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*Short Communication*

# Prevalence of *Staphylococcus aureus* on the Hands of Health-Care Workers and the Environment of a Nigerian University Health Centre

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ABSTRACT

Hospital-acquired infections continue to be an important public health issue with unacceptable levels of morbidity and mortality. *Staphylococcus aureus* is a frequent cause of infections in the hospital. This research aimed at giving a better understanding of the prevalence of *S. aureus* in a hospital setting in order to adequately account for its potential threat. A total of 115 samples comprising 65 environmental samples obtained from trays, bed railings, doorknobs, and other surfaces of patient wards and 50 hand swabs of health-care workers were screened for *S. aureus* using established microbiological techniques. Twenty-eight isolates each represented positive cultures from environmental and hand samples, respectively. Antimicrobial susceptibility testing was determined for the *S. aureus* isolates using the Kirby-Bauer disk diffusion assay. The antibiotic resistance pattern for the hand and environmental isolates respectively gave the following results: Ciprofloxacin (32.14%, 21.43%), Trimethoprim/ Sulphamethoxazole (60.71%, 67.86%), Oxacillin (28.57%, 35.71%), Erythromycin (21.42%, 17.86%), Gentamicin (42.86%, 28.57%), Tetracycline (17.86%, 21.42%), Penicillin (42.86%, 42.85%). Twelve resistant phenotypes were identified, of which Ciprofloxacin-Gentamicin- Trimethoprim/ Sulphamethoxazole (CIP-CN-SXT) was predominant. This study shows that the hands of health-care workers and the hospital environment could serve as potential vehicles of transmission of *S. aureus* infections, thus highlighting the need for effective infection control measures.

***Keywords:*** *Staphylococcus aureus*, Environmental samples, Hand swabs, Antimicrobial susceptibility testing.

## Introduction

Nosocomial infections are a common problem in health-care settings. They are associated with increased morbidity and mortality in addition to considerable costs.[1] *Staphylococcus aureus* is an important cause of infections within the hospital, and the community and its global spread and increasing resistance to antimicrobials require numerous actions of prevention and infection control.[2,3] *S aureus* is transmissible between patients and occurs mostly via staff and the environment. Colonised health-care personnel have been implicated as sources of transmission in outbreaks.[4] *S. aureus* is commonly found on surfaces in hospitals such as door handles and floors even after disinfection and can be indirectly transmitted through fomites, thereby serving as vehicles of transmission of infections.[5] Development of any nosocomial infection, and perhaps particularly those caused by resistant organisms such as methicillin-resistant *Staphylococcus aureus*, may have medicolegal implications as many are transmitted by health-care personnel from one patient to another.[6] Understanding the trends in the resistance pattern is important in order to have ample information for treatment and infection control.[7]
Therefore, this study was carried out to investigate the prevalence and antimicrobial susceptibility of *S. aureus* obtained from the environment and hands of health-care workers of a Nigerian University health centre.

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## Materials and Methods

*Collection of samples and identification of isolates*

Oral informed consent was obtained from all study participants. The consent procedure as well as the ethical approval for this study was previously approved by the ethics committee of the Covenant University, Ota, Nigeria with number CU/BIOSCREC/BIO/2016/016. The study was carried out in the University health centre between October 2016 and February 2017. A total of 115 samples were investigated (65 from the environment and 50 hand samples). The environmental specimens constituted swabs obtained from trays, bed railings, doorknobs, floors, and furniture in the different patient wards, while the hand swab samples were obtained from health-care workers. The samples were transported to the Microbiology laboratory of the Department of Biological Sciences, Covenant University, Ota, for microbiological analysis. Samples were inoculated on Mannitol Salt Agar, and isolates showing characteristic yellow colour were presumptively identified as *S. aureus* by colony morphology, Gram staining, sugar fermentation, catalase production, and coagulase test. The isolates were then sub-cultured on blood agar to check for the characteristic beta haemolysis displayed by *S. aureus*.

*Antimicrobial susceptibility testing*

*S. aureus* isolates were tested for susceptibility to several antibiotics using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar with a panel of 7 antibiotics according to CLSI (Clinical and Laboratory Standards Institute) guidelines, 20168. After incubation for 18 hours at 37°C, the results were recorded as sensitive (S), intermediate (I) and resistant (R). The antibiotics tested include oxacillin (5 µg), gentamicin (30 µg), ciprofloxacin (5 µg), trime-

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thoprim/Sulphamethoxazole (25 µg), penicillin (10 µg) and erythromycin (15µg), tetracycline (30 µg).

