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GARP INTERNATIONAL JOURNAL OF HEALTH SCIENCES

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Vol. 1, Issue I, Pp. 90-97; APR., 2026

PREVALENCE OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS NASAL CARRIERS AMONG STUDENTS OF IGBINEDION UNIVERSITY OKADA

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ARTICLE INFO
Received Date: 29th Mar. 2026
Date Revised Received: 6th Apr. 2026
Accepted Date: 17th Apr. 2026
Published Date: 28th Apr, 2026

Citation: Olley, M. & Zekeri, C. S. (2026 : Prevalence of Methicillin Resistant Staphylococcus Aureus Nasal Carriers Among Students of Igbinedion University Okada: GARP INT.J.HEALTH SCI.; Vol.1, Issues I Pp.90-97; Apr. 2026.

ABSTRACT

Background: *Staphylococcus aureus* is a common colonizer of the human nasal cavity and an important cause of community and hospital-associated infections. The emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) has become a major public health concern due to increasing antimicrobial resistance and associated treatment challenges.

Aim: This study was conducted to determine the prevalence of methicillin-resistant *Staphylococcus aureus* nasal carriers among students of Igbinedion University, Okada, Edo State, Nigeria.

Methods: A cross-sectional study involving 150 apparently healthy students was carried out between July and September 2025. Nasal swab samples were aseptically collected using sterile cotton swabs and cultured on blood agar and mannitol salt agar. Identification of *Staphylococcus aureus* isolates was performed using standard microbiological procedures, while antimicrobial susceptibility testing was carried out using the disc diffusion method according to Clinical and Laboratory Standards Institute guidelines. Data obtained were analyzed using SPSS software, with statistical significance set at $p < 0.05$.

Results: Out of the 150 samples analyzed, 22 (14.7%) showed significant growth of *Staphylococcus aureus*. All 22 isolates (100.0%) were resistant to methicillin, indicating complete prevalence of MRSA among the isolates recovered. Female students showed a higher prevalence of MRSA carriage (78.0%) compared to males (22.0%). Students within the age group of 20–24 years had the highest prevalence of MRSA colonization (74.0%).

Conclusion: The study revealed a high prevalence of methicillin-resistant *Staphylococcus aureus* among nasal carriers in the study population. Continuous surveillance, improved personal hygiene, and prudent use of antibiotics are recommended to reduce the spread of resistant strains within the university community.

Keywords: Antimicrobial resistance, Methicillin-resistant *Staphylococcus aureus*, Nasal carriage, *Staphylococcus aureus*, University students

Introduction

Staphylococcus aureus is a gram positive, non-motile, ubiquitous bacterium that is part of the microbiota of human body and has the potential to induce a range of infections from mild to severe. Worldwide, approximately 30.0% to 50.0% of individuals harbour Staphylococcus aureus in their nasal cavities on a permanent basis (Gonz´alez-Garc´ıa *et al*., 2021). While *Staphylococcus aureus* has the ability to inhabit various parts of the human body, its primary ecological habitat is found in the anterior nares. Approximately 20-30% of individuals are persistent carriers, while around 30% are temporary carriers. (Emaneini *et al.*, 2017). *Staphylococcus aureus* ranks among the prevalent bacterial sources of infection in both community and healthcare environments (Ajani *et al*., 2020) While local skin infections are mostly self-limiting, they sometime become an entryway for this pathogen into the deeper tissues and the bloodstream. Skin infections represent the most frequently detected origin of *S. aureus* bacteremia (Yarovoy *et al*., 2019). The precise mechanisms behind sporadic *S. aureus* systemic dissemination from skin wounds remain incompletely comprehended. However, primary risk factors for S. aureus sepsis include age (with infants and the elderly at highest risk), concurrent health conditions (such as heart disease, diabetes, renal disease, HIV infection), the presence of implanted medical devices, intravenous drug usage, and low socioeconomic status. (Asgeirsson *et al*., 2018). Although the majority of individuals carrying S. aureus will not experience an invasive infection, the sheer number of infected individuals positions S. aureus as one of the primary pathogens responsible for bloodstream infections.(Kern *et al*., 2019).

