylococcus aureus* in saliva and nasal secretions of the nursing staff was high. The adoption of standard precautions measures and control of pathogens are essential for the practice of nursing and patient safety.

Keywords: *Staphylococcus aureus*; Methicillin resistance; Nursing staff.

Resumo

Objetivo: Avaliar a prevalência de colonização por *Staphylococcus aureus* na saliva e secreção nasal de profissionais de enfermagem que cuidam de pessoas com HIV/aids e identificar medidas de associação entre os colonizados e não colonizados com as variáveis demográficas e profissionais. **Métodos:** Estudo transversal com profissionais de enfermagem de cinco unidades. Amostras de saliva e secreção nasal foram obtidas em três momentos. **Resultados:** A prevalência de *Staphylococcus aureus* foi de 43,0%. Armazenamento da escova dental em compartimento fechado foi fator de risco para a colonização. Conhecimento sobre as precauções-padrão e participação em treinamento apresentaram-se como um fator de proteção para a não colonização. **Conclusão:** A prevalência de *Staphylococus aureus* na saliva e secreção nasal da equipe de enfermagem foi elevada. A adoção de medidas de prevenção e controle de microrganismos patogênicos são essenciais para a prática da enfermagem e segurança do paciente.

Palavras-chave: *Staphylococcus aureus*; Resistência à meticilina; Recursos humanos de enfermagem.

Resumen

Objetivo: Evaluar la prevalencia de colonización por *Staphylococcus aureus* en la saliva y secreciones nasales de los profesionales de enfermería que atienden a personas con VIH/SIDA e identificar las medidas de asociación entre colonizados y no colonizados con las variables demográficas y profesionales. **Métodos:** Estudio transversal realizado con profesionales de enfermería de cinco unidades. Muestras de saliva y secreción nasal fueron obtenidas en tres momentos. **Resultados:** La prevalencia de *Staphylococcus aureus* fue del 43,0%. Almacenar el cepillo de dientes en un espacio cerrado/protegido fue un factor de riesgo para la colonización. Conocer las precauciones-estándares y participar en la formación se presentan como factores de protección para la no-colonización. **Conclusión:** La prevalencia de *Staphylococcus aureus* en la saliva y secreciones nasales del personal de enfermería fue alta. La adopción de medidas de prevención y control de patógenos son esenciales para la práctica de la enfermería y la seguridad del paciente.

Palabras clave: *Staphylococcus aureus*; Resistencia a la meticilina; Personal de enfermería.

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Submitted on 04/11/2016.
Accepted on 08/22/2016.

DOI: 10.5935/1414-8145.20160106

INTRODUCTION

Microorganisms with resistance to multiple antimicrobial agents have been a global threat to public health and are a concern to both developed and developing countries[1].

Human beings are natural reservoirs of several microorganisms, including *Staphylococcus aureus*, considered an important human pathogen that causes several infections in health services. While this microorganism is a member of human microbiota, it can cause a number of infections, from superficial skin diseases to lethal systemic infections[2,3].

Although it was first described over 50 years ago, methicillin-resistant *Staphylococcus aureus* (MRSA) keeps disseminating globally, and it accounts for a significant number of infections acquired in hospitals and the community[4].

The anterior nare is considered the primary reservoir of *Staphylococcus aureus* in people colonized by this microorganism, which makes it the best site for screening[5]. However, the oral cavity may also have a variety of microorganisms, which are often potentially pathogenic[6].

Considering the nursing work characteristics, which involve physical contact with patients, combined with non-adherence to standard precautions (SP), health professionals, in particular the nursing staff, can become vulnerable to colonization and potential disseminators of these microorganisms in health settings[7].

A study[8] showed that providing care to patients with resistant microorganisms has been a challenge to health professionals, due to the risk of becoming infected and disseminating these resistant bacteria among patients and the community.

The national and international literature has studies that consider health professionals, and particularly the nursing staff, as a group that is susceptible to colonization by *Staphylococcus aureus* and potential disseminators of these microorganisms in their work-related activities[9-14].

Given the considerations above and the absence of national studies published on this theme, specifically with this nursing population, this study was developed to assess the prevalence of colonization by *Staphylococcus aureus* in the saliva and nasal secretion of nursing professionals that provide care to patients with HIV/AIDS and identify measures of association between professionals colonized and not colonized by *Staphylococcus aureus* with demographic and professional variables. In addition, this study may provide important considerations regarding educational strategies for better adherence to microorganism control and prevention measures among nursing professionals.

