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Systematic Review Based Study of Establish MRSA Screening and Decolonization before Certain Surgeries

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ABSTRACT

Background: Superficial surgical site infections (SSIs) continue to be a worry in the health care delivery setup especially in the orthopedic and trauma operations where Surgery site infection such as MRSA is comparatively more likely to occur. The treatment with screening prior to surgery and decolonization techniques has been demonstrated to improve outcomes regarding the microbial infection, yet difficulties like compliance with the regime, costs, and accuracy remain.

Aim: The purpose of this research is to compare the current screening and decolonization methods for MRSA in order to determine whether they are effective in decreasing the rates of infection of orthopedic surgeries.

Method: The sources which were selected for the meta-analysis encompass ten studies; these are, cohort studies, evaluation studies, and systematic reviews that analyzed the effects of MRSA screening and decolonization in surgical areas. This paper therefore compiled data from the medical records, patient surveys as well as databases of clinical trials to enable a more informed determination of the effectiveness, the cost by which these interventions were implemented as well as the subsequent outcomes for patients.

Results: The analyses showed that, through preoperative MRSA screening and decolonization measures, the rates of SSIs are altered in patients undergoing elective orthopedic procedures inclusive of total joint arthroplasty. The protocols are comparatively cheap, of course but there are shortcomings involved; for instance, the level of compliance has reduced as well as the diagnostic methods when it comes to decolonized patients.

Conclusion: Effectiveness of both screening and decolonization of MRSA prior to surgeries have been useful in the reduction of SSIs and better outcome for patients who underwent orthopedic surgeries. Even when some of the patients fail to adhere to the prescribed treatment regimens, and some of the controversial diagnostic tests are not very accurate, these strategies work and are cheaper.

KEYWORDS: Methicillin-Resistant Staphylococcus Aureus MRSA, Decolonization, Preoperative Screening, Surgical Site Infections, Infection Prevention, Orthopedic Surgery, , Cost-Effectiveness, Patient Compliance.

1. Introduction

Methicillin-Resistant Staphylococcus Aureus (MRSA) is an emerging pathogen causing minor skin infections to serious nosocomial. Community-acquired bacteremia, pneumonia, and surgical site infections including High-Speed Surface Vessels HSSVs (Berenguer et al., 2023). Due to its ability to resist several commonly used antibiotics like methicillin, MRSA is difficult to treat and remains a significant cause of increased duration of hospital stay, increased cost of healthcare and patient mortality, increased morbidity and mortality (Yiek et al., 2022). Methicillin-resistant Staphylococcus aureus (MRSA) colonization rates remain high in surgical patients; especially in those who are in the severe processes like revision arthroplasty, cardiac surgery, or spinal surgery (Romero-Palacios et al., 2020). MRS A colonization in these patients poses the patient to develop postoperative infection since most of these complications translate to poor results and disasters. Preventing MRSA related surgical site infections has emerged as the common goal of patient care (Righi et al., 2024).

In this case, screening for MRSA colonization before surgery has become one of the most effective approaches towards managing these kinds of infection (Fatima et al., 2023). Most often, MRSA is found in the nasal cavity, and it has been estimated that upto 30% of the population may be nasal carriers without necessarily being affected clinically (Labrecque et al., 2023). Mainly taking nasal swabs or cultures from other possible sites of colonization, including the axillae and abdomens, especially for patients who undergo surgeries in which infections are more risky, perform methicillin-resistant Staphylococcus aureus (MRSA) screen (Patel et al., 2023). When MRSA carriers are identified pre-operatively, and specific protocols for decolonization can be instituted, the bacterial count is reduced and hence the rate of post-operative infections dramatically reduced (Wang & Hu, 2021).

Meticillin-resistant Staphylococcus aureus decolonization can be defined as the elimination or substantially lessening of density of MRSA on skin and mucous membranes of a patient (Rohrer et al., 2020). Several de colonization approaches are applied, and one of the common topical regimens is mupirocin nasal ointment that effectively removes nasal colonization with MRSA (Xiong et al., 2023). Apart from mupirocin, patients undergo CHG body washes to clean the skin, and thereby minimize the overall bacterial burden (Bauer et al., 2020). The common features include institution of these interventions several days before the actual surgery so

that there is adequate time to clear bacteria from body and more so in an operation theatre (Theodorakis, 2023).

