NASAL MRSA CARRIAGE STATUS AMONG HEALTHCARE WORKERS: ASSESSING THE NEED FOR SCREENING IN AN ACUTE CARE SETTING.

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Abstract:

Introduction: MRSA is a common hospital infection spreading to the community, with carriage rates up to 33%. Asymptomatic carriage in healthcare workers (HCWs) is concerning, especially in oncology, where vulnerable cancer patients have a high risk for severe infections. The CDC recommends decolonization only for MRSA. Invasive MRSA infection has a 15% to 60% mortality rate, and treatment options like Vancomycin and Daptomycin are costly. **Methods:** The study involved doctors, nurses, technicians, and housekeepers, with consent and risk questionnaires. Swabs from the nares were cultured, and MRSA was identified via cefoxitin sensitivity. HCWs with nasal MRSA were advised to decolonize. **Results:** Out of 149 healthcare workers, 7 (4.7%) had nasal MRSA - 3 doctors, 2 housekeepers, 1 nurse, and 1 technician. Higher carriage was associated with ages 31-40, females, and 1-5 years of experience. No MRSA outbreaks occurred during the study period. **Conclusion:** MRSA carriage is prevalent among HCWs and patients, which emphasizes the need for comprehensive

infection prevention and control programs in healthcare settings, especially in oncology units, owing to the vulnerable patient population prone to invasive infections. This should include administrative and engineering controls, surveillance, training, antimicrobial stewardship, environmental cleaning, targeted screening, and decolonization.

Key words: MRSA nasal carriage, healthcare workers, mupirocin, chlorhexidine, decolonization.

INTRODUCTION:

Methicillin-Resistant *Staphylococcus aureus* (MRSA) has become a frequent cause of infection in the hospital setting and is spreading even into the community. Misuse of antibiotics in healthcare and non-compliance with infection control practices among healthcare workers (HCWs) are the leading causes of developing MRSA carriage and also the nosocomial transmission of MRSA. MRSA carriage rate in the general population is up to 33%. The anterior nares are the main ecological niche for *Staphylococcus aureus*. Approximately 20% of individuals are persistently colonized with S. *aureus*, and 30% are intermittently colonized.

However, numerous other sites may be colonized, including the throat, axilla, groin, gastrointestinal tract, and open wound. Carriage provides a reservoir or source from which bacteria can be introduced when host defences are breached, whether by shaving, aspiration, insertion of an indwelling catheter, or by surgery or cancer. Carriage clearly increases the risk of subsequent skin and soft tissue infections, secondary bacteremia or septicemia. Those with *S. aureus* infections are generally infected with their own colonizing strain. Such invasive MRSA infections have mortality rates ranging from 15%-60%. The treatment options available are a few, such as vancomycin or daptomycin, etc, and are also expensive for patients from lower economic strata.

Currently, MRSA is known to be more endemic in hospital settings and is among the major nosocomial pathogens. According to the statement of the CDC, MRSA is known to be a major threat to public health because of its increasing prevalence in hospitals, the community, and animals, transmission between humans and animals, infection rates, resistance, and therapeutic issues. On average, it is estimated that the annual health costs due to MRSA nasal carriage account for 3 billion dollars. CA-MRSA has also been emerging as a principal pathogen in recent years. The risk of transmission to household contacts from an index case of MRSA (either infection or carrier status) has been studied, and it ranges from 13% to 47% based on the site of MRSA infection or colonization and the type and duration of contact. CDC recommends decolonization protocol only for MRSA, not for any other multidrug-resistant organism (MDRO).

Asymptomatic MRSA carriage is of significant concern, especially in oncology settings, with healthcare workers (HCWs) acting as potential vectors for MRSA transmission to cancer patients, who are vulnerable and more susceptible to serious infections due to their immunocompromised state and the need for invasive procedures for diagnostic and therapeutic purposes.

MATERIALS AND METHODS:

A cross-sectional study was conducted from August 2023 to October 2023. The Study participants were doctors, nurses, technicians, and housekeepers.

