

## Prevalence of MRSA carriage among Health care workers (HCW) of tertiary healthcare centre in Western India

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### Abstract

**Objective:** Methicillin-resistant *Staphylococcus aureus* infections are associated with higher mortality, morbidity as compared to infections by methicillin-susceptible strains. MRSA carriage in healthcare personnel is potential focus for spread of hospital acquired infections. The following study was conducted to assess, the prevalence of MRSA carriage in healthcare workers (HCWs) at a tertiary care centre in western India and to analyse the relation of age, gender, work experience and other factors with MRSA carriage.

**Methods:** A cross sectional study was conducted on a total of 104 HCWs (Nurses & Doctors). Nasal swabs were collected and cultured on Blood Agar. The isolates were identified as *S. aureus* based on Gram staining, colony morphology, catalase production test, slide and tube coagulase tests, and mannitol fermentation test. Methicillin resistance was detected using cefoxitindisc on Muller Hinton agar using modified Kirby-Bauer disc diffusion method.

**Results:** Of the 104 HCWs, 22 (21.15%) were identified as MRSA carriers. MRSA carriage was particularly higher among nurses (24.07%) as compared to doctors (18.0%). There was no significant difference between the gender ( $p = 0.2365$ ), age ( $p = 0.2207$ ), cadre of participant ( $p = 0.4485$ ) and years of healthcare service ( $p = 0.1155$ ) with regards to nasal carriage of MRSA.

**Conclusions:** The high rate of nasal MRSA carriage among healthcare workers found in this study indicates the need for adjusted infection control measures to prevent MRSA transmission in our healthcare setting.

**Keywords:** MRSA, Health care workers, nasal carriage.

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### 1. Introduction

Methicillin-resistant *Staphylococcus aureus* infections are associated with higher mortality, morbidity as compared to infections by methicillin-susceptible strains. [1] MRSA has been responsible for many nosocomial epidemics. [2]

The ecological niches of *Staphylococcus aureus* are anterior nares. Kluytmans *et al* have reported that over a period of time, in healthy population three patterns of *S.aureus* carriage can be observed. About 20% subjects are permanent carriers, 60% are temporary carriers and remaining 20% never carry it. [3]

Carriage of *S. aureus* appears to play a key role in the epidemiology and pathogenesis of infection. [3]

Estimates of HCW carriage from the worldwide literature vary widely depending on the country, hospital specialty and setting (endemic, nonendemic or outbreak).[4] Several studies world-wide have reported nasal carriage of *Staphylococcus aureus* strains in a range of 6.6%-90%.[2,3] In Scotland and England routine MRSA screening of hospital inpatients has started [4]

Good hand hygiene practices and strict adherence to infection control policies remain essential to control the spread of MRSA. [5] Apart from these, de-colonization of health care workers as a part of multifactorial approach has contributed to successful termination of nosocomial MRSA outbreak.

This is easy and reported to be more cost effective before MRSA becomes endemic in the health care institute. However, eradication therapy varied between studies. Mupirocin with or without additional agents, used in 57 studies have reported high success rate. [6]

The following study was conducted to assess, the prevalence of MRSA carriage in HCWs at a tertiary care centre in western India. A further aim of the study was to analyse the relation of age, gender, work experience and other factors with MRSA carriage.

## 2. Materials and Methods

The present cross-sectional study was conducted over a period of one year from October 2017 to October 2018, in the department of Microbiology, at a tertiary health care centre in western India, after obtaining permission from the Institutional Ethics Committee. A total of 104 samples, obtained from HCWs (Nurses & Doctors) were processed.

### 2.1 Nasal swab collection

Sterile moistened cotton swabs were used to collect samples from anterior nares of both sides (rotating the swabs gently five times so that the tip is entirely at the nasal ostium level) and were transported to microbiology department within 30 minutes without employing any transport medium. [7]

### 2.2 Culture and identification

Swabs were inoculated on to Blood agar and were incubated at 37°C for 48 hrs. The isolates were identified as *S. aureus* based on Gram staining, colony morphology, catalase production test, slide and tube coagulase tests, and mannitol fermentation test.