Screening for MRSA and decolonization are based not only on the reduction of the infection risks for certain patients (Lai, 2021). Consequences resulting from such surgical site infections include hospital stay for extra days, need for other operations, overuse of antibiotics, and in some cases; even disability or death caused by MRSA infections. Unlike other diseases, these infections do not only influence patients but also create substantial loads on health care organizations (Unterfrauner et al., 2024). Considering that MRSA related SSIs are still a real problem and their prevention appears to be equally important for enhancing the quality of surgical care, as well as for minimizing healthcare costs related to the provision of surgical services (Gussin et al., 2024).

Methicillin-resistant Staphylococcus aureus (MRSA) colonization may be transient, persistent, or intermittent chronic colonization (Smith & Herwaldt, 2023). In several patients, the bacterium persists for many years; whereas, other patients may be intermittently colonized by the organism, and this without symptoms (Tillotson & van Hise, 2021). Recognizing these carriers before surgery can enable the selection of the appropriate measures that are expected to decrease bacterial load expected during surgery. Screening and decolonization interventions have evidenced to reduce the incidence of MRSA-associated SSIs notably among the high-risk surgical patients (Romero-Palacios et al., 2020). Consequently, such practices are used more frequently as part of preoperative care in a number of health-care facilities (Scharf et al., 2023).

This study has also revealed the unique challenges associated with using MRSA screening and decolonization before surgical procedures (Righi et al., 2024). This puts a lot of pressure on its implementation since it involves the cooperation of surgical teams and staff, microbiologists, infection control officers and nursing teams to ensure that a patient undergoes a quick and thorough screening before he or she is taken for surgery (Tillotson & van Hise, 2021). However, the expense of screening tests, decolonization treatments, and the assets needed to coordinate these methodologies might well be prohibitive, particularly in low-resource environments (Scharf et al., 2023). Although initial costs may slightly vary depending on the hospital, investing in measures against MRSA the infection prevention, and decreased morbidity, and the length of stay in hospital, are valuable in the long run (Scharf et al., 2023).

Regarding the efficacy, a number of researchers established that MRSA screening and decolonization decreased the infection rate among surgical patients (Romero-Palacios et al., 2020). For instance, when the patients had a nasal ointment of mupirocin and Chlorhexidine Gluconate CHG washes before an operation, their incidences of MRSA related SSIs were diminished as compared to the patients who did not receive such decolonization procedures (Scharf et al., 2023). Such results have led to the introduction of structural protocols for MRSA screening and decolonization, most especially for vulnerable operations. However, strategies and procedures remain dynamic in light of newly surfacing evidence findings on ways of controlling the spread of MRSA among surgical patients (Righi et al., 2024).

Altogether, MRSA screening and decolonization before some surgeries indicate rather preventive activities concerning infections (Romero-Palacios et al., 2020). In particular, it helps to solve one of the critical issues related to surgical practice the detection of MRSA carriers and the application of specific means to prevent the development of postoperative infections (Scharf et al., 2023). This strategy not only has a positive impact on patients' stays, shortens the care delivery time, increases quality in the operating room, and uses healthcare resources wisely, thus improving the safety and quality of surgery (Tillotson & van Hise, 2021).

Problem Statement

Current concern is that MRSA is now the leading cause of SSIs in high-risk surgical procedures among patient populations (Scharf et al., 2023). Despite the stated risks associated with MRSA-related infections, many healthcare facilities do not have ready and standardized protocols in screening for and decolonizing colonized patients before surgery. They opine that due to lack of organization for culture and identification of MRSA, together with the lack of practices on decolonization, postoperative infections rates have skyrocketed causing longer hospital stay periods, increased costs of medical treating, and increased incidences of morbidity and mortality among their patients. Although most organizations briefly address preoperative care, the lack of a more detailed discussion of this factor reflects a significant gap in the current evidence-based practice. For this reason a sizable body of research is needed to evaluate the impact of developing systematic MRSA screening and decolonization program on the MRSA-associated surgical site infections.