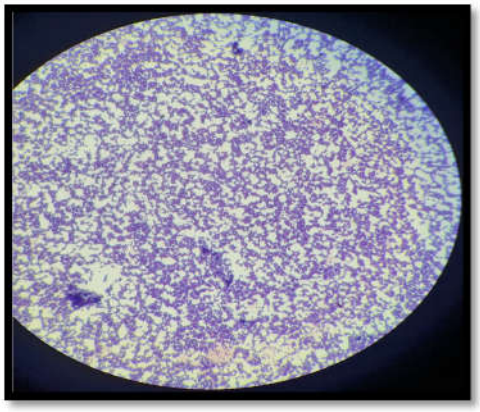
Staff excluded from the study were admin staff, pharmacists, physiotherapists, and kitchen staff.

Informed consent was taken from the study participants with a questionnaire regarding risk factors. Swabs from anterior nares pre-moistened with sterile saline were collected and inoculated onto sheep blood agar, followed by incubation for 24 hours at 35°-37°C.

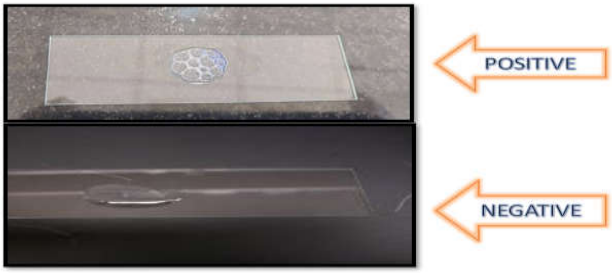
Suspected Staphylococcus colonies were subject to Gram staining, catalase test, coagulase test, and mannitol fermentation. After identification of Staphylococcus aureus, methicillin resistance was detected by the cefoxitin sensitivity test using the Kirby-Bauer disc diffusion method. Quality control was also performed according to Clinical and Laboratory Standards Institute guidelines.

Descriptive and inferential statistical analysis was carried out. All the data collected were analysed and entered into the Excel sheet for the statistical Analysis. The Statistical software, namely SPSS 22.0 and R environment ver.3.2.2, were used for the analysis of the data, and Microsoft Word and Excel were used to generate graphs, tables, etc.

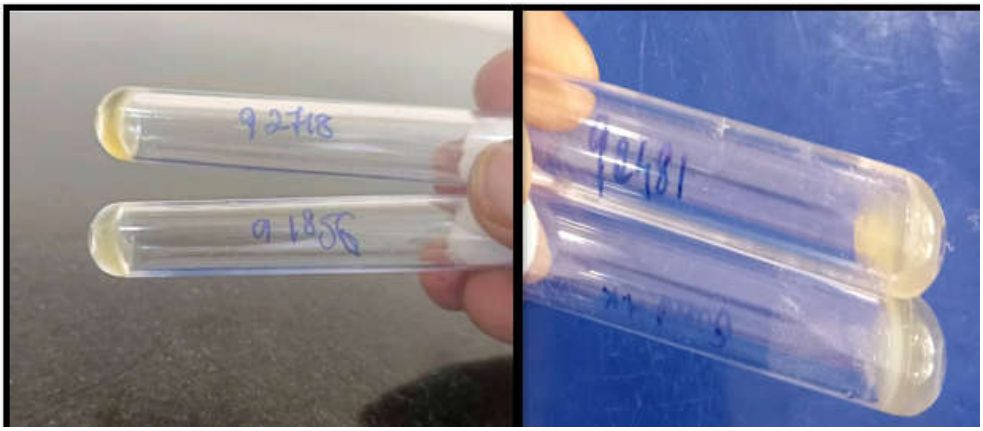
Picture 1: Gram staining of a Staphylococcal colony



Picture 2: Catalase test showing positive (up) and negative (down) test results



Picture 3: Positive coagulase test



Picture 4: Cefoxitin susceptibility test using a 30 µg cefoxitin disc

RESULTS

Among 149 samples, 37(24.8%) had *Staphylococcus aureus,* and out of these, 7 (4.7%) isolates were MRSA.

The MRSA nasal carriage was seen in 2 (8.69%) housekeeping staff, 1 nurse (6.25%) in emergency, 1 doctor (7.14%) in general surgery, 1 technician (16.66%) in radiology, 1 doctor (25%) in psychiatry, and 1 doctor (100%) in paediatrics departments. Five among the seven had 1-5 years of working experience.