### 2.3 Antimicrobial susceptibility testing

Laboratory antimicrobial susceptibility testing was performed using Kirby Bauer disc diffusion method which is recommended by the Clinical and Laboratory Standards Institute (CLSI). The suspension from broth of confirmed *S. aureus*, matched to standard turbidity (0.5 MacFarland) was used to inoculate a Mueller-Hinton agar (MHA). Cefoxitin (25 µg) was placed on the plates and the plates were incubated for 24 hours at 35°C. In this study *Staphylococcus aureus* ATCC 25923 was used for the control [8].

### 2.5 Mupirocin treatment

Local application of Mupirocin twice a day for 7 days was advised to the MRSA carriers. Repeat swabs were collected for those who completed the course. MRSA screening was done in similar manner, as described above.

### 2.6 Statistical analysis

The data was tabulated using Microsoft Excel. Mean and standard deviations were calculated. Data was analyzed using SPSS 20 software.

Association between variables was checked & compared using the Chi-square or Fisher's exact test. All p-values were two-sided and p value < 0.05 being considered as significant value.

## 3. Results

A total of 104 nasal swab samples from various clinical departments were randomly collected and screened during the course of the study. The participants comprised of 50 doctors (48%) and 54 nurses (52%).

The overall prevalence of MRSA among all the participants was 21.15%

### 3.1 Age-wise distribution:

The age ranged between 18 and 58 years with mean age of 33.64 ± 11.64 years (mean ± SD). Table-1 shows the prevalence of MRSA according to various age groups. It was seen that among the age group 18 to 35 years of participants MRSA prevalence was more (62.73%).

**Table 1: Age-wise distribution of MRSA carriers**

Age group (range in years)	Percentage of MRSA carriers
18-25	22.73
26-35	40.91
36-45	18.18
46-55	13.64
56+	4.545

### 3.2 Gender-wise distribution:

All the 54 nurses in this study were females. Of the 50 doctors, 26 (52%) were females, and 24 (48%) were males.

In these study 24 (23.07%) participants were males, all being doctors and 80 (76.92%) were females, doctors and nurses. It was seen that MRSA prevalence is more in females (74%) as compared to males.

**Table 2: Gender-wise distribution of MRSA nasal carriers**

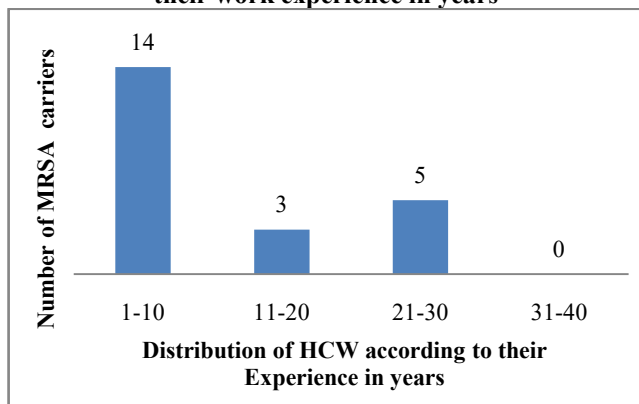
Gender	MRSA Isolated	MRSA Not Isolated	Total Participants
Female	19	61	80
Male	3	21	24
Total	22	82	104

### 3.3 Distribution of MRSA carriers according to duration of their work experience

The mean number of years in service of participants was 12.70 ± 9.5years. The mean experience of doctors was 7.74 years (±5.27 years) and that of the nursing staff was 17.29 years (±10.32 years).

It was seen that as the number of years of service increased, the MRSA occurrence decreased.

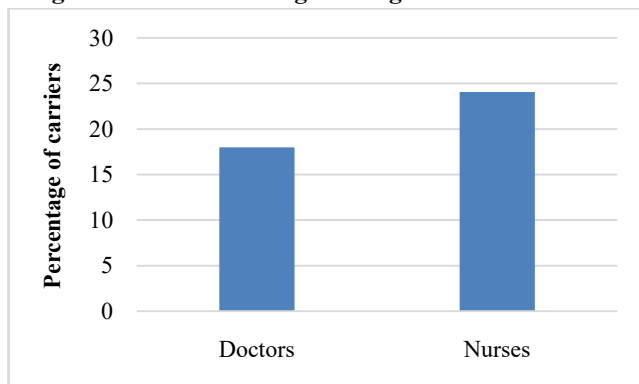
**Figure 1: Distribution of MRSA carriers according to their work experience in years**



**3.4 Comparison of MRSA carriage among doctors and nurses**

Among health care workers, nurses had more MRSA carriage rates (24.07%) as compared to doctors (18.0%).

