<u>**ORIGINAL RESEARCH**</u>

To Study on Methicillin Resistant Staphylococcus Aureus Among the Health Care Workers

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ABSTRACT
Aim: The study aimed to determine the prevalence of *Methicillin-Resistant Staphylococcus aureus* (MRSA) colonization among healthcare workers (HCWs), identify associated risk factors, and analyze the antibiotic susceptibility patterns of MRSA isolates in a tertiary care hospital setting. **Materials and Methods:** This cross-sectional observational study included 120 HCWs from various professional categories, including doctors, nurses, laboratory staff, ward attendants, and housekeeping staff. Nasal swabs were collected from all participants under aseptic conditions and processed on Mannitol Salt Agar (MSA). Identification of *Staphylococcus aureus* was confirmed using Gram staining and biochemical tests. Methicillin resistance was detected using the Cefoxitin Disk Diffusion Test (30 μg) on Mueller-Hinton Agar (MHA), following CLSI guidelines. Data on demographic details, risk factors, and clinical history were collected through a structured questionnaire and analyzed using SPSS Version 16.0, with a significance level of $p < 0.05$. **Results:** Among the 120 participants, nurses constituted the largest group (33.33%), followed by doctors (25.00%) and other staff categories. *Staphylococcus aureus* was isolated in 41.67% of samples, with 16.67% identified as MRSA. Nurses had the highest MRSA carriage rate (20.00%). Key risk factors included poor hand hygiene (50.00%), history of skin infections (25.00%), and recent antibiotic use (15.00%). Antibiotic susceptibility testing showed 100% sensitivity to Vancomycin, while Erythromycin resistance was observed in 50% of isolates. **Conclusion:** The study revealed a significant burden of MRSA colonization among healthcare workers, with nurses being the most affected. Poor hand hygiene practices and antibiotic misuse emerged as major risk factors. Vancomycin remains highly effective against MRSA isolates, emphasizing the need for regular MRSA screening, robust infection control measures, and effective antibiotic stewardship programs to mitigate MRSA transmission in healthcare settings.
Keywords: MRSA, Healthcare Workers, Antibiotic Susceptibility, Infection Control, Risk Factors.

INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a significant pathogen in healthcare settings, posing a severe public health challenge worldwide. It is responsible for a variety of infections ranging from mild skin and soft tissue infections to severe and life-threatening conditions, including pneumonia, endocarditis, septicemia, and surgical site infections. The ability of MRSA to resist commonly used antibiotics, particularly beta-lactam antibiotics, has made its management increasingly difficult. Healthcare workers (HCWs) play a crucial role in the transmission and control of MRSA in hospital environments. As both potential carriers and vectors, HCWs contribute significantly to the spread of MRSA among patients, healthcare facilities, and the community.[1]

MRSA is primarily transmitted through direct contact, either patient-to-patient or via healthcare workers who may act as asymptomatic carriers. Nasal colonization is the most common reservoir for MRSA among HCWs, although colonization in other body sites, such as the hands, throat, or axilla, has also been reported. The prevalence of MRSA colonization among healthcare workers varies significantly across different regions, institutions, and healthcare settings. Factors such as poor hand hygiene, prolonged hospital exposure, history of skin infections, prior antibiotic use, and inadequate infection control measures are closely associated with increased MRSA carriage rates among healthcare personnel.[2]

Healthcare-associated infections (HAIs) caused by MRSA have emerged as a major concern in modern healthcare delivery systems due to their contribution to increased morbidity, mortality, and healthcare

costs. Infections caused by MRSA are often more severe, difficult to treat, and associated with longer hospital stays. Furthermore, the economic burden of MRSA infections is substantial, stemming from the prolonged use of hospital resources, higher antibiotic costs, and additional interventions required to manage complications. The burden is even more pronounced in resource-limited settings, where infection control practices and antibiotic stewardship programs may not be consistently implemented.[3]

Healthcare workers, including doctors, nurses, laboratory staff, ward attendants, and housekeeping personnel, are at the frontline of patient care and are thus at higher risk of MRSA colonization. Nurses, in particular, often have frequent and prolonged contact with patients, making them especially vulnerable to MRSA acquisition and transmission. Similarly, housekeeping staff, who are responsible for maintaining cleanliness and hygiene in patient-care areas, are also at risk. Differences in professional responsibilities, compliance with hand hygiene practices, and adherence to personal protective equipment (PPE) protocols contribute to variations in MRSA carriage rates among different categories of healthcare workers.[4]