METHODS

This is a cross-sectional study with nursing professionals from five hospitalization units of a teaching hospital located in the municipality of Ribeirão Preto, of which three units are for general medicine and two for the provision of care to adults with HIV/AIDS. This study included the institution's general medicine units because they have patients of high and medium complexity for long hospitalization periods, including people with HIV/AIDS.

This study observed the guidelines and standards for research involving human subjects from Resolution Nº 466, 12 of December 2012, issued by the National Health Council.

The project was submitted to the research ethics committee of the Ribeirão Preto College of Nursing, at the University of São Paulo, and approved according to protocol nº 603.228/2013. Approval was also obtained from the research ethics committee of the Clinics Hospital of the Ribeirão Preto School of Medicine, at the University of São Paulo.

The study population was made up of nursing professionals (nurses, nursing technicians and nursing aides) belonging to the sectors defined above and who met the inclusion criteria - providing direct care to patients, working in any of the hospitalization units selected for this study, being fully active in the position during the data collection period.

A list of 142 nursing professionals from the hospitalization units was obtained with the institution's personnel department. Of these, 14 refused to participate in the study and seven were on medical leave for indefinite periods. In total, 121 nursing professionals were contacted in the first collection period, but during the study, other 21 professionals were excluded due to medical leaves, dismissals, transfers to other units or dropout.

Data were collected from April 2014 to February 2015 by the researcher and four study assistants, during the work shifts and in the workplace (a private room) of the nursing staff, and using a semi-structured instrument. Each collection procedure lasted 15 to 20 minutes on average.

In the first data collection period, an instrument with open- and closed-ended questions was applied by three experts in the theme to collect demographic and professional data of every participant (sex, age, professional category, work shift and division, time of nursing practice, weekly working hours, habits or characteristics of healthcare, and knowledge of standard precautions).

Samples of saliva and nasal secretion were obtained from the participants at three times (months zero, four and eight). Each professional was asked to place three to five milliliters of saliva into a graduated, dry, sterile, capped sample tube. Samples of nasal secretion were obtained with a dry nasal swab introduced in each anterior nare, and rotating it clockwise.

A pilot study was conducted to standardize the specimen collection technique and analyze the time spent with this procedure. Saliva and nasal secretion samples were collected from five nursing professionals, who were not included in the study.

After the sample collection, the material was immediately sent to the hospital's Microbiology and Serology Laboratory. The recommended biosafety standards were observed in all stages of material collection and transportation. After that, the material was placed on agar blood and mannitol plates, and the collected samples were processed. The automated system Vitek® 2 (BioMérieux(tm)), with cards GP Test Kit Vitek® 2, was used for the identification of gram-positive bacteria.

In this study, a participant was considered colonized when at least one saliva and/or nasal secretion sample was positive to *Staphylococcus aureus*.

Data were organized on spreadsheets produced with Microsoft Office Excel for Windows 2013 and analyzed with software IBM® SPSS, version 20.0.

Data analysis used descriptive statistics with measures of central tendency (mean and median) and dispersion (standard deviation), and prevalence ratio (PR) was calculated to test the association between colonized and non-colonized professionals with demographic and professional variables.

RESULTS

Of 100 nursing professionals who participated in all research stages, 59 (59.0%) were nursing aides, 22 (22.0%) were nursing technicians and 19 (19.0%) were nurses. Female professionals were predominant (79.0%); aged 23.5 to 61.8 years; median 41.4 years (SD = 8.6); 39 (39.0%) were aged 40 to 49 years.

Considering the three collection times (months zero, four and eight), 57 (57.0%) nursing professionals were not colonized by *Staphylococcus aureus* in any sample, 43 (43.0%) presented at least one saliva and/or nasal secretion sample positive to this microorganism.

In nasal secretion samples from nursing professionals, the prevalence was 32.0% and in saliva, 1.0%, whereas in combined samples of nasal secretion and saliva, 10.0%. The prevalence of *Staphylococcus aureus* in the nasal site was 42.0% (42/100), and in the oral cavity, 11.0% (11/100).

Table 1 shows the demographic and professional characteristics of the groups of nursing professionals colonized and not colonized by *Staphylococcus aureus*.