It was seen that the 31-40 years of age group, female gender, healthcare workers having 1-5 years of work experience have a positive association with MRSA nasal carriage. Among professional categories, doctors and housekeepers showed a positive association. No statistical significance was observed with respect to age, gender, years of experience, working area, professional category, present health status, and underlying medical condition of HCWs.

The HCWs who were having nasal MRSA carriage were advised with 2% Mupirocin ointment twice daily to the anterior nares and 2% chlorhexidine bath (on alternate days) for 7 days to decolonize themselves from MRSA. All of them were rescreened on Day 11, Day 14 and Day 17 post decolonization and were found to be MRSA screen negative.

During the study period, no outbreak of MRSA was reported in the hospital.

DISCUSSION:

MRSA nasal carriage rate of 4.75% among HCWs was observed in this study, which was lower than that reported by the studies conducted in Belagavi (6.35%) and Madhya Pradesh (42.85%). Research conducted in western Nepal showed a lower rate of MRSA carriage (3.4%) compared to this study. Several studies showed variable prevalence ranging from 0% to 42.85%. These differences can be attributed to variations in microbiological methods (sampling technique, culture, and method of MRSA identification), local infection control standards, and the prevalence of MRSA.

Currently, routine screening of HCWs for MRSA carriage is not recommended during pre-employment or annual health examinations for healthcare settings according to the CDC, USA or NCDC, India. But it is recommended to perform regular screening and surveillance for MRSA carriage in high-risk settings such as oncology & transplant units for both HCWs and patients, such that targeted decolonization therapy can be given for those having MRSA carriage to reduce the risk of serious MRSA infections in vulnerable patients. Screening for carriage should also be performed during MRSA outbreaks when HCW is suspected of being the source.

Patient-to-patient transmission of MRSA has been attributed to non-compliance with standard precautions and mainly occurs via the hands of healthcare workers. This shows that the prevention of MRSA emergence and transmission requires a comprehensive approach including administrative measures such as better staff to patient acuity, good communication systems, adequate budget and resources, implementing engineering measures enhancing stricter infection prevention and control protocols, performance improvement projects/processes, surveillance activities to protect patients and control outbreaks, education and training of medical personnel, ensuring adherence to antimicrobial stewardship program, cleaner environmental measures and following regular targeted screening and decolonization therapy for healthcare workers and patients alike when applicable.

CONCLUSION

Adherence and compliance to infection control protocols and procedures, and MRSA decolonization therapy for positively screened HCWs can help to control MRSA nasal carriage and invasive infections. Regular screening and surveillance for MRSA carriage is recommended in the oncology unit owing to the highly vulnerable patients with weakened immune systems who are prone to invasive infections. The current study with an inadequate sample size because of voluntary participation of the study participants, so follow-up testing to determine whether carriage was temporary or permanent was not conducted. These factors necessitate further studies to characterize MRSA colonization among healthcare workers, which will also help in assessing the need for screening, education, and stricter implementation of infection control practices and antimicrobial stewardship.

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Table 1: Proportion of MRSA nasal carriage, p-value, and Odds ratio among healthcare workers

Variables	MRSA detected		Total	p Value	OR (95%CI)
	No	Yes			
AGE IN YEARS					
• 20-30	93	4(4.12%)	97(65.1%)	0.505	0.70(0.15-3.26)
• 31-40	28	3(9.67%)	31(20.8%)		3.05(0.64-14.42)
• 41-50	17	0(0%)	17(11.4%)		-
• >50	4	0(0%)	4(2.7%)		-
GENDER					
• Female	77	5(6.09%)	82(55%)	0.459	2.11(0.39-11.24)
• Male	65	2(2.98%)	67(45%)		0.47(0.089-2.52)
NO. YEARS OF WORKING EXPERIENCE					
• I: <1year experience	33	1(2.94%)	34(22.8%)	0.942	0.55(0.06-4.73)
• II: 1-5years experience	67	5(6.94%)	72(48.3%)		2.79(0.52-14.90)
• III: 5-10years experience	27	1(3.57%)	28(18.8%)		0.70(0.08-6.14)
• IV: 10-20 Years' experience	13	0(0%)	13(8.7%)		-
• V: >20years experience	2	0(0%)	2(1.3%)		-
PROFESSION					
• DOCTORS	34	3(8.1%)	37(24.8%)	0.365	2.38(0.50-11.17)
• STAFF NURSE	45	1(4.34%)	46(30.9%)	0.437	0.35(0.04-3.07)
• TECHNICIAN	42	1(%)	43(28.9%)	0.454	0.39(0.04-3.39)
• HOUSE KEEPING	21	2(8.69%)	23(15.4%)	0.595	2.30(0.41-12.66)
DEPARTMENT					
• LABORATORY	28	0(0%)	28(18.8%)	0.348	-
• EMERGENCY	15	1(6.25%)	16(10.7%)	1.000	1.41(0.15-12.52)
• GENERAL SURGERY	13	1(7.14%)	14(9.4%)	1.000	1.65(0.18-14.81)
• OT	16	0(0%)	16(10.7%)	0.608	-
• HOUSEKEEPING	21	2(8.69%)	23(15.4%)	0.595	2.30(0.41-12.66)

