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Research Article

Prevalence of Methicillin Resistant Staphylococcus aureus strains among Medical Undergraduate Students in South-West Nigeria

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Abstract

Background: *Staphylococcus aureus (S. aureus)* infections pose significant challenges in healthcare settings due to the emergence of methicillin-resistant strains (MRSA). This study aimed to evaluate the prevalence of nasal carriage of S. aureus (including MRSA) and antibiotic sensitivity pattern, among medical undergraduate students at Babcock University, Nigeria, and assess antibiotic resistance patterns.

Methods: Nasal swabs were obtained from 200 consenting participants, cultured on enriched and selective media (blood agar, mannitol salt agar, and Baird-Parker agar) and incubated at 37°C for 18-24 hours. Isolates were identified using standard biochemical tests, and antibiotic sensitivity testing was performed. MRSA detection utilized the Cefoxitin disk diffusion test and a latex agglutination kit.

Results: Among participants, 34% harbored S. aureus in their nasal passages, with MRSA carriage observed in 61.8%. Notably, medicine and surgery students exhibited the highest MRSA carriage (30%), particularly fifth-year students (66.6%). Antibiotic resistance analysis revealed vancomycin and cefoxitin resistance rates of 47.1% and 61.8%, respectively, while clindamycin and erythromycin showed the highest sensitivity (70.6%).

Conclusion: This study underscores a concerning prevalence of MRSA among medical undergraduate students, highlighting the urgent need for effective strategies to mitigate its spread. Implementation of stringent antibiotic prescription regulations and MRSA control measures is imperative in addressing this growing public health threat and combating antibiotic resistance effectively.

Key words: methicillin; nasal carriage; prevalence; resistance; staphylococcus aureus

1.Introduction

The human nose acts as a habitat and a means of transmission for various disease-causing microorganisms. Staphylococcus aureus, a pathogenic bacterium, is known to be carried in the nasal passages of both individuals in hospitals and community settings, especially among food handlers [1,2]. *S. aureus* can also be found in other body sites like the skin, rectum, throat, and more, but it is commonly present in the anterior nares of 50-70% of healthy individuals.

The Staphylococcus genus belongs to the Micrococcaceae family, which includes a wide range of bacteria capable of causing various diseases such as impetigo, boils, wound infections, toxic food poisoning, and more [3]. *S. aureus* is a Gram-positive bacterium that produces several virulence factors, making it harmful to both healthy individuals and those with weakened immune systems [3,4]. Staphylococci are normally harmless commensals that colonize around one-third of the human population, causing no harm unless they enter the body through cuts or injuries. However, the majority of recent clinical isolates of staphylococci have become resistant to penicillin, and multiple drug resistance is now common, particularly among MRSA strains. MRSA strains are resistant to common medications used to treat staphylococcal infections, and some have even developed resistance to the last-resort antibiotic, vancomycin. This has led to increased concern over MRSA's involvement in both community-acquired and hospital-acquired infections. Efforts are

underway to find new antibiotics and vaccines effective against MRSA strains [4-8].

The presence of *S. aureus* in the nasal passages plays a significant role in the development of infections among patients in the intensive care unit (ICU) [9], those undergoing dialysis [9,1], and individuals after surgery [2,12]. To cause infection and colonize the human nares, *S. aureus* must effectively interact with human nasal epithelial cells and evade the host's immune system. However, various circumstances can prevent *S. aureus* colonization, while specific host characteristics and environmental factors can promote it. Nasal colonization by *S. aureus* can lead to the emergence of opportunistic and potentially fatal infections in both non-surgical and surgical patients, particularly at surgical sites, giving rise to surgical site infections and other types of infections. This, in turn, results in increased healthcare costs, disease burden, and even fatalities [13].