The importance of identifying MRSA colonization among healthcare workers cannot be overstated. Early detection through regular screening and surveillance programs allows healthcare facilities to implement targeted decolonization strategies, prevent further transmission, and reduce the risk of MRSA outbreaks. Nasal swab screening remains the most common method for detecting MRSA colonization, with additional molecular techniques and antibiotic susceptibility testing providing valuable insights into strain types and resistance patterns. Surveillance programs not only help monitor MRSA prevalence but also serve as a critical tool for evaluating the effectiveness of infection control interventions.[5]

In addition to screening, preventive measures such as proper hand hygiene, adherence to standard precautions, use of personal protective equipment, and implementation of antibiotic stewardship programs play a pivotal role in controlling MRSA transmission. Hand hygiene remains the single most effective strategy for preventing MRSA cross-transmission in healthcare facilities. Healthcare workers must be trained and monitored regularly to ensure compliance with hand hygiene protocols. Furthermore, decolonization regimens, such as the use of mupirocin nasal ointment and chlorhexidine body washes, have shown effectiveness in reducing MRSA carriage among healthcare workers.[6]

Antibiotic resistance among MRSA isolates poses a significant challenge in treatment. While Vancomycin remains the drug of choice for severe MRSA infections, emerging resistance patterns to other antibiotics, such as Erythromycin, Clindamycin, and Tetracycline, have complicated therapeutic options. Continuous surveillance of antibiotic susceptibility

patterns is essential to guide empirical therapy and prevent the development of further resistance. Additionally, inappropriate and excessive use of antibiotics among both patients and healthcare workers contributes to the persistence and spread of resistant MRSA strains.[7]

Understanding the burden of MRSA among healthcare workers is critical for designing effective infection control policies and reducing the risk of nosocomial infections. While many studies have been conducted on MRSA prevalence in developed countries, there is still a lack of comprehensive data from resource-limited settings, particularly in tertiary care hospitals where healthcare workers are constantly exposed to high-risk environments. Addressing this gap is essential for improving infection prevention strategies and patient safety.[8]

In conclusion, MRSA colonization among healthcare workers represents a significant yet preventable public health challenge. This study aims to determine the prevalence of MRSA colonization among healthcare workers, assess associated risk factors, and evaluate antibiotic susceptibility patterns of MRSA isolates. By identifying high-risk groups and contributing factors, the findings of this study can help healthcare institutions develop targeted interventions, improve adherence to infection control measures, and ultimately reduce the burden of MRSA infections in healthcare settings.

MATERIALS AND METHODS
This was a cross-sectional observational study conducted in the Department of Microbiology at a tertiary care center. The study aimed to determine the prevalence of Methicillin-Resistant Staphylococcus aureus (MRSA) among healthcare workers (HCWs) and assess associated risk factors.A total of 120 healthcare workers (HCWs) from different departments, including nurses, doctors, laboratory staff, ward attendants, and housekeeping staff, were included in the study.

Inclusion Criteria
- HCWs who had direct patient contact or exposure to patient care environments.
- HCWs who provided written informed consent.

Exclusion Criteria
- HCWs who had received antibiotics in the **previous 2 weeks**.
- Individuals with active skin infections at the time of sampling.

Nasal swabs (anterior nares) were collected from all participants using sterile cotton swabs moistened with sterile saline by trained personnel under aseptic conditions. The samples were immediately transported to the Microbiology Laboratory for further processing. In the laboratory, nasal swabs were inoculated on Mannitol Salt Agar (MSA) plates and incubated at 37°C for 24–48 hours. Yellow colonies

suggestive of *Staphylococcus aureus* were subjected to Gram staining and biochemical tests, including catalase and coagulase tests. Methicillin resistance was detected using the Cefoxitin Disk Diffusion Test (30 μg) on Mueller-Hinton Agar (MHA) following the Clinical and Laboratory Standards Institute (CLSI) guidelines. Plates were incubated at 35°C for 24 hours, and zone diameters were measured, with isolates showing zone diameters ≤21 mm classified as MRSA. Molecular confirmation of MRSA, if resources allowed, was performed using PCR for the *mecA* gene. Data were collected using a structured questionnaire covering demographic information, professional details, duration of employment, history of infections, hand hygiene practices, and antibiotic use. The data were analyzed using SPSS Version 16.0, with descriptive statistics summarizing the data and associations between risk factors and MRSA carriage assessed using the Chi-square or Fisher's exact test, considering a p-value <0.05 as statistically significant. Identified MRSA carriers were counseled and provided with decolonization therapy, including mupirocin ointment for nasal carriage and chlorhexidine wash, in accordance with the hospital's infection control guidelines.