**Figure 2: MRSA carriage among doctors and nurses**



**3.5 Univariate Analysis:**

Association between variables was checked & compared using the Chi-square or Fisher’s exact test. All p-values were two-sided with  $p < 0.05$  being considered significant. There was no significant difference between the gender ( $p = 0.2365$ ), age ( $p = 0.2207$ ), cadre of participant ( $p = 0.4485$ ) and years of healthcare service ( $p = 0.1155$ ) with regards to nasal carriage of MRSA.

**3.6 Mupirocin treatment**

Out of 22, 7 participants completed local mupirocin therapy. Repeat swabs after completion of therapy were negative for MRSA in all the 7 participants.

**4. Discussion**

Methicillin-resistant *S. aureus* (MRSA) is currently the most commonly identified antibiotic-resistant pathogen in many parts of the world. The incidence of nosocomial infection caused by MRSA continues to increase worldwide [9].

Infections caused by MRSA strains are associated with longer hospital stay, prolonged antibiotic administration and higher cost. Next to colonized patients and contaminated environmental surfaces, colonized

healthcare workers (HCWs) can act as a reservoir for the spread of MRSA to patients and other HCWs [10].

Identification of patients and healthcare workers colonized with MRSA, combined with hand hygiene and other contact precautions have been shown to be effective in reducing the transmission and controlling the spread of MRSA. [9]

Screening of MRSA should be directed at the common sites of carriage and infection. In methicillin susceptible *Staphylococcus aureus* as well as MRSA, anterior nares are persistently or intermittently colonized. Hence, samples are collected from anterior nares [11] Active surveillance culture is important for identifying hidden reservoirs of MRSA. Currently there is no such active surveillance and policy for MRSA at our hospital.

The prevalence of MRSA varies between institutions and geographical areas. The difference in the study designs, sample size may account for the disparity [12] The prevalence of MRSA carriage in our study was 21.15%, where as that in other study was 4.6, 6.6%, 11.43%, 12%, 15.4%, and 17.5% respectively. [2,6,12-15] A very high MRSA nasal carriage rate of 38.9% was reported from Nigeria [16].

**4.1 Age-wise distribution**

As seen in our study and in another study by Askarian *et al*, no significant difference was found in age-wise distribution of MRSA [17].

**4.2 Gender-wise distribution**

Though, the prevalence of MRSA was more in females in our study, it was not statistically significant. In a study conducted in Assam, carriage amongst males was more as compared to females [13]. Like the current study, no significant difference was found in gender-wise distribution of MRSA in another study. [17]

**4.3 Duration of service**

There was no statistically significant difference in MRSA carriage depending upon years of service in the hospital, in our study as well as study by Askarian *et al* [17].

**4.4 Carriage in nurses and doctors**

Kakhandki *et al* have reported higher carriage rate amongst nursing staff. [14] In another study, more carriage was seen in doctors [16]. In our study, nurses had more MRSA carriage rates (24.07%) as compared to doctors (18.0%). Prevention of MRSA infection merits discussion as once introduced in a hospital, MRSA is very difficult to eradicate. Identification of the carrier and treating the carrier with mupirocin ointment is an important measure in preventing outbreaks of MRSA infection in the hospitals. [14] Mupirocin specifically binds to bacterial isoleucyl-tRNA synthetase (IRS) and inhibits protein synthesis [18]. The staff who were positive for the growth of MRSA were advised to apply Mupirocin ointment to the anterior nares 2 times daily for 7 days. [14]

The study shows the need for a periodic screening and decolonization of all the hospital personnel for termination of outbreaks, reduction of burden of *S. aureus* infections, long-term cost savings, decreased risk of transmission and patient and public confidence.

## 5. Conclusion

The present study indicates high nasal carriage rate of MRSA (21.15%) among health care workers. The carriage rate was more among nurses (24.07%) than doctors (18%). This high rate of nasal MRSA carriage indicates the need for adjusted infection control measures to prevent MRSA transmission in our healthcare setting.

In hospitals, HCWs must be regularly screened for MRSA and give an early warning of the presence of antimicrobial resistant pathogens. Measures to be taken to control the spread of MRSA infection should include: laboratory based surveillance, isolation of colonized and infected patients and screening and treatment of MRSA-positive HCWs.

**Conflict of Interest:** Not declared

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