Apart from using culture media like Baird-Parker agar to isolate MRSA, there are various identification kits available for the definite diagnosis of MRSA. Some of these kits include the Electronic RapIDTM Staph Plus Diagnostic Code Compendium Panel System (ERIC®), Dryspot Staphytect Plus (DR0100), and Penicillin Binding Protein (PBP2') Plus (DR0900). These kits can identify particular proteins and enzymes specific to MRSA, and they are generally more cost-effective compared to Polymerase Chain Reaction (PCR) methods.

Staphylococcal infections, especially MRSA, have been primarily associated with hospital-acquired infections, presenting a significant concern due to its resistance to antibiotics. Consequently, the role of medical undergraduates in transmitting nosocomial infections, such as *S. aureus* infections, to patients is of utmost importance. These healthcare workers can serve as a source of infection and reservoir for transmitting the pathogenic organism to hospitalized patients. Nasal colonization by the pathogen can lead to infections and reinfections among the patients in the hospital setting. Additionally, MRSA nasal colonization among healthcare workers poses a substantial public health threat to in-patients as these workers can potentially transmit the multidrug-resistant bacteria strain within the hospital environment [14,15]. Notably, there is currently no available data on the nasal carriage of Staphylococcus aureus, particularly the MRSA strain, among undergraduate students at Babcock University. Due to this lack of data, conducting this research is essential. The primary objective of this study is to evaluate the nasal carriage of *S. aureus* and the prevalence of antibiotic resistance among medical undergraduate students at Babcock University, Ilishan-Remo, Ogun state, Nigeria.

Methodology

Study Design

This cross-sectional study was carried out among undergraduate medical students at Babcock University, Ilishan-Remo, in the Ikenne Local Government Area of Ogun State, Nigeria. Babcock University is a prominent Seventh-day Adventist institution of higher education located in the South-Western region of Nigeria, with coordinates 70 29'00"N, 20 55'00"E. The university consists of nine schools and has a total student population of approximately twelve thousand (12,000), offering various academic and professional courses at both the undergraduate and postgraduate levels. The selection of undergraduate medical students as study participants was based on their regular and continuous interaction with patients who could potentially carry *S. aureus*, making them susceptible to staphylococcal infections. The geographical location was chosen due to its close proximity to the laboratory, ensuring minimal loss of viable organisms of interest and easy accessibility for study subjects to participate.

Duration of Study

The research work lasted for 2 months (May to June, 2022).

The sample size for this study was calculated using the formula as described by Sharma *et al [16].*

$N= (z1-a/2)^2* (p) (q) d^2$

A simple random sampling technique was used to select two hundred (200) subjects into the study and this comprised of: 68 Medical Laboratory Science, 70 Medicine and Surgery students and 62 Nursing Sciences students.

Eligibility of Subjects

Inclusion Criteria

Consenting medical undergraduate students of Babcock University were recruited for the study.

Exclusion Criteria

Non-medical undergraduate students were excluded from the study.

Informed Consent:

Before collecting samples, each participant was provided with a comprehensive explanation of the study's purpose and methodology. They were then given a consent form to voluntarily complete and sign, indicating their willingness to take part in the research. The participants were assured of the confidentiality of their study results.

Data Collection:

Upon obtaining ethical approval from BUHREC and informed consent from willing participants, a well-structured standardized questionnaire was used to collect data from the study subjects before specimen collection. Each questionnaire contained a unique participant identification number and other relevant personal information to distinguish the three departments from one another. The data collection process spanned approximately 14 days, during which the questionnaires were distributed and collected, study participants were selected, and samples were obtained from each department.

Sample Collection and Transportation:

Sterile swab sticks were used to collect nasal samples from the nostrils of study participants. These samples were promptly transported to the laboratory for analysis. In the laboratory, the samples were appropriately sorted and labeled. Media were prepared and stored in the refrigerator following the manufacturer's instructions. Before culturing, the agar plates were briefly dried in a hot air oven to eliminate surface moisture.

