



Prevalence of and Factors Associated with MRSA among Patients with Hand Infection Treated in a Public Tertiary Hospital

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ABSTRACT

Background. Methicillin-resistant *Staphylococcus aureus* (MRSA) poses significant challenges in managing hand infections, especially in resource-limited settings like the Philippines. Despite its global prevalence, data on MRSA-specific hand infections in Filipino patients remain scarce. This study aimed to determine the prevalence of MRSA and identify associated factors among patients treated for hand infections at a public tertiary hospital.

Methodology. A retrospective, cross-sectional study was conducted at Jose B. Lingad Memorial General Hospital from February 2022 to January 2024. Data from 233 patients treated for hand infections were analyzed. Variables examined included demographics, employment status, infection etiology, comorbidities, traditional medicine use, infection location, and classification. Statistical analyses were performed to identify associations with MRSA.

Result. MRSA prevalence was 30% and was significantly associated with etiology (bite wounds being the most common), traditional medicine use ($p = 0.002$), location of infection (ring finger and thumb being most common, $p = 0.001$) educational attainment (with unschooled individuals having a higher prevalence, $p = 0.027$). Other variables, such as age, gender, employment, comorbidities, and infection type, did not show significant associations.

Conclusion. This study highlights the high prevalence of MRSA in hand infections, with traditional medicine use and bite wounds as key risk factors. The location of infection, particularly in the ring finger and thumb, also correlated with MRSA infection. The findings underscore the need for targeted educational campaigns, early intervention protocols for bite wounds, and community engagement to address traditional medicine practices. These measures could improve MRSA management and prevention in similar settings.

Keywords. methicillin-resistant *Staphylococcus aureus*, hand infections, risk factors, traditional medicine, Philippines

INTRODUCTION

Hand infections are common conditions encountered by orthopedic surgeons, emergency physicians, and primary care providers. Patient demographics, comorbidities, mechanism of injury, and cultural practices influence their severity and outcome.^{1,2} Despite extensive global research on hand infections,^{3,4} local data in the Philippines remains limited, particularly regarding methicillin-resistant *Staphylococcus aureus* (MRSA).⁵

MRSA infections pose significant treatment challenges, often leading to prolonged hospitalizations, surgical interventions, and increased morbidity.^{6,7} Delayed diagnosis and inappropriate management can result in severe complications, including deep tissue infections and even limb amputation.⁸ Additionally, traditional medicine use and limited healthcare access may contribute to treatment delays and worse clinical outcomes.^{9,10}

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This study aimed to determine the prevalence of MRSA in hand infections and identify associated factors among patients treated at a public tertiary hospital. Understanding these factors could help improve preventive strategies, treatment protocols, and patient education in similar healthcare settings.¹¹

METHODOLOGY

Study design and setting

This was a retrospective, cross-sectional study conducted at Jose B. Lingad Memorial General Hospital (JBLMGH), a public tertiary hospital in Pampanga, Philippines. Data collection covered cases from February 2022 to January 2024.

Study population and sample size

Inclusion criteria

- Patients diagnosed and treated for hand infections at JBLMGH (outpatient or inpatient)

Exclusion criteria

- Patients in extremis
- Non-infected wounds
- Infections not classified as:
 - Bite wounds
 - Paronychia, felon, flexor tenosynovitis, collar button abscess, septic arthritis, osteomyelitis, necrotizing fasciitis, cellulitis, and deep space infections (thenar, hypothenar, dorsal, mid-palmar, Parona's abscess)
- Atypical infections (mycobacterial, viral, fungal)

A total enumeration method was used, including all 233 eligible cases.

Data collection and variables

Patient records were reviewed using a standardized data extraction sheet. Specimens submitted for culture studies included aspirates, tissue samples, or wound discharge obtained during surgical intervention. Wound swabbing was avoided as recommended by our Infectious Disease Service (IDS) and Infection Control Committee (ICC) due to its low microbial yield. Variables collected from patient records were:

- Demographics: Age, gender, handedness, educational attainment
- Employment status and nature of work
- Etiology of hand infection (household, industrial, bite wounds, atraumatic)
- Comorbidities: Diabetes, cardiac disease, renal disease
- Use of traditional medicine before seeking medical consult
- Location of infection
- Infection classification

Statistical analysis

Data were analyzed using OpenEpi. Chi-square and Fisher's exact tests were used for categorical variables. The significance threshold was set at $p < 0.05$.