• ICU	10	0(0%)	10(6.7%)	1.000	-
• MEDICINE	8	0(0%)	8(5.4%)	1.000	-
• ORTHOPEDICS	6	0(0%)	6(4%)	1.000	-
• RADIOLOGY	5	1(16.66%)	6(4%)	0.254	4.56(0.45-45.43)
• DIALYSIS	4	0(0%)	4(2.7%)	1.000	-
• OBG	4	0(0%)	4(2.7%)	1.000	-
• BLOOD CENTRE	4	0(0%)	4(2.7%)	1.000	-
• PSYCHIATRY	3	1(25%)	4(2.7%)	0.176	7.72(0.69-85.65)
• SURGERY	3	0(0%)	3(2%)	1.000	-
• CATH LAB	1	0(0%)	1(0.7%)	1.000	-
• ENDOSCOPY	1	0(0%)	1(0.7%)	1.000	-
• PEDIATRICS	0	1(100%)	1(0.7%)	0.046	-
Total	142	7(4.69%)	149(100%)	-	-

Figure 1: Age-wise distribution of MRSA nasal carriage among Healthcare Workers

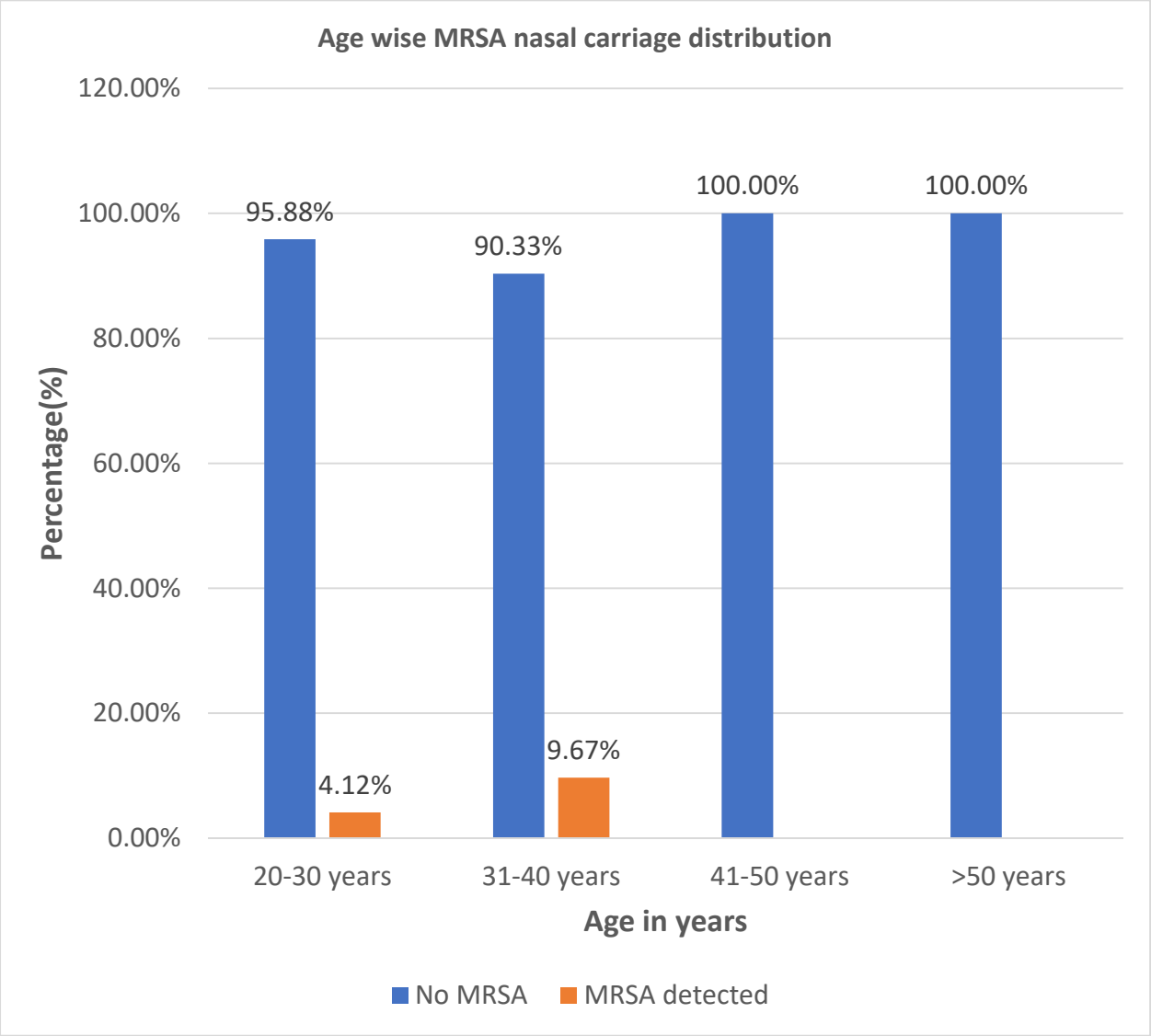

Figure 2: Professional category-wise distribution of MRSA nasal carriage among Healthcare Workers

