

# Carriage of Methicillin Resistant *Staphylococcus aureus* amongst Theater/Intensive Care Unit Workers in a Tertiary Healthcare Center in Nigeria: FMC Owerri Experience

Uchegbu UN<sup>\*1</sup>, Nwadike VU<sup>1</sup>, Amah HC<sup>1</sup>, Udunna M<sup>1</sup>, Nwokeji CM<sup>2</sup>, Okorie O<sup>3</sup>, Uwakwem A<sup>4</sup>

<sup>3</sup>F gr ctvo gpv'qh'O letqdkmqi { IRctcukmqi { 'HO E'Qy gttk0

<sup>4</sup>F gr ctvo gpv'qh'Rc'j qmqi { 'HO E'Qy gttk0

<sup>5</sup>F gr ctvo gpv'qh'Cpcguj guk'HO E'Qy gttk0

<sup>6</sup>F gr ctvo gpv'qh'Qr'j cno qmqi { 'HO E'Qy gttk0

druhegbujnr@yahoo.com\*

## Abstract

**Background:** In recent years nosocomial outbreaks of methicillin and multiple-antibiotic-resistant *Staphylococcus aureus* (MRSA) have become a major infection control problem. *S. aureus* is ubiquitous and can easily colonize individuals leading to the potential for rapid spread. Antibiotic resistance is also a concern with this bacterium particularly the MRSA. The screening and eradication of MRSA from the colonized HCWs has been recognized and recommended as an important part of a comprehensive infection control policy for this organism. This study was therefore aimed at establishing the carriage rate of MRSA among the HCWs in the 6 bedded critical care units and newly commissioned six- suite operating theatre of FMC Owerri .

**Materials and Method:** Nasal swabs and swabs of the webs of the digits were collected from all recruited staff for microscopy, culture. The specimens were inoculated on selective and non selective media. The specimen was inoculated on MacConkey agar and blood agar and incubated at 35-37°C for 18-24hrs. *Staphylococcus aureus* grew on MacConkey agar appearing as a lactose fermenter and on blood agar as golden colonies. Antibiotic Susceptibility Testing was done using the disc diffusion method (Modified Kirby-Bauer test).

**Results:** A total of 32 staff were screened for carriage of Methicillin Resistant *Staphylococcus aureus*, 15 (46.9%) were male and 17 (53.1%) were female. Twelve were physicians (37.5%), 15(46.9%) were nurses and 5(15.6%) were attendants. The results of cultures revealed that 20.3% of isolates recovered. The susceptibility of the fourteen MRSA isolates yielded the following results: 83.4% were resistant to Amoxicillin-clavulanate, 57.2% were resistant to chloramphenicol, 42.8% were resistant to Gentamicin and Erythromycin, 14.2% were resistant to ciprofloxacin, 21.2% resistant to ceftriaxone, 35% were resistant to Levofloxacin, and 28.5% were resistant to Ofloxacin.

**Conclusion,** the prevalence of MRSA (20.3%) found in workers in the ICU may indicate the need for regular screening of healthcare workers in this setting and the development of control measures to mitigate any colonization.

These solutions may require both short- and long-term planning and implementation, however, the reduction of hospital-acquired and iatrogenic infection spread, particularly in the ICU, may well be worth the effort.

**Keywords:** Methicillin Resistant *Staphylococcus aureus*, Theater/Intensive Care Unit, Tertiary Healthcare, Owerri, Nigeria.

## 1. Introduction

In recent years nosocomial outbreaks of methicillin and multiple-antibiotic-resistant *Staphylococcus aureus* (MRSA) have become a major infection control problem. *Staphylococcus aureus* (*S. aureus*) is one of the most significant human pathogens causing a variety of diseases from superficial skin lesions to invasive infections associated with high mortality (Kollef and Fraser, 2001). *S. aureus* is ubiquitous and can easily colonize individuals leading to the potential for rapid spread (2). Antibiotic resistance is also a concern with this bacterium, particularly the Methicillin Resistant *Staphylococcus aureus*. Approximately 60% of all infections caused by *S. aureus* in patients admitted to intensive care units (ICU) are caused by MRSA (3).