MRSA comprises a cluster of Gram-positive bacteria distinguished genetically from other S. aureus strains. These bacteria cause infections resistant to typical antibiotics like methicillin, amoxicillin, and penicillin (NIH, 2022). MRSA, often referred to as a superbug, can also be identified as oxacillin-resistant *Staphylococcus aureus* (ORSA) or multiple-resistant Staphylococcus aureus. Conversely, strains of S. aureus that remain susceptible to methicillin are occasionally labeled methicillin-susceptible Staphylococcus aureus (MSSA) for clarity. MRSA stands out as the most prevalent and perilous antibiotic-resistant bacterium (Larsen *et al.,* 2022) and represents the main cause of nosocomial infections, leading to a variety of diseases such as endocarditis, chronic osteomyelitis, pneumonia, septic arthritis, osteoarthritis, and bacteremia (Gao *et al.*, 2021). Over time, MRSA has evolved various mechanisms of drug resistance to ensure its survival, including thickening of the cell wall, heightened efflux pumps, mutation of drug targets, enzymatic modification of drugs, and formation of biofilms (Singh *et al.*, 2021). Therefore, MRSA has acquired resistance to a broad spectrum of antibiotics, including penicillin, linezolid, and daptomycin (Vestergaad *et al*., 2019). The development of methicillin resistance is facilitated by the acquisition of the mecA gene within the chromosomal DNA of S. aureus, granting resistance to β-lactam antibiotics. Nonetheless, the rise of drug-resistant strains of S. aureus, particularly methicillin-resistant S. aureus (MRSA), poses a significant global concern (Anaedobe *et al.,* 2020) based on information gathered from multiple hospitals and communities throughout the United States (Ajani *et al.*, 2020). According to a report on antimicrobial resistance by the World Health Organization (WHO), individuals afflicted with MRSA infections are estimated to face a 64% higher risk of mortality compared to those with non-resistant S. aureus strains (WHO, 2020). The term "hospital-acquired" or "healthcare-associated MRSA," abbreviated as HA-MRSA, is commonly employed to describe this type of MRSA because it was identified in healthcare environments (Hibbitts & O'Leary 2018). In healthcare settings, the hospital environment, gowns, and patients' care items significantly contribute to the transmission of pathogens. A study conducted in England found that 58.0% of healthcare workers (HCWs) identified S. aureus carriage in the nasal cavity (Neopane *et al.*, 2018).The disease can transmit through direct contact with a infected wound or contaminated hands. If left untreated, pneumonia, severe bloodstream infections (BSIs), sepsis, and surgical site infections (SSIs) may all arise (Siddiqui & Koirala, 2022). CA-MRSA (community associated) and LA-MRSA (livestock) are additional forms of MRSA (Siddiqui and Koirala, 2021).

This study is aimed at determining the prevalence of methicillin resistant staphylococcus aureus (MRSA) Nasal carriers among students of igbinedion university okada.

Study area

This work was carried out in Igbinedion University Okada Ovia North East Local Government of Edo state. Okada is a rural area and local government headquarters of Ovia North East Local Government area of Edo state.

Study design

The cross-sectional study was conducted from July to September 2025 at the medical laboratory science department of the Igbinedion University Okada, Edo state, Nigeria. Ethical approval for study was gotten from ethical committee of Igbinedion University Teaching Hospital where the research was carried out. Informed consent was obtained from students before collection of sample for research.