The prevalence of *Staphylococcus aureus* was higher in nursing technicians (50.0%), male (47.6%), aged 20 to 29 years (88.9%), with complete higher education (54.5%), from day work shift (56.8%), with over five years of nursing practice (53.3%), only one job (43.0%) and working 30 to 36 hours a week (51.2%).

All colonized professionals reported knowledge of and prior training on SP. This training was provided in the same institution to 90.7% of the colonized professionals. In addition, only 9.3% mentioned it was provided in the last 12 months. Of the other colonized professionals, 51.2% reported the training was provided 1 to 5 years before, 7.0% more than 5 years before and 32.5% did not know when the training on SP was provided.

Regarding the use of antimicrobials, eight (8.0%) professionals reported they were using it, or they had used it in the last 30 days before the first collection. Of these, three (37.5%) were colonized by methicillin-sensitive *Staphylococcus aureus* (MSSA).

Of 43 professionals colonized by *Staphylococcus aureus*, four (9.3%) were smokers; of these, three (75.0%) were colonized by MSSA and one (25.0%) by MRSA.

Regarding dental prostheses and orthodontic brackets among colonized professionals, four (9.3%) professionals reported having dental prostheses and two (4.7%) reported orthodontic brackets.

When describing the place where they used to keep their toothbrush at home, 65.1% of the colonized professionals reported they kept it in a closed/protected compartment in the bathroom.

The total professionals colonized by MSSA and MRSA were similar at three collection times, that is, 27 (27.0%), 26 (26.0%) and 25 (25.0%), respectively, considering the samples of saliva and/or nasal secretion (Table 2).

The prevalence of colonization by MSSA at months zero, four and eight, in samples of saliva and/or nasal secretion was 23.0%, 22.0% and 21.0%, respectively, whereas the prevalence of MRSA was 4.0% at all three times.

The prevalence of colonization by *Staphylococcus aureus* in the samples of saliva and/or nasal secretion was 43.0%, at all three times - 36.0% for MSSA and 7.0% for MRSA.

In this study, a risk factor for colonization by *Staphylococcus aureus* was the toothpaste storage in a closed/protected compartment in the bathroom. On the other hand, knowledge of standard precautions and prior participation in training were a protective factor for non-colonization (Table 3).

DISCUSSION

Staphylococcus aureus is a microorganism that has gained importance in the global scenario, not only due to its resistance to antibiotics, but also because of its potential to develop serious infections in people and increase morbi-mortality rates[15].

Usual therapies do not present a satisfactory response in most cases of infections caused by *Staphylococcus aureus*. It happens because these pathogens can easily develop resistance to a variety of medications, increasingly limiting the therapeutic options in clinical practice[16].

Studies indicate nursing professionals are more vulnerable to colonization by microorganisms, because during their provision of care, they are in direct contact with potentially colonized patients, and they constantly handle contaminated objects, surfaces and biological materials[7,14].

Table 1. Distribution of nursing professionals not colonized (n = 57) and colonized (n = 43) by *Staphylococcus aureus*, according to demographic and professional characteristics. Ribeirão Preto, SP, 2014-2015

Variables	Not colonized (n = 57)		Colonized (n = 43)		Total (n = 100)	
	f	%	f	%	f	%
Professional category						
Nurse	10	52.6	09	47.4	19	100
Nursing technician	11	50.0	11	50.0	22	100
Nursing aide	36	61.0	23	39.0	59	100
Sex						
Female	46	58.2	33	41.8	79	100
Male	11	52.4	10	47.6	21	100
Age (years)						
20 to 29	01	11.1	08	88.9	09	100
30 to 39	24	61.5	15	38.5	39	100
40 to 49	25	69.4	11	30.6	36	100
≥ 50	07	43.8	09	56.2	16	100
Educational level						
Complete high school	42	61.8	26	38.2	68	100
Complete higher education	10	45.5	12	54.5	22	100
Complete graduate education	05	50.0	05	50.0	10	100
Work shift						
Day	16	43.2	21	56.8	37	100
Night	22	78.6	06	21.4	28	100
Taking turns	19	54.3	16	45.7	35	100
Years of nursing practice						
< 5	07	46.7	08	53.3	15	100
5 to 14	27	62.8	16	37.2	43	100
≥ 15	23	54.8	19	45.2	42	100
Work in another institution?						
Yes	08	57.1	06	42.9	14	100
No	49	57.0	37	43.0	86	100
Weekly working hours						
30 to 36	21	48.8	22	51.2	43	100
> 36	36	63.1	21	36.9	57	100
Knowledge of SP?*						
Yes	49	53.3	43	46.7	92	100
No	08	100	-	-	08	100
Prior training on SP?*						
Yes	48	52.7	43	47.3	91	100
No	09	100	-	-	09	100

* SP: standard precautions.