Culture and Identification:

Nasal swabs were streaked on mannitol salt agar, blood agar, and Baird-Parker agar, followed by incubation at 37°C for 24 hours. *S. aureus* identification relied on colonial characteristics and standard biochemical tests including catalase and tube coagulase tests [3].

Antibiotic Sensitivity Testing:

Two methods were used: Kirby Bauer disc diffusion and agar dilution.

Kirby Bauer Method: Pure colonies were emulsified, inoculated onto Mueller Hinton agar, and incubated with antibiotic discs (Clindamycin, Gentamycin, Ciprofloxacin, Erythromycin, Cefoxitin). Zones of inhibition were measured and interpreted.

Agar Dilution Method: Mueller Hinton Agar plates with vancomycin were prepared. MRSA isolates were inoculated, and MIC was determined after incubation [18,19,20,21].

MRSA Detection:

Latex agglutination test using a penicillin binding protein (pbp2') test kit supplied by Oxoid, UK was utilized [22]. *S. aureus* colonies were

suspended, heated, and centrifuged. Test latex was added, and agglutination was observed for MRSA detection.

Interpretation:

Antibiotic susceptibility was categorized as resistant, intermediate, or susceptible based on CLSI guidelines. MRSA detection was confirmed by agglutination within three minutes.

Data Analysis

Microsoft Excel was used to enter the raw data. Results were presented using frequency distribution tables and charts. Statistical Package for Social Sciences (SPSS) version 26.0 was used for data analysis. Chi-square test was used to determine association between prevalence of nasal carriage of *Staphylococcus aureus* and socio-demographic variables. P-values less than or equal to 0.05 were considered statistically significant at a 95% confidence interval.

Results

This present study assessed the nasal prevalence of *S. aureus* and its antibiotic susceptibility amongst medical undergraduate students at a private university in Ogun state. *S. aureus* colonisation according to the socio-demographic characteristics of the study participants is presented in Table 1. A total of 200 students (81 males and 119 females) between the ages of 16 and 25 years were recruited for the study. 68 (34%) *S. aureus* isolates were recovered from the 200 nasal swabs examined. The female participants (57.4%) were more colonised than their male counterparts (42.6%); however, the difference was not statistically significant (Chi square = 17.42; p = 0.872). Based on age, *S. aureus* colonisation was higher among those aged 21-25 years (54.4%) than among those aged16-20 years (45.6%). However, the difference was not statistically significant (Chi square= 24.28; p = 0.432). Nasal colonisation of *S. aureus* was found to be significantly higher among students of Medicine (38.2%), as well as Nursing (38.2%), but lower among students of the Medical Laboratory Science Department (23.5%) (Chi-squared=10.47*;* p=0.012). Based on their year of study, nasal colonisation of *S aureus* was found to be statistically significant (Chi squared = 12.52; p = 0.005) higher among students in the fifth year of study.

The prevalence of MSSA and MRSA according to the socio-demographic characteristics of the study participants is presented in Table 2. From the 68 isolates recovered from the nasal swabs examined, MSSA had a prevalence of 38.2% (26 out of 68), while MRSA had a prevalence of 61.8% (42 out of 68). The prevalence of MRSA is not significantly associated with the gender and age of the study participants (X^2 = 2.01; 4.02; and 14.07; p>0.05). The prevalence of MRSA was statistically significant (X^2= 10.47; p=0.012) higher among students of Medicine and Surgery (50%), followed by students of Nursing (31%) and then Medical Laboratory Science (19%). Based on their year of study, MRSA prevalence was significantly higher among students in the fifth year of study (66.6%) (X^2=34.28; p = 0.000).

Regarding nose hygiene among the participants, a correlation was found between their beliefs about nose hygiene and their actual nose hygiene practices across the three departments. The questionnaire results indicated that the belief in nose hygiene was lowest among medicine students (50 or 71.4%), followed by medical laboratory science students (54 or 79.4%), and highest among nursing science students (58 or 93.5%) (X2= 6.81; p=0.000). However, the practice of nose hygiene was most commonly observed among medical laboratory science students (60 or 88.2%), followed by medicine students (54 or 77.1%), and least among nursing science students (46 or 74.2%) (X2 = 14.20; p=0.017), as shown in Table 3.