The primary habitat of *S. aureus* spread in humans is characterized through skin or respiratory transmission. While skin spread can be effectively reduced through proper hand washing practices, the management and control of respiratory spread offers a greater challenge (4). Colonization of *S. aureus* in the nostrils has been associated with infection spread and is recognized as a risk factor for the development of invasive infection (5). In the healthcare environment, colonization is a serious concern for both hospital-acquired and iatrogenic infections. Our inability to treat these infections at an early stage with first-choice antibiotics and the limited choices available pose serious therapeutic problems. Kluytmans et al. in 1997 (6) demonstrated that the prevalence of colonization

in healthcare workers ranged from 16.8% to 56.1%. The knowledge of the MRSA prevalence and the current antimicrobial profile is necessary for the selection of the appropriate antimicrobial empirical treatment for these infections [7].

Similarly, the screening and eradication of MRSA from the colonized HCWs have been recognized and recommended as an important part of a comprehensive infection control policy for this organism. The hospital infection control staffs need to limit the spread of MRSA for several reasons. There have recently been reports on the strains of MRSA that had an intermediate resistance to vancomycin. This is an important concern since the already limited treatment to 3 options for serious MRSA infections may become more limited due to the increase in resistance to vancomycin. Limiting the transmission of MRSA might reduce the potential for these strains to spread [8].

This study was therefore aimed at establishing the carriage rate of MRSA among the HCWs in the critical care units of newly commissioned six-suite operating theater of FMC Owerri. The outcome may be useful for formulating an MRSA control policy and an infection control policy for the hospital.

## 2. Methodology

This cross sectional study was carried out in the Federal Medical Center Owerri, Nigeria. The Federal Medical Center is a 250 bedded tertiary health institution with a 10 bedded ICU and which has a monthly turnover of 25 patients. Federal Medical Center, Owerri is a tertiary Healthcare center which provides healthcare services to the people of Imo state and neighboring Enugu, Abia, Ebonyi and serves as a referral hospital to secondary and tertiary hospitals across the South Eastern part of the country.

The study population consists of all staff of the theatre and ICU ethical approval was obtained from the management of the Federal Medical Center Owerri. Verbal and written informed consent was sought and obtained from all the participants. The tests were carried in the Bacteriology laboratory of the microbiology department.

### 2.1 Specimen collection and transport

Nasal swabs and swabs of the webs of the digits, swabs were collected from all recruited staff for microscopy, culture. Specimens were collected using swabs moistened with peptone broth. A Gram stain was done on smears made from specimens and then viewed under the light microscope at x100. Classically they are Gram positive cocci.

### 2.2 Culture and identification

The specimens were inoculated on selective and non selective media. The specimen was inoculated on MacConkey agar and blood agar and incubated at 35-37°C for 18-24hrs. *Staphylococcus aureus* grew on MacConkey agar appearing as a lactose fermenter and on blood agar as golden colonies.

### 2.3 Characterization

All Gram-positive cocci isolated were tested for catalase and coagulase. All catalase positive, coagulase positive Gram positive cocci were subsequently identified as *Staphylococcus aureus*.

#### 2.3.1 Antibiotic susceptibility testing

This was done using the disc diffusion method (Modified Kirby-Bauer test). The inoculum was prepared from a suspension of the organism made by picking 2 or 3 colonies of the organism and making an emulsion of it in peptone water. This suspension was then compared against a turbidity standard (0.5 McFarland standards). At this level growth is expected to be in the logarithmic phase. Using a sterile swab stick the Mueller-Hinton agar was inoculated with the broth culture after about 3mins; oxacillin 1ug was placed on the surface of the agar and incubated at 35°C for 24hrs.

#### 2.3.2 Interpretation

The diameter of the zone of inhibition was measured with a calibrated meter rule and interpreted with standard interpretative CLSI charts.

#### 2.3.3 Control

*Staphylococcus aureus* ATCC 25922 was used as control.

## 3. Results

A total of 32 staff were screened for carriage of methicillin resistant *staphylococcus aureus* of the thirty two staff that participated in the screening, 15 (46.9%) were male and 17 (53.1%) were female. Of the participants, twelve were physicians (37.5%), 15(46.9%) were nurses and 5(15.6%) were attendants. Table 1

**Table 1.** Theatre staff screened for MRSA

Category	Frequency (%)	Male (%)	Female (%)
Doctor	12(37.5%)	9(75%)	3(25%)
Nurse	15(46.9%)	0(0%)	15(100%)
Attendants	5(15.6%)	4(80%)	1(20%)

**Table 2.** Categories of Staff and % colonized with MRSA

% <i>Staphylococcus aureus</i>	%MRSA	%MSSA
60.9%	20.3%	40.6%
Category	MRSA	MSSA
Doctor 12(37.5%)	6(50%)	6(50%)
Nurses 15(46.9%)	1(6.7%)	12(80%)
Attendants 5(15.6%)	3(60%)	2(40%)