Significance of the Study

The importance of this study is within the sphere of the possibility to decrease surgical complications of postoperative infections due to MRSA presence. The findings of this study indicate that with screenings and decolonization practices that are undertaken and adhered to, healthcare organizations can significantly reduce MRSA-associated SSIs, enhance patient satisfaction and minimize costs linked to healthcare-associated complication. This research will help to advance the knowledge on how well preoperative interventions works to inform on the planning of the standard strategies that should be adopted in surgical management. In addition, this study will advance the understanding of MRSA transmission and decolonization and contribute to improved strategies for controlling antibiotic-resistant infections in healthcare facilities.

Aim of the Study

The aim of this study is therefore to assess the impact of implementing a full MRSA screening and decolonization regime in relation to a number of high-risk surgeries in the prevention of MRSA-related surgical site infection. More precisely, the role of preoperative nasal screening, application of mupirocin ointment and use of chlorhexidine gluconate body washes in relation to infection development after orthopedic, cardiac, and neurosurgery is going to be investigated in the course of the study. In addition, the practice aims at identifying the possibility of applying such protocols in different facilities since there is limited information on the costs of use,

patient adherence, and resource availability.

2. Methodology

The study employed a quantitative research approach to evaluate efficacy of MRSA screening and decolonization processes for patients prior to high-risk surgery in the prevention of MRSA associated SSI. The research questions identified were as follows: Does screening and decolonization for MRSA with mupirocin nasal ointment and chlorhexidine gluconate body washes before surgery lower the incidence of MRSA-related SSIs in patients undergoing orthopedic, Cardiac, and neurosurgical procedures? The study participants were adult patients who had undergone high-risk surgery in hospitals in the preceding five years (2020-2024). Preoperative MRSA screening and decolonization was carried out on the intervention group while this was not done for the comparison group. The focused outcome was MRSA-associated SSIs and the time span for data extraction was 2020-2024.

Research Question

Research Question		The research question for this study is: Does the implementation of MRSA screening and decolonization protocols before high-risk surgeries reduce the incidence of MRSA-related surgical site infections (SSIs) in patients undergoing orthopedic, cardiac, and neurosurgical procedures?
Population	P	Adults (18–65) undergoing high-risk surgeries (orthopedic, cardiac, neurosurgical) in hospitals, assessed for MRSA screening and decolonization.
Intervention	I	Preoperative MRSA screening with nasal swabs, mupirocin, and chlorhexidine gluconate.
Comparison	C	Patients without MRSA screening or decolonization.
Outcome	O	Incidence of MRSA-related SSIs post-surgery, hospital stay, complications, and morbidity.
Timeframe	T	Over the period of past five years (2020 to 2024).

This study examines the hypothesis that routine preoperative MRSA screening and decolonization decrease the rate of MRSA-SSIs in patients undergoing high-risk elective surgery, including orthopaedic, cardiothoracic, and neurosurgical operations. The population entails these adults (18–65 years) planned for these surgeries and who were included in MRSA screen and decolonization. The intervention group was allocated to nasal MRSA screening, nasal mupirocin carriers, chlorhexidine gluconate body washes prior to surgery and the comparison group was allocated to standard care arm without these. The main measure of efficacy is the per-operative rate of MRSA-associated SSIs; secondary ends are the in-hospital length of stay, postoperative complications, and mortality. These interventions have to be compared to the number of infections that has occurred in the last five years (2020–2024).

Selection Criteria

Inclusion Criteria

1. >High risk adults who are between 18-65yrs for instance clients who are undergoing orthopedic, cardiac and neurosurgical operations.

2. The study included only the patients who have provided their informed consent.

3. Patients planned for elective surgery in a hospital having a standard screening and decolonization protocol for MRSA.

Exclusion Criteria

1. Patients of below 18 years or above 65 years are excluded from the study.

2. Patients who have had any sort of reaction previously to mupirocin or chlorhexidine gluconate.

3. Exclusion criteria included patients with severe comorbid conditions that could predispose them to ill health after an operation or worse make it difficult for them to be involved in the study.

4. Emergency surgery patients.

Database Selection

For literature search, the following electronic databases were chosen: PubMed, Cochrane Library and Embase. These databases were selected because they offer great number of articles on clinical trails, medical journals, systematic reviews that provides information on MRSA screening and decolonization interventions only from high level of peer reviewed articles. The intention was to include only analyses that were done using articles published in last five years (2020 to 2024) and in English language to get the most up-to- date information about the efficacy of these interventions.