In terms of the frequent use of antibiotics, medicine students had the highest occurrence with 35 (45.7%) reporting frequent use, followed by nursing science students with 25 (40.3%), and medical laboratory science students with 11 (16.2%). There was a significant association between the frequency of antibiotic use and the departments (X2 = 10.02; p = 0.000) as seen in Table 4. As for wound infection, it was not recorded among medical laboratory science students (0 or 0%), and the least occurrence was among nursing science students with 8 (12.9%), while medicine students had the highest occurrence with 12 (17.1%) among the three departments. There was no statistical relationship observed among the study departments concerning wound infection.

Variables	Category	No examined	No (%) isolated	$\chi 2$	*p*- value
Gender	Male	81	29(35.8)	0.09	0.755
	Female	119	39(32.8)		
Total		200	68 (34)		
Age (Years)	16 – 20	110	31(45.6)	1.80	0.180
	21 – 25	90	37(54.4)		
Total		200	68 (34)		
Course of Study	Medicine	70	26(38.2)	2.73	0.255
	Nursing	62	26(38.2)		
	Med Lab Sci.	68	16(23.6)		
Total		200	68 (34)		
Year of Study	First	0	0(0)	16.72	0.002*
	Second	56	4(7.5)		
	Third	15	5(33.3)		
	Fourth	24	7(29.1)		
	Fifth	91	47(51.6)		
	Sixth	14	5(35.7)		
Total		200	68 (34)		

Where $\chi 2$ = Chi-square; * = Significant at $p < 0.05$.

Table 1: *S. aureus* colonisation according to the socio-demographic characteristics of the study participants

Variables	Category	No. of samples examined N (%)	MSSA N (%)	MRSA N (%)	p- Value	Chi-square
Gender	Male Female	81 (40.5) 119 (59.5)	11 (42.3) 15 (57.4)	18 (42.9) 24 (57.1)	0.905	2.01
Age (Yrs)	16 – 20 21 – 25	110 (55) 90 (45)	13 (11.8) 13 (14.4)	18 (42.9) 24 (57.1)	0.134	4.02
Course of study	Medicine Nursing Med. Lab. Science	70 (35) 62 (31) 68 (34)	5 (7.1) 13 (21.0) 8 (11.8)	21 (50) 13 (31) 8 (19)	0.016*	12.43
Year of study	First Second Third Fourth Fifth Sixth	NA 56 (28) 15 (7.5) 24 (12) 91 (45.5) 14 (7)	NA 2 (3.6) 3 (20.0) 1 (4.2) 19 (20.9) 1 (7.1)	NA 2 (4.8) 2 (4.8) 6 (14.3) 28(66.6) 4 (9.5)	0.000*	34.28
	Total	200	26	42		

Keys: *MSSA = Methicillin Sensitive Staphylococcus aureus, MRSA = Methicillin-resistant Staphylococcus aureus. * p-value <0.05 was considered being statistically significant.*

Table 2: The prevalence of MSSA and MRSA was determined according to the socio-demographic characteristics of the study participants

Parameters	Medicine (n =70)		Nursing (n = 62)		Med Lab Sci. (n=68)		Total (%)	P – value	Chi square
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)			
Do you believe in nose hygiene?	50(71.4)	20(28.6)	58(93.5)	4(6.5)	54(79.4)	14(20.6)	100	0.000	6.81
Do you maintain nose hygiene?	54(77.1)	16(22.9)	46(74.2)	16(25.8)	60(88.2)	8(11.8)	100	0.017	14.20
Do you apply bare hands in picking/cleaning your nose?	54(77.1)	16(22.9)	51(82.3)	11(17.7)	40(58.8)	28(41.2)	100	0.004	4.51