Sample size

A total of 150 samples were used for this study. These subjects were apparently healthy individuals without symptoms of nasal infections. The sample size of this study was determined using the statistical formula adopted by Fischer, 2004.

$$n = \frac{z^2 (p) (1- p)D}{c^2}$$

Where:

n = Estimated sample size

z = value of 95% confidence level = 1.96 at 5%level of confidence

p = Prevalence rate of MRSA taken as 6% = 0.06

c = confidence interval

D = Design effect which is usually 1

For present study z value at 95% confidence level is 1.96

Existing prevalence from other study (Okwu *et al*., 2023) = 6%

Confidence interval =5% (0.05)

Sample Collection and processing

Nose swabs were aseptically collected from the subjects using sterile cotton wool swab and analysed in blood agar plates and mannitol salt agar. Plates were incubated at 35℃ for 24 hours. Isolates were identified using procedures described by Cheesbrough, (2006). All yellowish colonies on mannitol salt agar conforming as *Staphylococcus aureus* strain were subjected to methicillin test.

Detection of Methicillin Resistance

Methicillin resistance was determined using cefoxitin-containing Mannitol Salt Agar plates prepared at a concentration of 4 mg/L. Bacterial suspensions equivalent to 0.5 McFarland standard were inoculated onto the agar plates, while blood agar plates served as controls for each isolate. Plates were incubated aerobically at 35°C for 48 hours. The appearance of visible growth after incubation was interpreted as positive for methicillin resistance. All confirmed *S. aureus* isolates were screened for resistance to methicillin (cefoxitin).

Susceptibility testing

The antimicrobial susceptibility testing for *S. aureus* was performed using the disc diffusion method as recommended by the Clinical Laboratory Standards Institute Guidelines (CLSI 2020) using an array of antibiotics? Isolates were seeded into Muller Hinton agar and incubated at 35℃ overnight. Inhibitory zones produced were ascertained as resistant or susceptible (CLSI, 2020)

Data analysis

Data obtained were analyzed using Chi=square and Fischer exact test and odd ratio analysis as appropriate, using the statistical software SPSS. Statistical significance was set at (P<.005)

Results

Age and gender distribution of the Participants

The age and sex characteristics of enrolled participants are presented in Table 1. A total of 150 students were recruited for this study. There were a total of 33 (22.0%) males and 117 (78.0%) (p=0.00003).The mean age for the participants was approximately 22 years, and the subjects were aged between 15 and 35 years. The specimen was examined by the method described for Methicillin-resistant *Staphylococcus aureus*. The median age of the students was 21 years ±3.0 SD. (p<0.0001).

Prevalence of observed growth among cultured samples of students of Igbinedion University, Okada

Out of the total of 150 samples from the students subjected to microbial culture, there was significant *Staphylococcus aureus* growth in a total of 22 cultures (14.7%), while there was no observed *Staphylococcus aureus* growth in 128 cultures (85.3%) (p=0.0006) (Table 2).

Prevalence of methicillin Resistant *Staphylococcus aureus* (MRSA) nasal carriers among students of Igbinedion University, Okada. The 22 cultures (14.7%) with significant *Staphylococcus aureus* growth obtained from students in Igbinedion University, Okada were subjected to antimicrobial susceptibility testing for the presence of methicillin Resistant *Staphylococcus aureus* (MRSA). The overall prevalence of MRSA was 100.0%. A total of 22 samples (100.0%) were methicillin resistant, while no sample (0.0%) was susceptible to the effects of methicillin antibiotic (p<0.00001) (Table 3).

Table 1: Age and gender distribution of the subjects

Characters		Frequency	p-value
Age (years)	15 – 19	24 (16.0%)	<0.0001*
	20 – 24	111 (74.0%)	
	25 – 29	10 (6.7%)	
	30 – 34	4 (2.7%)	
	35 – 39	1 (0.7%)	
	Male	33 (22.0%)	
Gender	Female	117 (78.0%)	0.00003*

Values are finding (%). The calculated Chi-square values were compared with the critical **χ2** statistic value for p = 0.05 (95% confidence level) with degree of freedom 4 (3.8). Significant difference, NA= not applicable.