## Results and Discussion

From the 115 samples examined, fifty-six (48.7%) yielded positive *Staphylococcus aureus* cultures. Twenty-eight (50%) of the positive isolates were from environmental samples, and Twenty- eight (50%) were from hand samples. The isolation of *S. aureus* in the health centre reflects its ubiquitous occurrence, as previously reported.[9] The isolation rate of 48.7% indicates a high occurrence of *S. aureus* when compared to 33.3% obtained in an earlier study from environmental and hand samples in a health-care setting in Africa.[10] The occurrence of the *S. aureus* in the environmental samples (50%) may indicate poor infection control in the hospital environment, thereby making the environment to serve as a reservoir of the pathogen. This may also account for the high occurrence of the pathogen observed on the hands of health personnel, as observed in a previous study carried out in Nigeria.[11]

The antibiotic resistance pattern as shown in Figure 1 for the hand and environmental isolates respectively is as follows: Ciprofloxacin (32.14%, 21.43%), Trimethoprim/ Sulphamethoxazole (60.71%, 67.86%), Oxacillin (28.57%, 35.71%), Erythromycin (21.42%, 17.86%), Gentamicin (42.86%, 28.57%), Tetracycline (17.86%, 21.42%), Penicillin (42.86%, 42.85%). Resistance to tetracycline and erythromycin was low in this study.

Twelve antimicrobial resistance phenotypes were identified in this study, as presented in Table 1. Of the 12 phenotypes, the most predominant was Ciprofloxacin-Gentamicin-Trimethoprim/ Sulphamethoxazole (CIP-CN-SXT), occurring in 28.6% of the isolates. In contrast, the least common phenotypes were Gentamicin-Trimethoprim/ Sulphamethoxazole (CN-SXT) and Gentamicin-Penicillin-Trimethoprim/ Sulphamethoxazole (CN-P-SXT).

The present study showed that MRSA spread in health-care settings is a possibility as oxacillin (methicillin) resistance was detected in 18 (26.79%) out of the 56 *S. aureus* isolates. The high incidence of oxacillin resistance corroborates the findings of another study in Nigeria.[11]

Approximately 60.71% of the *S. aureus* isolates were resistant to three or more classes of antibiotics. Although a higher percentage of these multidrug-resistant isolates originated from hand samples, 14.2% of the isolates were from the environment. Multidrug resistance in health-care settings has been attributed to the excessive use of antimicrobials in hospitals, which provides a major selective pressure for resistant bacteria.

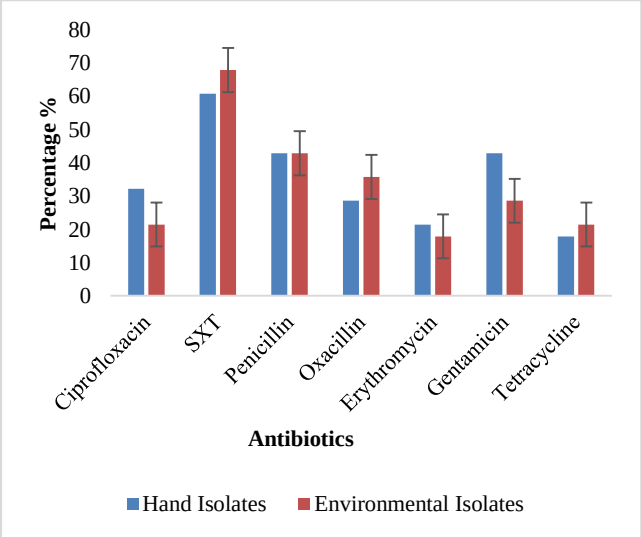


**Figure 1:** Antimicrobial resistance pattern of *S. aureus* isolates from the hands and the environment

**Table 1:** Antimicrobial resistance phenotype of *S. aureus* isolates

| Resistance Phenotype | Number of isolates |
|---|---|
| SXT | 3(7.1%) |
| OX-TE-P-E | 4(9.5%) |
| P-SXT | 2(4.8%) |
| OX-TE-P-E-SXT | 5(11.9%) |
| OX-P-TE | 2(4.8%) |
| OX-P-E-SXT | 2(4.8%) |
| CN | 2(4.8%) |
| CIP-CN-P-SXT | 4(9.5%) |
| CIP-CN-SXT | 12(28.6%) |
| OX-P-SXT | 4(9.5%) |
| CN-SXT | 1(2.4%) |
| CN-P-SXT | 1(2.4%) |

**CIP** - Ciprofloxacin, **OX** - Oxacillin, **CN** - Gentamicin, **TE** - Tetracycline, **P** - Penicillin, **E** - Erythromycin, **SXT** - Trimethoprim / Sulphamethoxazole.

## Conclusion

The findings of this study show that health-care workers, as well as the hospital environment, could serve as a reservoir of *S. aureus*. Multidrug-resistant strains are found to be common. Regular surveillance of hospital-associated *S. aureus* infections and their susceptibility to antibiotics is of utmost importance in the prevention of the spread of resistant strains in the hospital environment.

## Conflict of interest

The authors declare no conflict of interest.

## Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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