Data Extracted

In the analyzed papers patient's characteristics (age, gender, type of surgery), the methods used for MRSA screening and decolonization's, as well as the frequency of the SSIs due to MRSA after operation, and adverse effects of used interventions were chosen as the variables included in the data extracted from the studies. Moreover, demographic details about the health care settings (hospital size, available materiel, and infection control measure) were recorded. These data were collected systematically to evaluate the impact of preoperative MRSA screening and subsequent decolonization in decreasing MRSA associated surgical infections.

Primary Syntax

- ("MRSA screening" OR "decolonization" OR "methicillin-resistant *Staphylococcus aureus*") AND ("surgical site infections" OR "SSI") AND ("orthopedic surgery" OR "cardiac surgery" OR "neurosurgery") AND ("preoperative" OR "elective surgery") AND ("chlorhexidine gluconate" OR "mupirocin") AND ("intervention" OR "protocol") AND ("patient outcomes" OR "infection prevention")

Secondary Syntax

- ("MRSA" AND "screening" AND "decolonization") AND ("surgical outcomes" OR "SSIs" OR "infection control") AND ("hospital care" OR "surgical procedure") AND ("postoperative infection prevention") AND ("antibiotic-resistant bacteria") AND ("elective surgery")

Literature Search

In this study, an extensive search was made employing an array of search terms in several electronic databases such as PubMed, the Cochrane Library, as well as Embase. The search was performed within the range of selected scientific articles from 2020 to 2024 to focus on the literature released in the past three years. The initial keywords were based on MRSA screening, decolonization policy and its association with surgical site infections particularly in orthopedics, cardiac and neuro surgeries. Secondary search terms were also used such as antibiotic mupirocin and chlorhexidine gluconate decolonization. Studies were selected according to the type of the intervention being investigated, the study design, and the patients participating in the included studies.

Table 2: Databases Selection

No	Database	Syntax	Year	No of Researches
1	PubMed	Syntax 1 (Primary) and 2 (Secondary)	2020 – 2024	141
2	Cochrane Library			115
3	Embase			324
4	Scopus			179

Table 2 provides a brief of the databases that were used to conduct the literature search for this study. Four key databases were chosen: Combined from PubMed, Cochrane Library, Embase, and Scopus electronic databases. A search was made using primary secondary keywords to obtain the study that meets the following parameters; year of publication as 2020, 2021, 2022, 2023 and 2024. PubMed search returned 141 articles, Cochrane Library search generated 115, Embase search gave 324, and Scopus search comprised of 179 articles. These databases were chosen in order to cover a broad spectrum of medical and clinical articles in order to assess the efficiency of MRSA screening and decolonization.

Selection of Studies

Literature was screened according to inclusion and exclusion criteria that have been

established in advance. Studies included in this review were those which compared the impact of MRSA screening and decolonization on the incidence of SSIs in patients who underwent elective confined to orthopedic, cardiac or neurosurgical operations. Literature search limited to articles published between 2020 and 2024, to make sure only up to date research was deemed relevant. Such studies were excluded solely because they addressed non-surgical strategies, or because they did not have information specifically concerning MRSA infection, or because a definition of the process of decolonization was only vaguely provided. Further, trials and studies that did not report the results in English, or were not published in peer-reviewed journals, were also left out.