**Table 3.** Sites of Staphylococcal Colonization and categories of staff

Category	Collection site	MRSA	MSSA
Doctors 12(37.5%)	Nasal	50%	41.7%
	Web	8.3%	8.3%
Nurses 15(46.9%)	Nasal	6.7%	73.3%
	Web	0%	33.3%
Attendant 5(15.6%)	Nasal	60%	40%
	Web	40%	40%

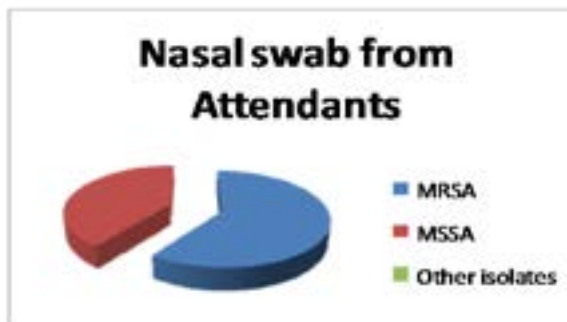
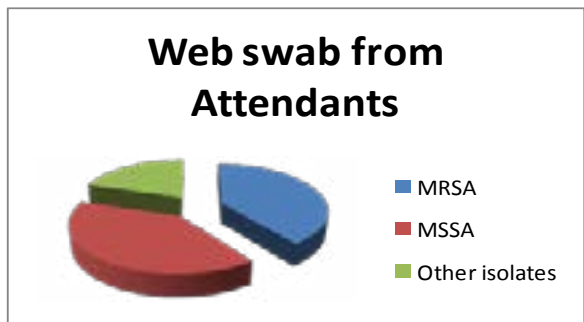
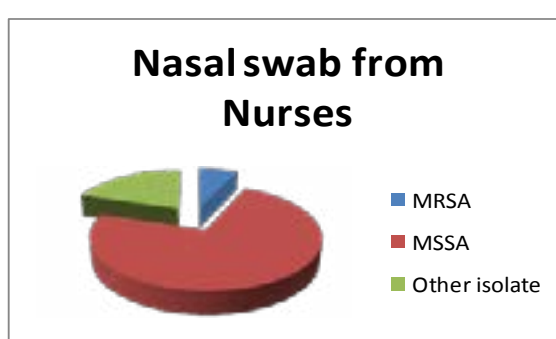
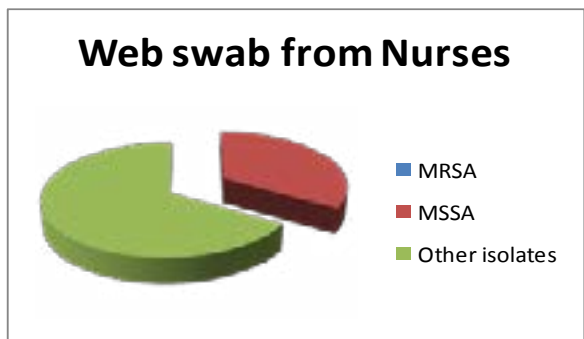
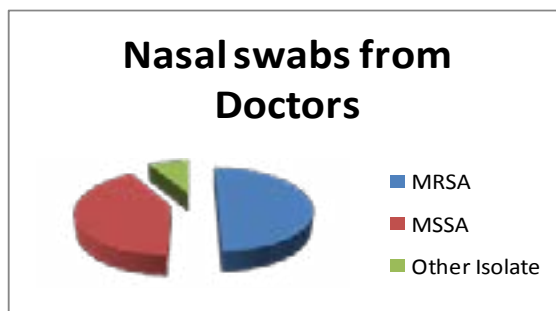
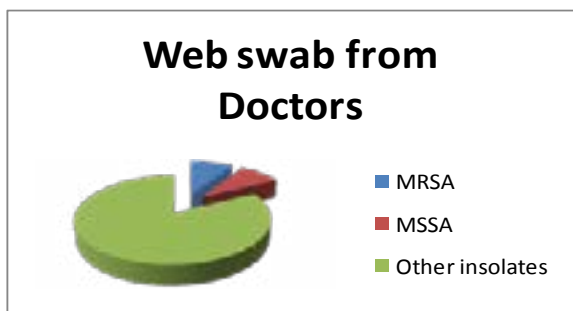
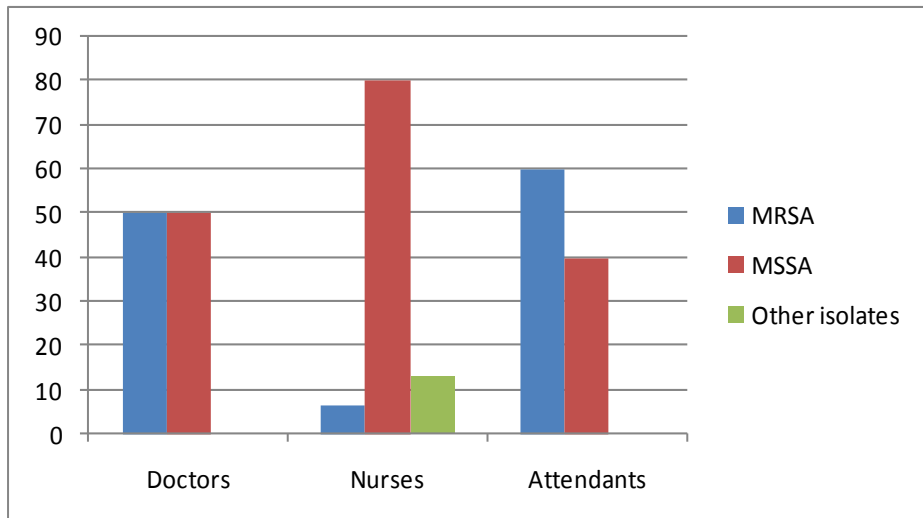
The susceptibility patterns of the isolates revealed that the highest resistance was to Amoxicillin-clavulanate (85.7%), chloramphenicol (57.2%) with increased susceptibility to quinolones and ceftriaxone.