Table 2. Distribution of nursing professionals (N = 100) colonized by *Staphylococcus aureus* sensitive or resistant to methicillin in saliva and/or nasal secretion, at three collection times. Ribeirão Preto, SP, Brazil, 2014-2015

Colonization by *Staphylococccus aureus*		MSSA		MRSA	
		f	%	f	%
Month zero	Nasal	21	21.0	04	4.0
	Saliva	01	1.0	-	-
	Nasal and saliva	01	1.0	-	-
Month four	Nasal	17	17.0	03	3.0
	Saliva	01	1.0	01	1.0
	Nasal and saliva	04	4.0	-	-
Month eight	Nasal	18	18.0	03	3.0
	Saliva	01	1.0	-	-
	Nasal and saliva	02	2.0	01	1.0

Individuals with HIV/AIDS, for having an immunological deficiency, are more susceptible to colonization and infection by *Staphylococcus aureus*[17]. Nursing professionals in direct contact with these patients are vulnerable to colonization in case of poor adherence to SP. Once colonized, these professionals become potential disseminators of microorganisms in healthcare settings, which may lead to an outbreak of infection and aggravate the patient's health status.

An investigation conducted to identify the presence of microorganisms in nostrils of nursing professionals from HIV/AIDS units showed six types of microorganisms were isolated in nasal secretion samples from these professionals, with *Staphylococcus aureus* being the most prevalent microorganism, identified in 23.0% of positive cultures[13].

A study conducted with 270 health professionals from five university hospitals in Iran showed the prevalence of *Staphylococcus aureus* in nostrils of these professionals of 14.4% (39/270), of which 6.3% (17/270) were MRSA[11].

In this study, the prevalence of *Staphylococcus aureus* in saliva and nasal secretion samples from nursing professionals was 43.0%; the prevalence of MSSA and MRSA was 36.0% and 7.0%, respectively. These findings are consistent with data found in the literature7, in which 41.0% of nursing professionals were colonized by the microorganism, 29.6% were MSSA and 7.1% were MRSA.

A study[13] showed 6.6% of Staphylococcus aureus isolated in the nasal cavity of nursing professionals working in HIV/AIDS units were MRSA, in agreement with the results obtained in this study. An investigation conducted with 120 health professionals in the state of Pernambuco, Brazil, showed 22.5% were colonized by MRSA and 74.1% of these professionals belonged to the nursing team[18].

In agreement with the results from this study, an investigation[18] reported a higher prevalence of MRSA among nursing technicians (48.1%). In addition, it also indicated the individuals with higher colonization were younger (20 to 28 years old) and with less professional experience (< 5 years).

In this study, 78.0% of nursing professionals store their toothbrush in a protected compartment. This attitude is a risk factor for colonization by *Staphylococcus aureus* (PR = 2.07; CI95% = 1.07-3.80).

The literature[19] indicates microorganisms from the mouth and the environment can remain alive on the toothbrush bristles for 24 hours, up to seven days. These bacteria remain active when only water is used in tooth brushing, and especially if the brush is stored in a closed and damp space, such as plastic cases and bathroom storage units.

In this study, more than one site was used to investigate colonization by *Staphylococcus aureus*, considering the literature[20] recommends screening at different anatomic sites. Individuals may present negative cultures in certain sites, but positive cultures in others.

Although studies[5,7,9] also consider the oral cavity as a potential reservoir and a source of dissemination of *Staphylococcus aureus*, this investigation observed higher microorganism colonization in the nasal cavity, with prevalence of 42.0% in this site *versus* 11.0% in the oral cavity. In addition, if the identification of *Staphylococcus aureus* had been only through samples of saliva, 31.0% of the cases would not have been detected.

A study[21] conducted with nursing professionals from the city of São Paulo associated the adherence to SP with the level of knowledge of this theme. The authors[22] mentioned, in a study with health professionals, that specific training on SP provided by the institution has a positive impact on the adherence to personal protection equipment (PPE).

