

## Prevalence and Risk Factors of *Staphylococcus aureus* Infection in Hospitalized Patient in Tirana

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### Abstract

**Introduction:** *Staphylococcus aureus* is a significant pathogen in human medicine. The prevalence of *S. aureus* varies between age, gender, ethnicity, geographic location, and body niche. *S. aureus* is very well adapted to colonize the nares, throat, perineum skin and the intestine also. So the human body and skin probably provide favorite condition for this species. The aim of the study is to evaluate the prevalence of *S. aureus*, and also to describe observational result of the influence bacterial-host and environmental/modifiable factors might have on the relationship with humans.

**Method:** This study was carried out from October 2016 to December 2017 across hospitalized patients from different units of Mother Theresa Hospital Center. About 258 Clinical specimens were collected based on infection type such as wound, pus/exudates, blood, urine, sputum and indwelling medical devices. We isolated and identified *S. aureus* using standard tests like catalase, coagulase, and growth on mannitol salt agar.

**Results:** Over all 258 specimens tested, the prevalence of *S. aureus* was found in 36% patients. Out of all 93 cases isolated with *S. aureus*, 25% were from urine infections; 24.6 % from skin and soft-tissue infections cases; 20.4 from vaginal and urethral swab; 15% from nasal and ear swab cases and 15% from blood stream, indwelling medical devices and catheter-associated infections. We did find statistically significant differences between Infection and sex, residence area, wards and place where the samples were collected. In all cases the p value was <0.05.

**Conclusions:** The rate of *S. aureus* in hospitalized patients in this study was high. These results indicated that this type of infection is a significant concern for health services and patients. The highest percentage of *S. aureus* found in surgical and non-surgical wounds suggests that further investigation should be implemented. A screening of all hospitalized cases can lead to reduce the incidence of this infection in the hospital environment and control the risk factors.

**Keywords:** *S. aureus*; Risk factor; Significant infection; Prevalence

### Introduction

*Staphylococci* are Gram-positive bacteria, with diameters of 0.5–1.5 µm and characterized by individual cocci, which divide in more than one plane to form grape-like clusters [1-4]. Till date, there are 32 species and eight sub-species in the genus *Staphylococcus*, many of which preferentially colonize in the human body [5,6]. Only *Staphylococcus aureus* and *Staphylococcus epidermidis* are significant in their interactions with humans. *S. aureus* is considered to be a major pathogen that colonizes and infects both hospitalized patients with decreased immunity, and healthy immuno-competent people and animals in the community [7,8]. This bacterium was found naturally in different parts of some animals and also in human body like, the nares (primary reservoir), pharynx, axilla, groin, vaginal cavity, in gastrointestinal tract, or damaged skin surfaces etc. and is a disease-producing pathogen [7].

*S. aureus* is a major human pathogen that causes a broad range of serious diseases in humans, associating with numerous mild skin and soft tissue infections, as well as life-threatening pneumonia,

bacteraemia, osteomyelitis, endocarditis, sepsis, and toxic shock syndrome [8-11].

*Staphylococcus aureus* bacteremia (SAB) is an important infection with an incidence rate ranging from 20 to 50 cases/100,000 population per year. Between 10% and 30% of these patients will die from SAB. Comparatively, this accounts for a greater number of deaths when compared with AIDS, tuberculosis, and viral hepatitis combined [12]. There are many cases about the situation in hospital-associated (HA) and community-associated (CA) *S. aureus* infection in Albanian population [13-15]. The main goal of our research is to investigate the prevalence of *Staphylococcus aureus* in hospital-associated infection in Hospital Centre of Tirana.

### Materials and Methods

This is a retrospective study conducted in tertiary University Hospital Center “Mother Theresa” from October 2014 to December 2017. Patients (aged 18 years or older) enrolled in this study were hospitalized in different wards such as surgery, dermatology, nephrology, cardiology, neurology, infection diseases, cardiology, hemodialysis etc. About 258 clinical specimens were collected based on infection type such as wound, pus/exudates, blood, urine, sputum, and

indwelling medical devices. All specimens were sent to the microbiology laboratory within one hour. A standardized questionnaire was used to collect socioeconomic and demographic data from medical personalized files of each patient. The demographic data included age, sex, school education, residence (urban/rural), marital status, number of children, etc. We isolated and identified *S. aureus* on the basis of colony morphology and also we used standard tests like catalase, coagulase, and growth on mannitol salt agar. For statistical analysis, all the data were expressed in frequencies and percentages. Chi-square test and Fisher's exact test were used to determine relationships between categorical variables. In the univariate analyses of risk factors; age, number of household, and income were categorized. A p value<0.05 indicated a statistically significant difference in all tests. All data collected from the medical files of each patient were analyzed by SPSS version 20.0 (SPSS Inc., Chicago, IL, USA).

## Results

A total of 258 patients from Mother Theresa University Hospital Center in Tirana were enrolled during the study period. The socio-demographic and clinical characteristics of 258 patients are shown in Table 1. Among the age groups, the most predominant age was patients older than 46 years. For the age groups; marital status, school education, social level and underlying medical conditions of patients we did not find any significant association.

In Table 2, Sample distribution among patients attending to different wards in Mother Theresa University Hospital Center and prevalence of *S. aureus* among each of them are shown.