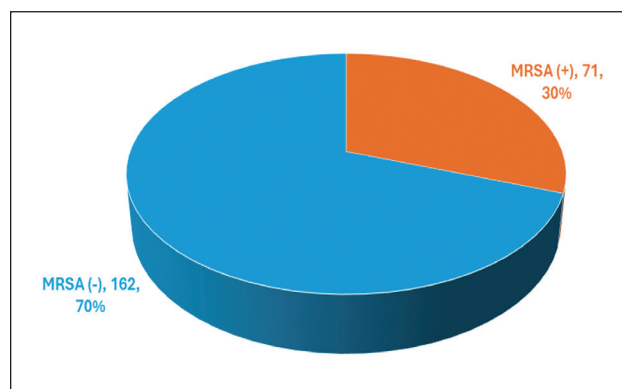


Figure 1. Prevalence of MRSA.

Ethical considerations

The study was approved by the JBLMGH Research Ethics Committee (JBLMGH-REC 2022-42B). Patient data confidentiality was maintained.

RESULT

A total of 233 patients with hand infections, managed as either outpatients or inpatients, were included in this study. Out of this number, 71 patients with MRSA were found, resulting in a MRSA prevalence of 30% (Figure 1).

Age ($p = 0.447$, Fisher's exact test), gender ($p = 0.594$, Chi-square test), and handedness ($p = 0.550$, Chi-square test) were not significantly different between the MRSA (+) and MRSA (-) groups (Table 1). However, education was significantly associated with MRSA status ($p = 0.027$), with a higher percentage of MRSA (+) cases among the unschooled (47%).

Employment status ($p = 0.148$, Chi-square test) had no significant association, with similar MRSA (+) proportions among employed (27%) and unemployed (36%) patients (Table 2). Likewise, the nature of work ($p = 0.124$, Fisher's exact test) did not significantly correlate with MRSA status, with no clear trend across occupations.

MRSA (+) cases were more commonly caused by bite wounds (60%, $p = 0.002$, Chi-square test) compared to household (29%), industrial (24%), and atraumatic infections (20%) (Table 3).

The presence of any comorbidity showed no significant association with MRSA ($p = 0.972$, Chi-square test), as MRSA (+) proportions are similar among patients with (31%) and without (30%) comorbidities (Table 4). Similarly, diabetes, cardiac, and renal conditions did not show a significant link to MRSA ($p = 0.493$).

Among MRSA (+) patients, 41% used traditional medicine before consulting at JBLMGH, compared to 23% who did not (Table 5). The difference is statistically significant ($p = 0.002$, Chi-square test), indicating a strong association.

Table 1. Demographic characteristics of patients with and without MRSA

Variable	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Age (years)					
0-10	7 (27)	19 (73)	26	0.447	F
11-20	15 (35)	28 (65)	43		
21-30	16 (36)	28 (64)	44		
31-40	13 (32.5)	27 (67.5)	40		
41-50	14 (34)	27 (66)	41		
51-60	4 (15)	23 (85)	27		
61-70	2 (17)	10 (83)	12		
Gender					
Male	35 (29)	86 (71)	121	0.594	C
Female	36 (32)	76 (68)	112		
Education					
Unschooling	18 (47)	20 (53)	38	0.027*	C
Elementary	24 (33)	48 (67)	72		
High School	21 (21)	77 (79)	98		
College	8 (32)	17 (68)	25		
Handedness					
Right	51 (32)	110 (68)	161	0.550	C
Left	20 (28)	52 (72)	72		

* Significant at 0.05 level (2-tailed)

C - Chi-square test; F - Fisher's exact test

Table 2. Comparison of immediate and one-year post-operative radiographic parameters

Variable	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Employment status					
Unemployed	33 (36)	59 (64)	92	0.148	C
Employed	38 (27)	103 (73)	141		
Nature of work					
Agriculture	10 (18)	47 (82)	57	0.124	F
Animal Handling	9 (43)	12 (53)	21		
Architecture and Construction	10 (31)	22 (69)	32		
Food Industry	8 (32)	17 (68)	25		
Forestry	1 (50)	1 (50)	2		