Table 3: Nose hygiene practices among study participants

Parameters	Medicine (n = 70)		Nursing (n = 62)		Med Lab. Sci. (n = 68)		Total (%)	*p* - value	$\chi 2$
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)			
Frequent use of antibiotics	32(45.7)	38(54.3)	25(40.3)	37(59.7)	11(16.2)	57(83.8)	100	0.000*	10.02
Present of skin/ wound infection	12(17.1)	58(82.9)	8(12.9)	54(87.1)	0(0)	68(100)	100	0.002*	19.00

Where $\chi 2$ = Chi-square; * = Significant at $p < 0.05$

The results of the antibiotic susceptibility test for *S. aureus* isolates, categorized by the participants' department, are presented in Table 5 and Figure 1. Among all the antibiotics used, there were no intermediate susceptibility results recorded; isolates were either classified as resistant or sensitive. A range of susceptibility levels to antibiotics was observed, with the highest resistance seen for cefoxitin (61.8%) and vancomycin (47.1%). On the other hand, the highest degree of antibiotic sensitivity was found for clindamycin and erythromycin, both showing 70.6% sensitivity (X^2= 5.47; p<0.05). Remarkably, all 16 (100%) isolates obtained from students in the Medical Laboratory Science Department were sensitive to vancomycin (X^2 = 45.71; p= 0.000), as well as erythromycin (X^2 = 12.68; p = 0.013).

Table 4: Frequent use of antibiotics and the presence of wound infection were found among study participants

Antibiotics	Medicine (n = 70) No. of isolates tested = 26		Nursing (n = 62) No. of isolates tested = 26		Med Lab (n =68) No. of isolates tested = 16		χ2	*p* - Value
	R N (%)	S N (%)	R N (%)	S N (%)	R N (%)	S N (%)		
Gentamycin	10(38.5)	16(61.5)	9(34.6)	17(65.4)	6(37.5)	10(62.5)	5.47	0.242
Clindamycin	13(50)	13(50)	6(23.1)	20(76.9)	1(6.25)	15(93.75)	14.65	0.000*
Cefoxitin	21 (80.8)	5(19.2)	13 (50)	13(50)	8(50)	8(50)	12.24	0.016*
Ciprofloxacin	10(38.5)	16(61.5)	10(38.5)	16(61.5)	8(50)	8(50)	5.91	0.206
Erythromycin	11(42.3)	15(57.7)	9(34.6)	17(65.4)	0(0)	16(100)	12.68	0.013*
Vancomycin	26(100)	0(0)	6(23.1)	20(76.9)	0(0)	16(100)	45.71	0.000*

Where **χ2** = Chi-square; * = Significant at $p < 0.05$

Table 5: Data analysis of the antibiotic susceptibility test of *S. aureus* isolates according to the participants' department.