In this study, knowledge of SP (PR = 0.53; CI95% = 0.44-0.64) and prior training on SP (PR = 0.52; CI95% = 0.43-0.64) were a protective factor for non-colonization of nursing professionals.

Providing care to a patient colonized by MRSA without knowing how to protect oneself and the patient may cause anxiety in the nursing professional. However, it is important for health professionals to feel confident in their role of caretakers, considering all patients have the right to receive the same quality of care, regardless of their diagnosis[8].

Nursing professionals, when learning about their condition of colonization by MRSA, reflect and analyze their practices to prevent occupational risks, leading to changes in attitudes and higher adherence to preventive measures[9].

Nursing professionals have a critical role in microorganism prevention and control in health services, and adherence to guidelines of the institution is extremely important to minimize the colonization and dissemination of multi-drug resistant microorganisms[23].

Table 3. Prevalence ratio (PR) and respective confidence intervals (CI95%) of the association between demographic and professional characteristics with colonization by *Staphylococcus aureus* in nursing professionals. Ribeirão Preto, SP, Brazil, 2014-2015

Variables	Not colonized (n = 57)		Colonized (n = 43)		PR (CI95%)
	f	%	f	%	
Professional category					
Nurse	10	17.5	09	20.9	0.90 (0.57-1.44)
Non-nurse	47	82.5	34	79.1	1
Sex					
Female	46	80.7	33	76.7	1.11 (0.71-1.74)
Male	11	19.3	10	23.3	1
Age (years)					
20 to 39	22	38.6	23	53.5	0.76 (0.54-1.10)
≥ 40	35	61.4	20	46.5	1
Educational level					
Complete high school	42	73.7	26	60.5	1.31 (0.87-1.99)
Complete higher education	15	26.3	17	39.5	1
Taking turns in work shift					
Yes	19	33.3	16	37.2	1.07 (0.64-1.34)
No	38	66.7	27	62.8	1
Years of nursing practice					
≤ 9	17	29.8	19	44.2	1.32 (0.51-1.12)
≥ 10	40	70.2	24	55.8	1
Work in another institution?					
Yes	08	14.0	06	14.0	1.00 (0.61-1.64)
No	49	86.0	37	86.0	1
Weekly working hours					
30 to 36	21	36.8	22	51.2	0.77 (0.54-1.11)
> 36	36	63.2	21	48.8	1
Toothbrush storage place					
Protected compartment	50	87.7	28	65.1	2.07 (1.07-3.80)**
Unprotected compartment	07	12.3	15	34.9	1
Knowledge of SP*					
Yes	49	86.0	43	100	0.53 (0.44-0.64)**
No	08	14.0	0	0	1
Prior training on SP*					
Yes	48	84.2	43	100	0.52 (0.43-0.64)**
No	09	15.8	0	0	1

* SP: standard precautions; ** Statistically significant.

One of the limitations of this study refers to the study site and population. This study was conducted in a large teaching hospital of high complexity, with population comprising nursing professionals only, which may limit the generation of results to other institutions and professional categories.

CONCLUSION

This study showed the prevalence of colonization by *Staphylococcus aureus* in saliva and/or nasal secretion samples from nursing professionals was high (43.0%), that is, 36.0% by MSSA and 7.0% by MRSA. A higher prevalence was observed in young nursing professionals (aged 20 to 29 years) with less professional experience (less than five years in nursing practice). In addition, storing the toothbrush in a closed compartment was a risk factor for colonization, and knowledge of and prior training on standard precautions were a protective factor for non-colonization. Adoption of standard precautions is critical for nursing practice, because it helps reduce the risk of acquiring pathogenic microorganisms and it is an effective way to protect health professionals from risks they are exposed to in the workplace.

ACKNOWLEDGEMENTS

The authors thank the National Council for Scientific and Technological Development (CNPq) for the financial support provided to this study.

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* This study was extracted from the thesis: "*Staphylococcus aureus* em profissionais de enfermagem e as interfaces com a adesão às precauções-padrão", submitted to the Graduate Program in Fundamental Nursing, Ribeirão Preto College of Nursing, University of São Paulo. Year: 2015. This thesis is part of the project: "Prevalência de microrganismos sensíveis e resistentes em indivíduos com HIV/aids e profissionais de enfermagem". CNPq process: 476480/2012. Universal Public Call 14/2012.