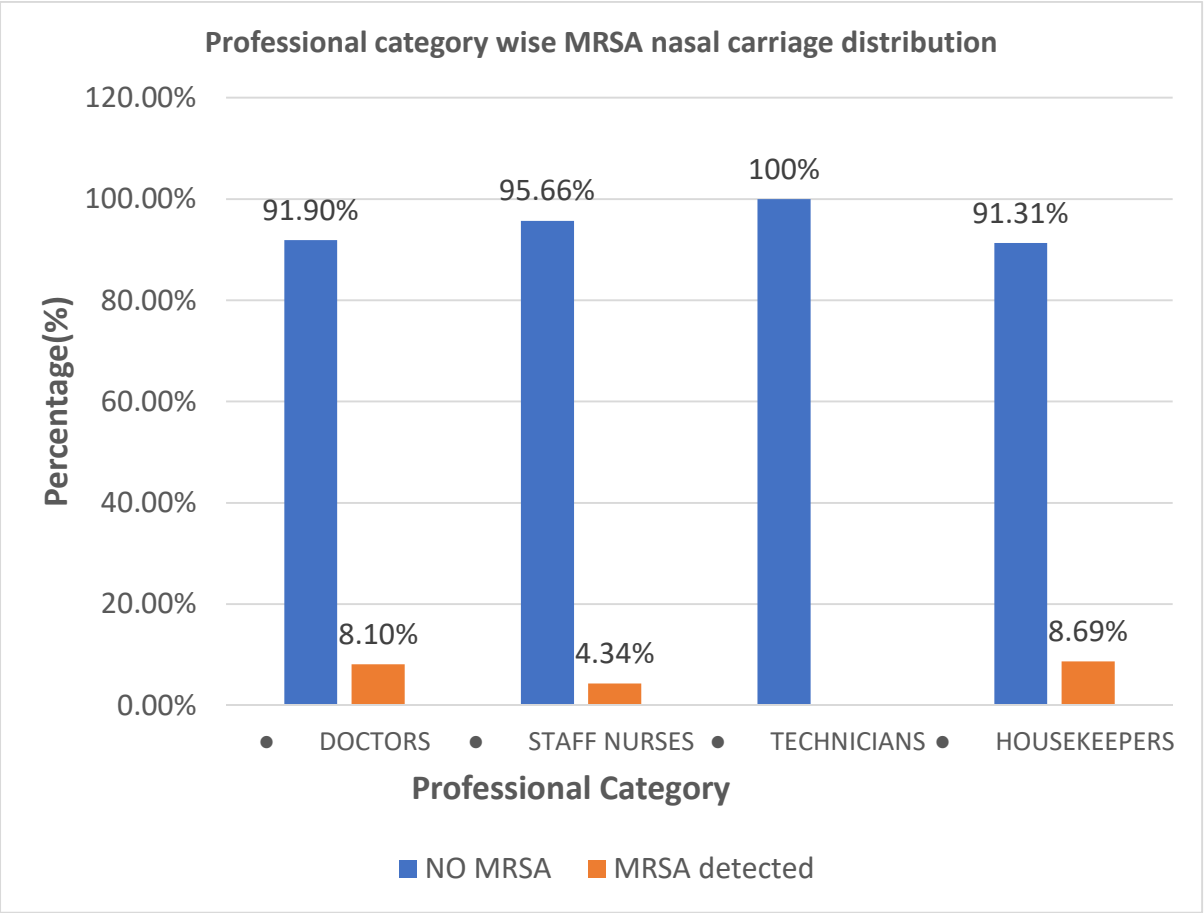

Figure 3: Years of experience-wise MRSA nasal carriage distribution