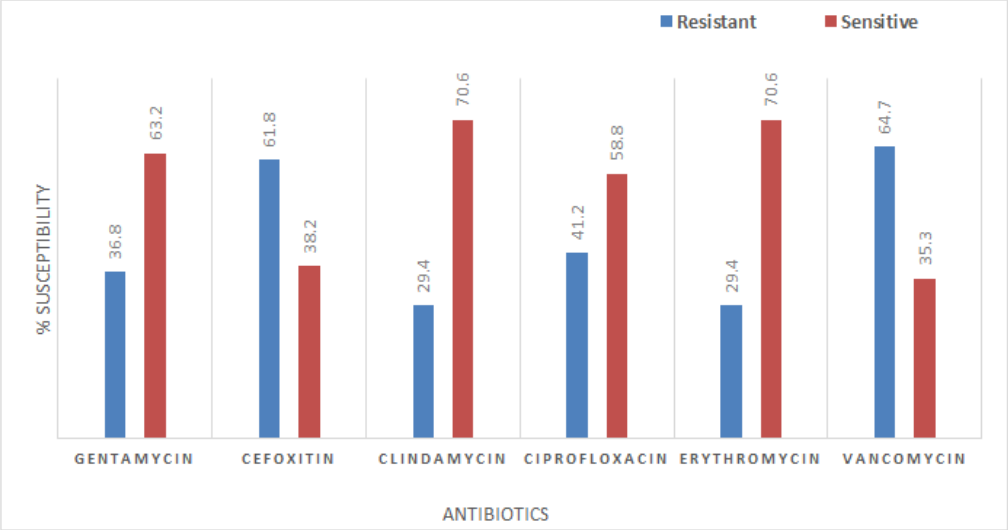

Figure 1: Bar chart showing the overall antibiotic susceptibility pattern of *S. aureus* nasal isolates recovered from the study participants.

Discussion

Approximately 20-30% of healthy individuals have *S. aureus* present in their nasal passages as a common commensal, with many being carriers unknowingly [23]. Nasal carriage of *S. aureus*, especially the methicillin-resistant strain (MRSA), has been mainly associated with healthcare workers and individuals within hospital environments [5-8,24-26]. MRSA has been identified in various geographical locations worldwide,[27] including Nigeria, where studies have shown an overall increase in its prevalence.[9] In this study, the focus was on assessing the nasal carriage of *S. aureus* and MRSA among medical undergraduate students at Babcock University, Ilishan-Remo, Ogun State.

Among the 200 nasal swabs examined, the carriage rate of *S. aureus* among the study participants was found to be 34%. This rate is lower than the 63.1% reported by Garoy *et al [5]*.in Asmara, Eritrea, and the 91.2% reported by Elimian *et al [17]* among outpatients in selected health facilities in Benin City, Nigeria. It was however lower than the 30.5% reported by Chai *et al [5]*. among animal handlers in Peninsular Malaysia. These variations could be attributed to differences in geographical

locations, socio-demographics, and hygiene levels among the study participants.

Additionally, in this study, the prevalence of MRSA was found to be 61.8%. This percentage is higher compared to the 46.9% and 1.2% reported by Adeiza *et al [28].*and Chai *et al [6].* in a study conducted among patients and staff of state-owned hospitals in North-West Nigeria and animal handlers in Malaysia, respectively. However, it is lower than the 72.0% reported by Garoy *et al [5].* among patients in Asmara, Eritrea.

In this current study, when considering gender, the carriage rate was higher among females (57.4%) compared to their male counterparts (42.6%). This is consistent with the work of Othman *et al [26].* who reported a higher prevalence in females than in males (OR = 1.96; $\chi^2 = 10.75$; p=0.001). However, it contradicts the work of Ibrahim and Sule [17], who reported a higher carriage rate among males (11.2%) than females (5.6%).

Regarding age, the carriage of *S. aureus* and MRSA was highest among individuals in the age group of 21-25 years, with rates of 54.4% and 57.1%, respectively. This finding is consistent with the study by Ibrahim and Sule [17] who also reported the highest carriage rate among individuals aged 21-30 years (8.4%). It further aligns with the work of Garoy *et al [5].*who found a higher carriage of *S. aureus* in patients under the age of 18 compared to those over the age of 61 years.

Furthermore, concerning the departments assessed in this study, the prevalence of MRSA was highest among Medicine and Surgery students, with a prevalence of 30%, followed by Nursing Science students (21%), and Medical Laboratory Science students (11.8%), which had the lowest prevalence. A similar study by Adeiza *et al.*[28] reported the highest MRSA prevalence among physicians in a health center in Sokoto, North-West of Nigeria. According to Albrich *et al [29].*the high prevalence rate of MRSA among healthcare workers can be attributed to their exposure to the hospital environment without adequate preventive measures and hospital hygiene. From the questionnaire, it was observed that Medical students had the lowest practice of nose hygiene compared to the other two groups. A similar study by Rongpharpi *et al [30].*emphasized major risk factors contributing to the spread of *S. aureus* in a hospital community, including poor sanitary and hygienic measures among healthcare workers.