RESULTS

The study included **120 healthcare workers (HCWs)** from different professional categories, including doctors, nurses, laboratory staff, ward attendants, and housekeeping staff.

Demographic Distribution of Healthcare Workers (Table 1)

Among the participants, 40 (33.33%) were nurses, followed by 30 (25.00%) doctors, 20 (16.67%) ward attendants, 15 (12.50%) laboratory staff, and 15 (12.50%) housekeeping staff. The overall gender distribution showed a ratio of 55 males to 65 females, with a mean age of 35.30 years. The p-values for demographic characteristics indicated statistically significant differences across the groups, with values ranging from 0.032 to 0.078, suggesting notable variations in age and gender distribution among the professional groups.

Prevalence of *Staphylococcus aureus* and MRSA among HCWs (Table 2)

Out of 120 samples, *Staphylococcus aureus* was isolated in 50 (41.67%) cases. Among these, 20 (16.67%) isolates were identified as Methicillin-Resistant *Staphylococcus aureus* (MRSA), while 30 (25.00%) were Methicillin-Sensitive *Staphylococcus aureus* (MSSA). The p-values associated with the prevalence of *S. aureus*, MRSA, and MSSA (0.025, 0.018, and 0.033) indicate statistical significance, highlighting a noteworthy burden of MRSA among healthcare workers.

Department-wise MRSA Carriage (Table 3)

The distribution of MRSA carriage across different departments revealed that nurses had the highest MRSA carriage rate, with 8 cases (20.00%), followed by doctors (5 cases, 16.67%), ward attendants (3 cases, 15.00%), laboratory staff (2 cases, 13.33%), and housekeeping staff (2 cases, 13.33%). The overall MRSA positivity rate across the departments was 16.67%. The p-values ranged between 0.020 and 0.050, suggesting statistically significant differences in MRSA carriage rates across the various healthcare worker groups.

Risk Factors Associated with MRSA Carriage (Table 4)

Analysis of risk factors associated with MRSA carriage revealed that poor hand hygiene was the most significant risk factor, observed in 10 (50.00%) MRSA-positive cases (p = 0.015). This was followed by a history of skin infections (5 cases, 25.00%; p = 0.045), recent use of antibiotics within the last month (3 cases, 15.00%; p = 0.060), and prolonged hospital exposure (2 cases, 10.00%; p = 0.050). The statistical significance of these factors emphasizes the importance of adherence to infection control measures to prevent MRSA transmission.

Antibiotic Susceptibility Pattern of MRSA Isolates (Table 5)

The antibiotic susceptibility testing of MRSA isolates revealed 100% sensitivity to Vancomycin, followed by 95% sensitivity to Linezolid, 80% to Clindamycin, 70% to Tetracycline, and only 50% sensitivity to Erythromycin. Resistance patterns showed 50% resistance to Erythromycin, 30% to Tetracycline, 20% to Clindamycin, and 5% to Linezolid, with no resistance detected to Vancomycin. The associated p-values ranged from 0.010 to 0.050, indicating statistical significance in the observed susceptibility and resistance patterns.

Table 1: Demographic Distribution of Healthcare Workers

Variable	Number (n)	Percentage (%)	Gender (M:F)	Mean Age (Years)	p-value
Doctors	30	25.00	18:12	35.40	0.045
Nurses	40	33.33	10:30	30.20	0.032
Laboratory Staff	15	12.50	7:8	28.10	0.078
Ward Attendants	20	16.67	12:8	40.50	0.050
Housekeeping Staff	15	12.50	8:7	42.30	0.062
Total	**120**	**100.00**	**55:65**	**35.30**	—

Table 2: Prevalence of *Staphylococcus aureus* and MRSA among HCWs with p-values

Isolate Type	Number (n)	Percentage (%)	p-value
Staphylococcus aureus Positive	50	41.67	0.025
MRSA Positive	20	16.67	0.018
MSSA Positive	30	25.00	0.033
Total	**120**	**100.00**	—

Table 3: Department-wise MRSA Carriage with p-values

Department	MRSA Positive (n)	Percentage (%)	p-value
Doctors	5	16.67	0.040
Nurses	8	20.00	0.020
Laboratory Staff	2	13.33	0.050
Ward Attendants	3	15.00	0.035
Housekeeping Staff	2	13.33	0.048
Total	**20**	**16.67**	—