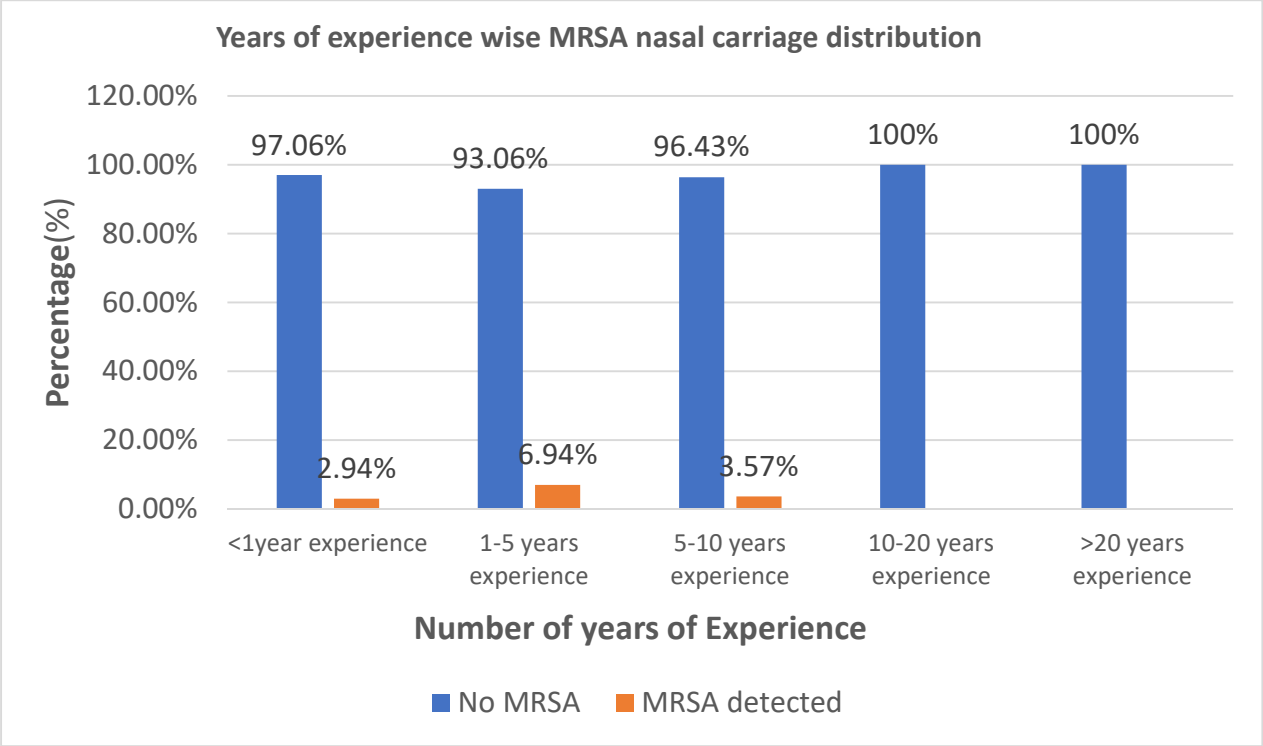

Figure 4: Percentage of MRSA detected and successful decolonization therapy given among HCWs