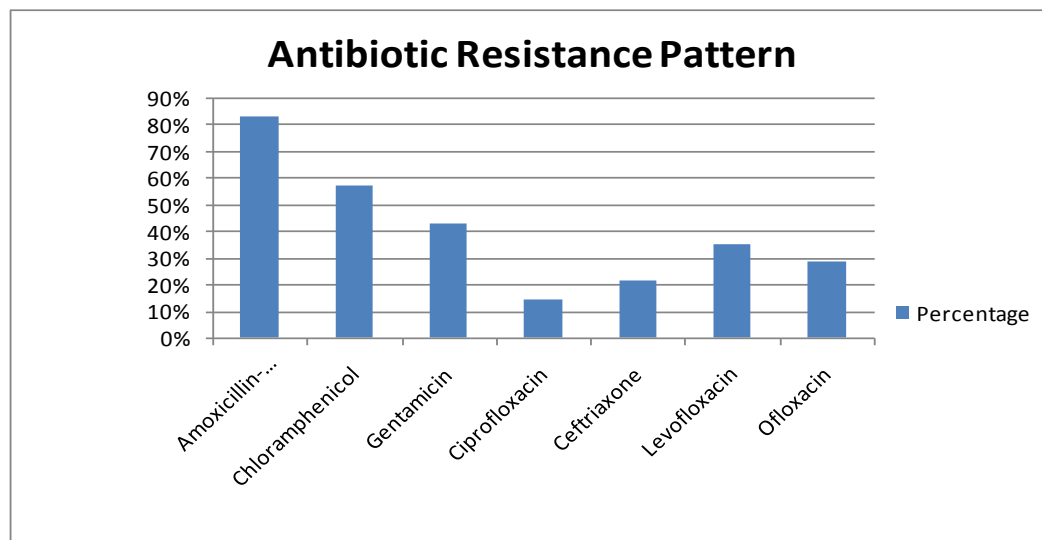
The results of cultures showed that *staphylococcus aureus* constituted 60.9% of all the isolates and Methicillin resistant staphylococcus aureus represented 20.3% of isolates recovered while 40.6% were methicillin susceptible *Staphylococcus aureus*. Twelve doctors were screened for MRSA and 6(50%) were found to be carriers, of the fifteen nurses screened 1(6.7%) was noted to be carrying MRSA. Five attendants participated in the study, 3(50%) were carriers of MRSA and 2(40%) had methicillin susceptible staphylococcus aureus.