Demographic data	Frequency	Percentage	No of positive cases with <i>S. aureus</i>	P-value
Sex				0.009
Female	90	34.9%	23	
Male	168	65.1%	70	
Residence area				0.02
Urban	119	46.12%	34	
Rural	139	53.88%	59	
Age groups (years)				>0.05
18-25	35	13.6%	16	
26-35	27	10.5%	10	
36-45	41	15.9%	12	
46-55	48	18.6%	14	
56-65	37	14.3%	15	
>76 +	70	27.1%	26	
Marital status				0.87
Married	174	67.4%	53	
Single/separated	58	22.5%	26	
Widowed	26	10.1%	14	
School Education (level)				0.15
Elementary	4	1.5%	3	
8-years	53	20.5%	24	
High school	139	53.9%	42	
University	62	24.1%	21	
Social level				0.56
School/Student	35	13.6%	16	
Without work	56	21.7%	20	

Employed	78	30.2%	24	
Retiree	89	34.5%	30	
Underlying medical conditions of patients				0.6
No	49	19%	17	
Heart diseases/cardiovascular diseases	41	15.9%	19	
Renal diseases	34	13.2%	12	
Neurological diseases	21	8.1%	8	
Hemodialysis	39	15.1%	15	
Other	74	28.7%	22	

**Table 1:** Demographic characteristics of patients admitted to Mother Theresa Hospital Center.

WARDS	Frequency	Percentage	Prevalence of <i>S. aureus</i>
Surgical	34	13.2%	11.8%
Dermatology	52	20.2%	19.4%
Cardiology	23	8.9%	7.5%
Nephrology	41	15.9%	15%
Neurology	12	4.6%	7.5%
Infection diseases	53	20.5%	21.5%
Cardiology	24	9.3%	9.7%
Hemodialyses	19	7.4%	7.5%

**Table 2:** Samples distribution among patients attending to different wards in University Hospital Center Mother Theresa and prevalence of *S. aureus* among each of them

Table 3 shows the prevalence of infection with *S. aureus* based on source of clinical specimens. Most of samples were collected from skin and soft-tissue infections, urine infections and from nasal, sputum and ear swab cases.

Cases collected from:	Frequency	Percentage	Prevalence
Urine infections	52	20.15	25%
Skin and Soft-tissue infections	58	22.5	24.6%
Vaginal and urethral swab	44	17.05	20.4%
From nasal, sputum and ear swab cases and	56	21.7	15%
Blood stream, indwelling medical devices and catheter-associated infections	48	18.6	15%

**Table 3:** Prevalence of infection with *S. aureus* based to source of clinical specimens

## Discussion

In this study we evaluated the prevalence and risk factors for *S. aureus* among adult patients admitted to a tertiary University Hospital Center in Tirana, Albania. The prevalence of *S. aureus* infection of patients was 36%. The prevalence of *S. aureus* at hospital admission observed in our study is higher than the prevalence published in

previous reports conducted in Albania one in 2007 and the other one in 2016 with prevalence of *S. aureus* 18.2% and 9.6% respectively [16,17]. There were significant associations between socio-demographic characteristics and wound colonization by *S. aureus*. Most patients (65.1%) were male, with a significant association with women (p value =0.009). People in rural areas have a high prevalence

compared to people that live in urban area, and in this case, we have found a significance level 0.02.

We think that the higher prevalence observed in our study was from differences in patient demographic characteristics and underlying medical problems. Many studies have evaluated the risk factors associated with *S. aureus* infection. The significant risk factors for *S. aureus* infection were age, sex, underlying medical problems (as having a chronic disease, surgical operation, diagnosis of skin or soft tissue lesions) [16,18-26].

In this study, there are significant associations with sex, living area, sample distribution among wards and also the source of clinical specimens. Many studies reported significant associations for different age groups. Some of them have found significance among 10-20 age groups [26,27]. Another study has found significance among 18-40 years and more than 60 years [23]. Faria et al, has found a logistic regression for older age more than 40 years as a risk factor for *S. aureus* infection. But in this study we did not find an association between the age groups. We did not find an association for marital status, school education (level), social level or underlying medical conditions of patients.

The most frequent samples were collected from dermatology, nephrology and infectious disease wards. In Infectious diseases wards, the prevalence for *S. aureus* were resulted to be 21.5%, which was the highest prevalence in this study based on the samples collected from the wards. In dermatology samples the prevalence was 19.4 %, and in nephrology 15%. Surgical wards had a prevalence of 11.8%, and cardiology, neurology and hemodialysis wards had the same prevalence of 7.5%. Based on Pearson Chi-Square 43.1 p value resulted <0.0001, for CI 95% (34-76).

For clinical specimens, 258 cases in total were collected based on infection type such as wound, pus/exudates, blood, urine, sputum and indwelling medical devices. Out of all 93 cases isolated with *S. aureus*, 25% were from urine infections; 24.6 % from skin and soft-tissue infections cases; 20.4% from vaginal and urethral swab; 15% from nasal and ear swab cases and 15% from blood stream, indwelling medical devices and catheter-associated infections. We did find statistically significant differences between infection and place where the samples were collected  $p < 0.0001$  Chi-Square 35.92 CI 95% (23.9-56.8).

## Summary

The rate of prevalence of *S. aureus* in hospitalized patients in this study was high. These results indicated that this type of infection is a significant concern for health services and patients. The highest percentage of *S. aureus* found in surgical and non-surgical wounds suggested that further investigation should be implemented. A screening of all hospitalized cases can lead to a reduction in the incidence of this infection in the hospital environment and also will help to control the risk factors.

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