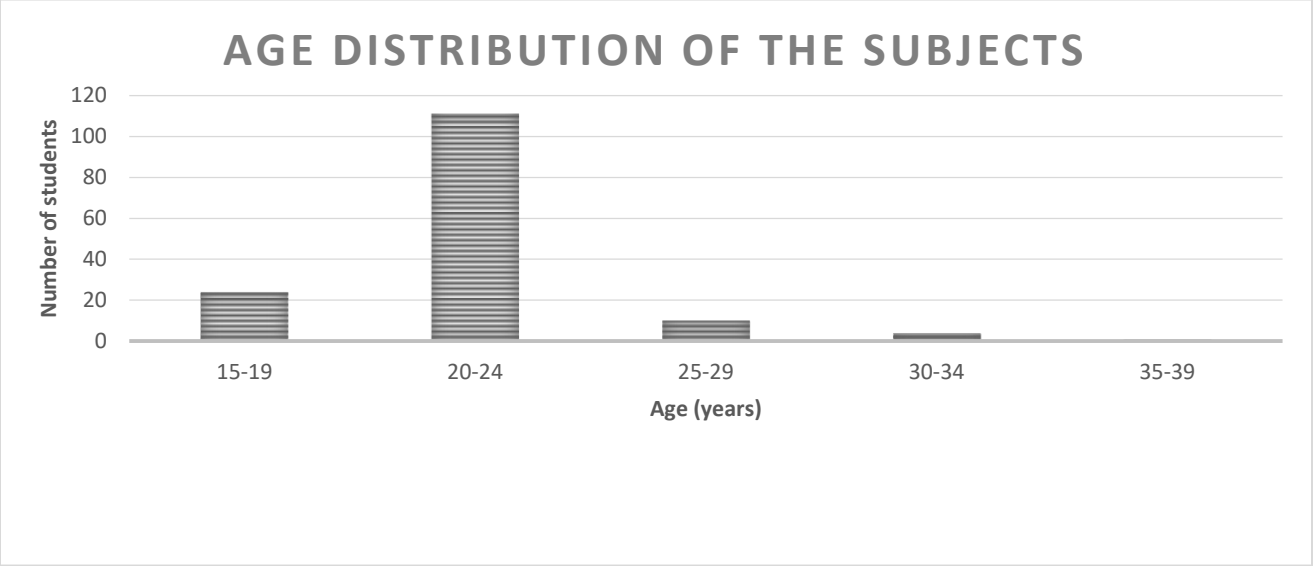

Figure.1: Age distribution of the subjects

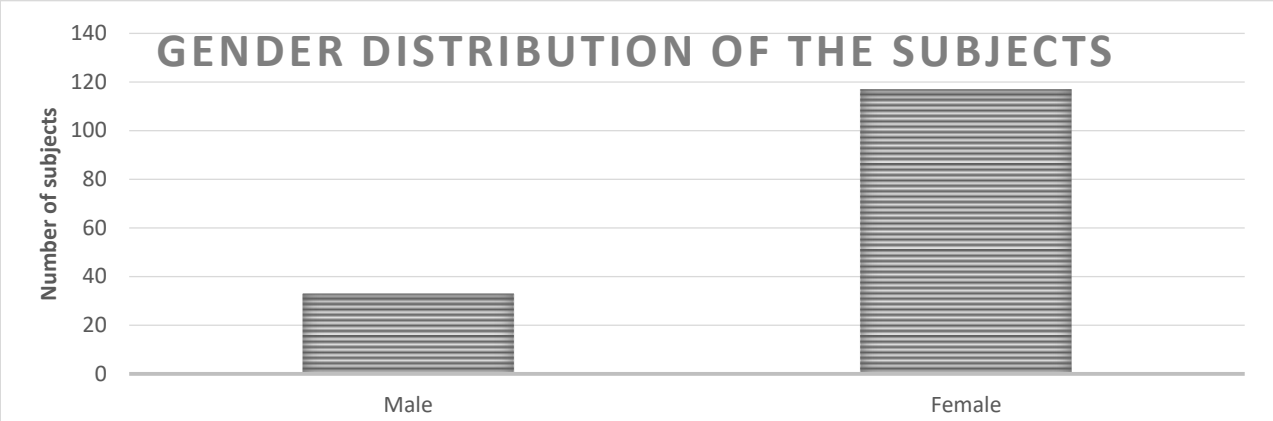

Figure 2: Gender distribution of the subjects

Table 2: Prevalence of observed *Staphylococcus aureus* growth among cultured samples of students of Igbinedion University, Okada

	Significant *Staphylococcus aureus* Growth (%)	No Significant *Staphylococcus aureus* Growth (%)	p-value
Microbial culture	22 (14.7)	128 (85.3)	0.0006

Values are finding (%). The calculated Chi-square values were compared with the critical **χ2** statistic value for p = 0.05 (95% confidence level) with degree of freedom 2 (2.8). *Significant difference, NA= not applicable.

Table 3: Prevalence of methicillin Resistant *Staphylococcus aureus* (MRSA) nasal carriers among students of Igbinedion University, Okada

	MRSA positive (%)	MRSA negative (%)	p-value
Microbial culture	22 (100.0)	0 (0.0)	<0.0001

Values are finding (%). The calculated Chi-square values were compared with the critical **χ2** statistic value for p = 0.05 (95% confidence level) with degree of freedom 2 (2.8). *Significant difference, NA= not applicable.

Discussion

The prevalence of nasal colonization with *staphylococcus aureus* in this study was 14.7%. This is lower than 20.0% and 34.0 % reported by Ajani et al., 2020 and Oyebode *et al.,* 2022. It is however lower than 18.7 % documented by Aisha *et al*., 2022 among school children in Kano Nigeria. These variations may be due to differences in level of hygiene between study participants in these studies. It could also be a function of geographical location, infection control policies (or lack of) and possible exposure levels.