Of the twelve Doctors recruited in the study from the nasal swabs 50% were MRSA, 41.7% were MSSA from the webs MRSA and MSSA were 8.6% apiece. In the nursing cadre nasal swabs were positive for MRSA in 6.7% of respondents and 73.3% for MSSA. In the webs none of the nursing staff had MRSA and 33.7% MSSA. Five attendants participated in the study; Nasal swab shows that 60% of them had MRSA and 40% MSSA, Web swab shows that 40% had MRSA and 40% MSSA. Graphical Resentation of Table 2

#### 4. Discussion

Detecting the MRSA carriage rate among apparently healthy hospital personnel, particularly those working in the critical care areas is very important. These individuals act as a potential source of infection to their patients, resulting in their extended stay in the hospital. In our study, MRSA colonization was found in 20.3% of the HCWs. This was greater than the values reported by other studies.





In this study the MRSA carriage was high among doctors (50%), theater attendants (60%) but lower in nurses (6.7%). Also the nasal carriage rate was higher than the web carriage, the presence of colonized health workers demonstrates the risk associated with working in a healthcare facility. Individuals may be colonized through a number of routes specific to their occupation, including contact with an infected individual or contaminated material, upon colonization, these individuals may then spread the bacteria and potentially cause outbreaks (9).

Of the MRSA isolates, there was improved susceptibility to the quinolones with ciprofloxacin being the best of the quinolones. The susceptibility of the isolates to the beta lactam antibiotics was poor demonstrating the potential for increased resistance *in vivo*. However, this should be further explored at the genetic level to determine the clonal relatedness of the isolates. While hand washing and other methods of skin decolonization may be effective in preventing skin transfer, there are few to no routine activities that can reduce the respiratory spread of MRSA. We thus propose that there is justification for the routine screening of health workers for MRSA colonization and subsequent treatment. Doebbeling et al. have shown that the application of mupirocin twice daily for five consecutive days for health workers was successful in 91% of nasal carriers, and after four weeks, 87% of them remained free of *S. aureus*.

In conclusion, the prevalence of MRSA (20.3%) found in workers in the ICU may indicate the need for regular screening of healthcare workers in this setting and the development of control measures to mitigate any colonization. These solutions may require both short- and long-term planning and implementation, however, the reduction of hospital-acquired and iatrogenic infection spread, particularly in the ICU, may well be worth the effort.

## 5. References

- 1• Kollef MH and Fraser VJ (2001) Antibiotic resistance in the Intensive Care Unit. *Ann. Intern. Med.* 134, 298-314
- 2• Velásquez J, Lizaraso F and Wong W (2002) Vigilancia de la resistencia de *Staphylococcus aureus* a la xacilnavancomicina y patrones de correspondencia. *Rev. Per. Soc. Med. Intern.* 15(4),184-189. Disponible [http://sisbib.unmsm.edu.pe/BVRevistas/spmi/v15n4/vigilancia\\_resistencia\\_staphylococcus.htm](http://sisbib.unmsm.edu.pe/BVRevistas/spmi/v15n4/vigilancia_resistencia_staphylococcus.htm).
- 3• Gastmeier P, Sohr D, Geffers C et al. (2005) Mortality risk factors with nosocomial *Staphylococcus aureus* infections in Intensive Care Units: Results from the German Nosocomial Infection Surveillance System (KISS). *Infection.* 33:50-55
- 4• Albrich WC and Harbarth S (2008) Healthcare workers: sources, vectors or victims of MRSA. *Lancet Infect. Dis.* 8, 289-301
- 5• Boyce JM., Landrey M, Deetz TR and Dupont HL (1981) Epidemiologic studies of an outbreak of nosocomial methicillin resistant *Staphylococcus aureus* infections. *Infect. Control.* 2, 110-116
- 6• Kluytmans J, Belkum AV and Verbrugh H (1997) Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks. *Clin. Microbiol. Rev.* 10, 505-520

- 7• Kaleem F, Usman J, Omair M, Khalid A and Uddin R (2010) The sensitivity pattern of MRSA which was isolated from patients who were admitted in a tertiary care hospital of Pakistan. *Iranian J.Micro.* 2,141-143
- 8• Fadeyi A, Bolaji BO, Oyedepo OO, Adesiyun OO, Adeboye MAN, Olanrewaju TO (2010) Methicilin resistant *Staphylococcus aureus* carriage amongst the health care workers of the critical care units in a Nigerian Hospital. *American J. Infectious Dis.* 6, 18-23
- 9• Smith TC, Male MJ and Harper AL (2008) Methicillin-resistant *Staphylococcus aureus* (MRSA) strain ST398 is present in mid-western U.S. swine and swine workers. *PLoS One.* 4,4258
- 10• Coates T, Bax R and Coates A (2009) Nasal decolonization of *Staphylococcus aureus* with mupirocin: strengths, weaknesses and future prospects. *J. Antimicrob. Chemother.*64,9-15