The *S. aureus* isolates recovered in this study exhibited varying susceptibility patterns to the different antibiotics tested. Clindamycin and erythromycin were found to be the most effective, with the highest overall susceptible rate of 70.6% each, while the highest resistant rates were recorded for cefoxitin (61.8%) and vancomycin (47.1%). Interestingly, a study in south Brazil reported contrasting results, showing clindamycin and erythromycin to have the least sensitivity to *S. aureus [31]*. Another earlier study[32] conducted in a teaching hospital in Abakaliki, Nigeria, reported high resistance to clindamycin (76.9%) and erythromycin (74.4%). Meanwhile, Chai *et al [6].* found that *S. aureus* was highly resistant to penicillin (72.3%) and amoxicillin (52.3%), while gentamicin and linezolid were highly effective against all the *S. aureus* isolates recovered from animal handlers.

Misuse of antibiotics plays a significant role in the development of drug resistance among drug-resistant pathogens, and a study by Tarai *et al [33].* identified easy availability and access to antibiotics at drugstores without a physician's prescription as a primary factor contributing to the development of drug resistance among pathogenic organisms. Additionally, the development of resistance to several other antibiotics by *S. aureus* can be attributed to their ability to acquire determinants through horizontal gene transfer of mobile genetic elements [34].

From this study, it was observed that other antibiotics like gentamicin and ciprofloxacin were also effective but less so compared to clindamycin and erythromycin. Ciprofloxacin showed a susceptibility rate of 58.8%, while gentamicin had a rate of 63.2%, which is slightly lower compared to other research findings, such as the study by Siddiqui *et al[35].* where a higher susceptibility rate of 74% was recorded for ciprofloxacin. Therefore, it is crucial to study the antibiotic susceptibility patterns of *S. aureus* based on global geographic regions. Doing so will enable researchers to better understand the organism's new and emerging resistance trends, which will be valuable for the management of both hospital- and community-acquired infections, as suggested by Abebe & Birhanu [36]

The prevalence of MRSA among medical undergraduate students is a concerning issue, as highlighted in this study. The identification of MRSA strains among individuals not directly involved in clinical practice underscores the potential for community transmission and the need for comprehensive preventive measures. Understanding the genetic mechanisms underlying antibiotic resistance in MRSA strains is crucial for developing effective management strategies. MRSA typically acquires resistance through the acquisition of mobile genetic elements carrying genes such as mecA, which encodes for altered penicillin-binding proteins, rendering beta-lactam antibiotics ineffective. Additionally, genes encoding efflux pumps and enzymes that modify or degrade antibiotics contribute to the multidrug resistance phenotype observed in MRSA isolates [36,37].

Environmental factors play a significant role in the prevalence and transmission of antibiotic-resistant MRSA strains among medical undergraduate students. The close proximity and frequent interaction within educational and healthcare environments create opportunities for MRSA colonization and transmission. Inadequate hygiene practices, overcrowding, and suboptimal infection control measures further exacerbate the risk of MRSA dissemination. Medical schools and healthcare institutions must prioritize environmental sanitation, promote hand hygiene practices, and implement stringent infection control protocols to mitigate MRSA transmission among students and staff [38,39].

Clinical exposure during medical training may contribute to the acquisition and dissemination of antibiotic-resistant MRSA strains among medical undergraduate students. Clinical postings in healthcare environments expose students to MRSA colonization and infection risk, particularly in settings with high MRSA prevalence [40-43].

Close contact with patients, inadequate personal protective equipment, and suboptimal adherence to infection control measures increase the likelihood of MRSA transmission. Integrating comprehensive infection control training into medical curricula and ensuring adherence to standard precautions during clinical rotations are essential to minimize MRSA transmission among students and healthcare workers [44,45].