C - Chi-square test; F - Fisher's exact test

Table 3. Etiology of hand infection of patients with and without MRSA

Etiology of Infection	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Household	31 (29)	77 (71)	108	0.002**	C
Industrial	20 (24)	65 (76)	85		
Bite wounds	18 (60)	12 (40)	30		
Atraumatic	2 (20)	8 (80)	10		

** Significant at 0.01 level (2-tailed)

C - Chi-square test

Table 4. Comorbidities of patients with and without MRSA

Comorbidities	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
With any comorbidity	51 (31)	116 (69)	167	0.972	C
Without any comorbidity	20 (30)	46 (70)	66		
Diabetes	32 (39)	50 (61)	82	0.493	C
Cardiac comorbidities	11 (29)	27 (71)	38		
Renal comorbidities	8 (42)	11 (58)	19		

C - Chi-square test

The results show a significant correlation ($p = 0.001$, Fisher’s exact test), with MRSA (+) cases more common in wounds located on the ring finger and fourth webspace (53%) and the thumb & first webspace (50%) (Table 6).

There was no significant association between type of infection and MRSA ($p = 0.297$, Fisher’s exact test) (Table 7).

DISCUSSION

This study reveals significant insights into the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) among patients with hand infections. The overall prevalence of MRSA in this study was 30%. This aligns with prior studies that reported variable MRSA prevalence rates across different settings, reinforcing the ongoing challenge posed by this resistant organism in healthcare environments.^{1,6}

Demographic factors

There was no significant association between MRSA status and age ($p = 0.447$). This supports prior research indicating that MRSA infections affect various age groups without

a clear predilection.¹² Similarly, sex was not significantly associated with MRSA ($p = 0.594$), consistent with previous reports suggesting that biological sex is not a strong determinant of MRSA infection risk.²

However, education level showed a statistically significant association with MRSA status ($p = 0.027$), where unschooled patients had a higher prevalence of MRSA (47%). This aligns with research suggesting that lower educational attainment may be linked to reduced healthcare access, poor wound care practices, and delayed treatment-seeking behavior.^{10,13} Meanwhile, handedness showed no significant correlation with MRSA ($p = 0.550$), consistent with the literature.³

Employment status and nature of work

Employment status did not show a statistically significant association with MRSA ($p = 0.148$), supporting prior studies that found no clear occupational predilection for MRSA in hand infections.⁸ Similarly, the nature of work ($p = 0.124$) was not significantly associated with MRSA status, suggesting that specific industries such as agriculture, animal handling, or construction do not independently increase MRSA

Table 5. Use of traditional medicine before seeking medical consult among patients with and without MRSA

Traditional medicine use	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Yes	38 (41)	54 (59)	92	0.002**	C
No	33 (23)	108 (77)	141		

** Significant at 0.01 level (2-tailed)
C - Chi-square test

Table 6. Location of infection of patients with and without MRSA

Location of infection	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Thumb and 1 st webspace	17 (50)	17 (50)	34	0.001**	F
Index finger and 2 nd webspace	11 (27)	30 (73)	41		
Middle finger and 3 rd webspace	9 (18)	40 (82)	49		
Ring finger and 4 th webspace	18 (53)	16 (47)	34		
Small finger	3 (10)	26 (90)	29		
Palm and dorsal side of hand	11 (31)	25 (69)	36		
Wrist and forearm	0 (0)	1 (100)	1		
Multiple sites	2 (22)	7 (78)	9		

** Significant at 0.01 level (2-tailed)
F - Fisher’s exact test

Table 7. Type of infection of patients with and without MRSA

Type of infection	MRSA (+) n (%)	MRSA (-) n (%)	Total	p-value	
Cellulitis	4 (36)	7 (64)	11	0.297	F
Tenosynovitis	32 (33)	65 (67)	97		
Deep infection	21 (29)	52 (71)	73		
Necrotizing type	1 (25)	3 (75)	4		
Osteomyelitis	6 (18)	28 (82)	34		
Multiple diagnoses	7 (50)	7 (50)	14		

** Significant at 0.01 level (2-tailed)
F - Fisher’s exact test

risk. Prior studies suggested that environmental exposure may contribute to bacterial transmission but is not the sole predictor of MRSA infection.¹⁴

Etiology of hand infections

Etiology was significantly associated with MRSA ($p = 0.002$), particularly for bite wounds (60% MRSA-positive). This aligns with research indicating that animal and human bite wounds pose a higher risk for MRSA colonization, given their polymicrobial nature and increased likelihood of deep tissue penetration.¹⁵ Comparatively, infections due to household injuries (29%), industrial trauma (24%), and atraumatic causes (20%) had lower MRSA rates, reinforcing the need for heightened vigilance in bite wound management.