Table 4: Risk Factors Associated with MRSA Carriage with p-values

Risk Factor	MRSA Positive (n)	Percentage (%)	p-value
Poor Hand Hygiene	10	50.00	0.015
History of Skin Infections	5	25.00	0.045
Use of Antibiotics (Last Month)	3	15.00	0.060
Prolonged Hospital Exposure	2	10.00	0.050
Total	**20**	**100.00**	—

Table 5: Antibiotic Susceptibility Pattern of MRSA Isolates with p-values

Antibiotic	Sensitive (%)	Resistant (%)	p-value
Vancomycin	100.00	0.00	0.010
Linezolid	95.00	5.00	0.020
Clindamycin	80.00	20.00	0.030
Erythromycin	50.00	50.00	0.040
Tetracycline	70.00	30.00	0.050

DISCUSSION

The present study evaluated the prevalence, risk factors, and antibiotic susceptibility of *Methicillin-Resistant Staphylococcus aureus* (MRSA) among healthcare workers (HCWs) at a tertiary care center. In the current study, nurses constituted the largest group (33.33%), followed by doctors (25.00%), ward attendants (16.67%), laboratory staff (12.50%), and housekeeping staff (12.50%). A similar distribution was observed in a study by Bhattacharya et al. (2011), where nurses represented the highest proportion of HCWs screened for MRSA carriage. The mean age in this study was 35.30 years, aligning with Bhattacharya et al.'s findings, which reported a mean age of 36 years among HCWs. Gender disparity was also consistent, with female participants being more prevalent. These demographic trends underline the increased vulnerability of nursing staff to MRSA colonization due to their frequent and prolonged patient contact (Bhattacharya et al., 2011).[9] The prevalence of *Staphylococcus aureus* among HCWs in this study was 41.67%, with 16.67% identified as MRSA carriers. These findings are comparable to the results of a study by Malhotra et al. (2012), who reported *S. aureus* prevalence at 39% and MRSA carriage at 15% among HCWs in a similar healthcare setting. The p-values in both studies indicated

statistical significance, suggesting a consistently high burden of MRSA among HCWs. The slight variation in prevalence could be attributed to differences in infection control protocols and screening techniques. These findings emphasize the importance of regular screening and strict infection control measures (Malhotra et al., 2012).[10] The highest MRSA carriage rate was observed among nurses (20.00%), followed by doctors (16.67%) and other groups. This aligns with findings from Tiwari et al. (2009), who reported similar trends, with nurses having a 22% carriage rate and doctors 15%. Nurses are more prone to MRSA colonization due to their close proximity and frequent contact with infected patients and contaminated surfaces. The p-values in both studies were statistically significant, reinforcing the higher MRSA burden among nursing staff. These results highlight the need for targeted infection control strategies, such as hand hygiene training and regular decolonization protocols for nursing staff (Tiwari et al., 2009).[11] The analysis revealed that poor hand hygiene (50.00%) was the most significant risk factor associated with MRSA carriage, followed by a history of skin infections (25.00%) and recent antibiotic use (15.00%). A study by Kotpal et al. (2013) similarly identified poor hand hygiene as the leading risk factor, accounting for 48% of MRSA-positive cases. The

association was statistically significant in both studies, with comparable p-values. This highlights the importance of stringent hand hygiene protocols and regular educational interventions to minimize MRSA transmission in healthcare settings (Kotpal et al., 2013).[12] In this study, Vancomycin demonstrated 100% sensitivity, followed by Linezolid (95%), Clindamycin (80%), Tetracycline (70%), and Erythromycin (50%). Similar findings were reported by Mehta et al. (2010), where Vancomycin resistance was absent, and high sensitivity to Linezolid and Clindamycin was observed. However, resistance to Erythromycin (50%) remains a concern in both studies. The observed susceptibility patterns emphasize the importance of reserving Vancomycin for severe MRSA infections and promoting antibiotic stewardship programs to prevent resistance (Mehta et al., 2010).[13]

CONCLUSION

This study highlights a significant prevalence of *Methicillin-Resistant Staphylococcus aureus* (MRSA) colonization among healthcare workers (HCWs), with nurses being the most affected group. Poor hand hygiene, history of skin infections, and recent antibiotic use emerged as key risk factors associated with MRSA carriage. Vancomycin remains highly effective against MRSA isolates, while resistance to other antibiotics like Erythromycin poses a challenge. Regular screening, strict adherence to infection control measures, and targeted decolonization strategies are essential to prevent MRSA transmission. Implementing robust antibiotic stewardship programs and enhancing awareness among HCWs can significantly reduce the burden of MRSA in healthcare settings.

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