The findings of this study hold critical implications for public health. The study identifies a high prevalence of MRSA among medical undergraduate students. Given MRSA's role in healthcare-associated infections, its presence in students increases the risk of transmission within healthcare settings, leading to elevated morbidity, mortality, and healthcare costs. MRSA carriers among medical students can act as reservoirs for transmission to vulnerable patient populations. This underscores the need for rigorous infection control measures to prevent transmission within healthcare facilities. Healthcare-associated MRSA infections pose severe consequences for patient safety, particularly for immunocompromised individuals. The presence of MRSA among medical students raises concerns about transmission to vulnerable patients during clinical rotations.

Addressing the high prevalence of MRSA among medical students requires multifaceted strategies including: Infection control education, screening of medical students for MRSA nasal carriage before clinical rotations, with decolonization procedures for carriers. Promote responsible antibiotic prescribing practices among medical students to

minimize antibiotic resistance development. Implement appropriate isolation and contact precautions for MRSA carriers during clinical rotations to prevent transmission to patients. Establish surveillance systems to monitor MRSA prevalence among medical students and healthcare-associated infections in clinical settings. Ensure thorough cleaning and disinfection of healthcare environments to reduce MRSA transmission, as well as conduct awareness campaigns targeting medical students to promote prudent antibiotic use and infection control practices.

The antibiotic management plan mentioned in this study emphasizes the importance of implementing policy regulations on antibiotic prescription and usage. Recommendations include promoting antimicrobial stewardship programs to optimize antibiotic prescribing practices, educating healthcare professionals and students on appropriate antibiotic use, and implementing surveillance systems to monitor antibiotic resistance patterns. While these recommendations are crucial, their successful implementation requires collaboration between healthcare providers, policymakers, and educational institutions [46-50].

Strengths of the Study:

This study contributes valuable insights into antibiotic resistance and MRSA prevalence, with implications for public health policies and infection control practices.

Limitations of the Study:

1. The study's cross-sectional design does not establish causality.
2. Lack of genetic analysis limits understanding of MRSA transmission patterns.
3. Lack of assessment for persistent or intermittent carriers.

Recommendations for Future Studies:

Future studies should address these limitations by considering longitudinal designs, genetic characterization, and assessing risk factors associated with MRSA carriage among medical students. Additionally, inclusion of control groups, expanded antibiotic panels, and investigation of mechanisms of resistance are warranted. By addressing these recommendations, future research can provide comprehensive insights into MRSA epidemiology and contribute to effective infection control strategies.

Conclusion

The high prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) among medical undergraduate students underscores the urgent need for policy regulations on antibiotic prescription and usage. Implementing stringent guidelines for MRSA detection and control measures is crucial to curb the spread of resistant strains and combat antibiotic resistance effectively. Key measures include regular surveillance for MRSA, appropriate use of antibiotics, infection control protocols, and promoting antimicrobial stewardship programs. These actions are essential to safeguard public health and preserve the effectiveness of antibiotics for future generations.

Competing Interests

The authors declare no competing interests.

Authors' Contributions:

Study concept and design: E.O.A., A.E.A.;

Acquisition of data: E.O.A., A.E.A., S.S.E.;

Analysis and interpretation of data: E.O.A., A.E.A.;

Drafting of the manuscript: E.O.A., A.E.A., S.S.E.;

Critical revision of the manuscript for important intellectual content: E.O.A., A.E.A., S.S.E.;

Statistical analysis: E.O.A., A.E.A.;

Study supervision: A.E.A.

Data Availability

Data supporting the findings of this study are available on reasonable request from the corresponding author [SSE], exclusively for non-commercial use and under a Data Usage Agreement.

Consent

Authors declared that a written informed consent was obtained from each study participant before the commencement of the research.

Conflict of Interest

There is no conflict of interest reported by the authors.

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Ethical Approval

Ethical approval (with the ethical registered number: BUHREC 342/22) was obtained from the Babcock University Health Research Ethics Committee (BUHREC) before the commencement of the research.

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Competing Interests

The authors declare that they have no competing interests.

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