Comorbidities

This study found no significant association between MRSA status and underlying comorbidities ($p = 0.972$), supporting prior research indicating that comorbidities do not necessarily increase MRSA susceptibility.⁹ However, conditions like diabetes have been associated with higher complication rates in MRSA-positive hand infections.¹⁶

Use of traditional medicine

A statistically significant association was found between traditional medicine use and MRSA positivity ($p = 0.002$). Patients who utilized traditional remedies before seeking medical consultation had higher MRSA rates, raising concerns about delayed treatment and potential bacterial resistance linked to non-standardized practices.¹⁷

Location and type of infection

The location of infection was statistically associated with MRSA ($p = 0.001$), with wounds on the ring finger and thumb being more frequently MRSA-positive. Previous studies suggest that hand infections in high-contact areas (e.g., dominant fingers) may have higher colonization rates due to frequent exposure to contaminated surfaces.¹⁸ The type of infection ($p = 0.297$) was not significantly associated with MRSA status, indicating that the type of infection alone does not predict MRSA involvement.³

CONCLUSION

The study highlights are as follows:

- **High prevalence of MRSA:** The study found that approximately 3 out of every 10 patients treated for hand infections were positive for MRSA. This high prevalence necessitates the implementation of stringent infection control measures within the hospital to prevent further spread.
- **Significant association with education level:** The only demographic factor significantly associated with MRSA status was education level, with unschooled individuals

showing a higher prevalence (47%). This suggests that educational interventions could be vital in reducing MRSA rates, emphasizing the importance of health literacy in preventing infections.

- **Bite wounds as a major risk factor:** The etiology of hand infections showed that bite wounds were significantly associated with MRSA (60%). This highlights the need for specific protocols when treating bite wounds, including thorough assessment and potential prophylactic measures against MRSA.
- **Traditional medicine use:** A significant proportion of MRSA-positive patients reported using traditional medicine before seeking medical care. This indicates a potential delay in appropriate treatment and suggests that healthcare providers should engage with communities to educate them about the risks associated with delaying conventional medical treatment.
- **Location of infection:** the location of hand infections was significantly associated with MRSA status, particularly in areas such as the ring finger and thumb. This information can guide clinicians in monitoring and managing high-risk areas more effectively.

These findings underscore the necessity for targeted interventions aimed at education and awareness regarding wound care and the risks associated with traditional medicine usage. Some practical implications of the study for JBLMGH are as follows:

- **Enhanced infection control protocols:** Implement strict infection control measures, including regular screening for MRSA among patients presenting with hand infections. This may involve isolating MRSA-positive patients to prevent cross-contamination.
- **Educational campaigns:** Develop educational initiatives aimed at improving health literacy among patients, particularly targeting unschooled individuals. These campaigns should focus on proper wound care, recognizing signs of infection, and the importance of seeking timely medical attention.
- **Targeted management for bite wounds:** Establish specific guidelines for managing bite wounds, including protocols for assessing risk factors for MRSA colonization and infection. This could involve prophylactic antibiotic treatment or referral to specialists when necessary.
- **Community engagement:** Collaborate with local communities to address the use of traditional medicine. Healthcare providers should work to build trust and demonstrate the importance of seeking conventional medical care promptly.
- **Resource allocation for training:** Allocate resources toward training healthcare staff on recognizing and managing MRSA cases effectively, focusing on high-risk populations and areas identified in this study.
- **Monitoring and evaluation:** Regularly monitor infection rates and evaluate the effectiveness of implemented strategies to adapt interventions based on emerging trends or challenges in managing MRSA within the hospital setting.

By addressing these implications, the hospital can enhance its capacity to manage MRSA effectively among patients with hand infections while ensuring patient safety and improving overall healthcare outcomes in a resource-limited environment.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

TJA: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration; **JAG:** Conceptualization, Methodology, Writing – original draft preparation; **MMV:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing, Visualization

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

DATA AVAILABILITY STATEMENT

The datasets generated and analyzed in this study are included in the published article.

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None.

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