The prevalence of methicillin resistant *staphylococcus aureus* in this study was 100%. This is higher than 42.9% and 61% as reported by Bawonda *et al.,* 2024 and Obajuluwa *et al.,* 2024. The World Health Organization (WHO), 2023 identified MRSA strains as a priority pathogen and designated them as a key indicator for antimicrobial resistance within the health-related targets of the Sustainable Development Goals. In this study, females were observed to have higher risk of harbouring methicillin resistant *staphylococcus aureus* in their nasal cavity (78.0%) than males (22.0%). The higher risk for methicillin resistant *staphylococcus*

aureus observed among females in this study may be related to more reckless use of antibiotics by them. Generally however, gender was not identified as a risk factor for acquisition of methicillin resistant *staphylococcus aureus* in this study. Young students (20-24 years) were observed to have the highest prevalence of methicillin resistant *staphylococcus aureus.* This age group represents students who may not be well informed of the risk of emergence of bacteria resistance through unwise use of antibiotic.

Conclusion

This study demonstrated the presence of nasal carriage of methicillin-resistant *Staphylococcus aureus* (MRSA) among students of Igbinedion University, Okada, with an overall MRSA prevalence of 100% among the *Staphylococcus aureus* isolates recovered. The findings highlight the potential public health risk associated with asymptomatic carriage of resistant strains within the university community. Continuous surveillance, improved personal hygiene practices, and rational use of antibiotics are therefore essential in reducing the spread of MRSA and limiting the emergence of antimicrobial resistance.

Author's Contribution

Conceptualization of this work by M.O; Data curation and editing by ZCS

Acknowledgement

The authors greatly acknowledge members and management of Igbinedion University Teaching Hospital for use of its facility.

Conflict of Interest

The authors declared no conflict of interests.

Funding

This study received no external funding.

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