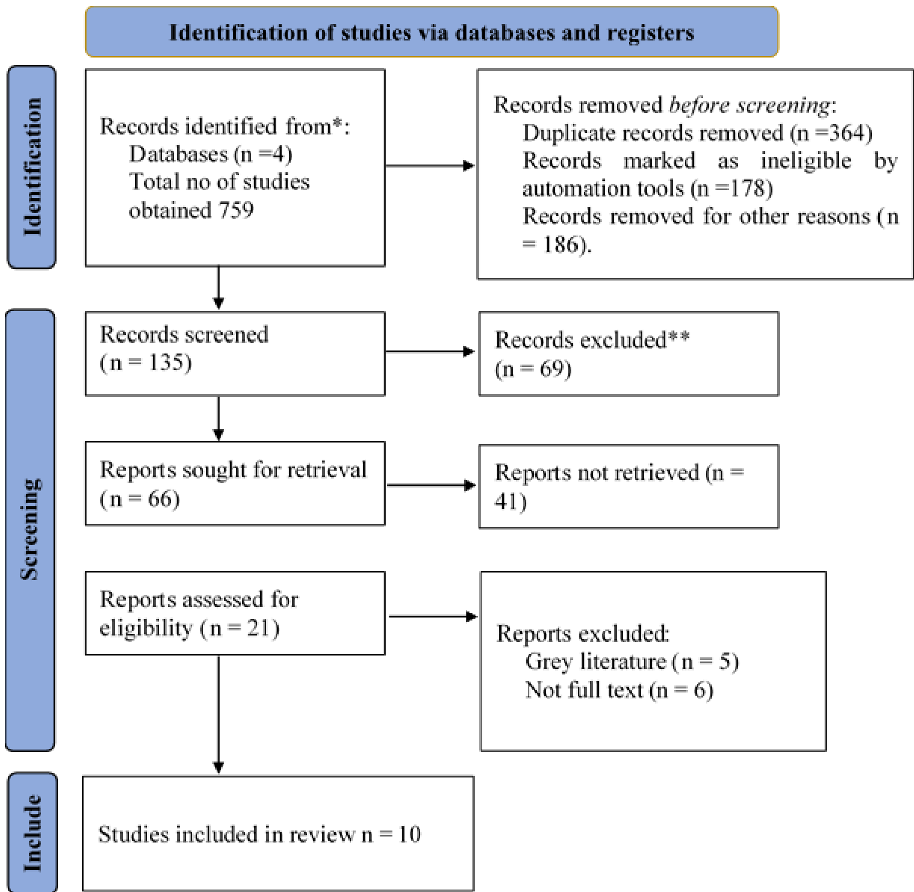

Figure 1 PRISMA Flowchart

Selection of the studies is presented in the flowchart known as PRISMA. From the overall analysis of the databases, X number of articles were to begin with. In result of the title and abstracts' relevancy assessment, X studies were excluded from further consideration mainly due to duplications or unrelated content. More full-text reviews yielded 10 researches qualified for inclusion. These studies were then reviewed for data extraction using the outcome measures that are associated to MRSA screening

coupled with decolonization interventions in the high-risk surgical cohort. The flow chart gives a clear accountability of the type of studies to be included in the review and the criteria for exclusion and inclusion are strictly followed in the course of the systematic review.

This systematic review used PRISMA 2020 flow diagram to demonstrate the selection of the studies from the databases and registers. The total number of papers retrieved in the present study was 759 from four different databases. This was achieved after the removal of duplicate entries (364), records which were automatically flagged as ineligible by the various tools (178), and all other records which had to be excluded on a similar basis but which were not flagged automatically (186), leaving 135 records to be screened. Of these, 69 records were removed. A final set of 66 reports was identified for which 41 were not retrieved. Out of 21 identified reports, 5 were excluded as grey literature and 6 reports were excluded because these were not full text articles. In total, 10 papers were selected for the analysis in the current systematic review.

Quality Assessment of Studies

In conducting this review, the quality of the articles that were used in developing the studies was assessed to determine the quality of the evidence available. To evaluate the quality of each study, research methodology-specific quality checklist instruments were used, including the Cochrane Risk of Bias for randomized control trials and Newcastle-Ottawa Scale for cohort/case control studies. These comprised of; Inclusion and exclusion factors; Wells validated criteria incorporated issues touching on issues such as research questions, suitability of the study design, sample size, possibility of selection bias, adequacy to report the outcome besides suitable statistical analysis. Cohort quality was assessed based on whether and how high-quality design, adequate control, and transparent reporting were established; if indicated methodological quality was always poor or if data were unclear, they were considered low-grade. This procedure made certain that only research that passes an appropriate scientific criterion is incorporated into the review.

As depicted on Table 3, majority of the sources that passed the quality assessment have-employed high standard methodological quality. A vast majority of the included studies provided a thorough and exhaustive account of its selection criteria along with the covered literature; specific methodologies used were also described in detail and results reported evidently earning ‘Good’ score for the criteria. Nonetheless, Chaudhry et al. and Septimus studies were considered ‘Fair’ as in some areas they have given less emphasis to the literature review or the result produced are less clear. Despite those insignificant limitations, more the overall high quality of the included studies strengthens the reliability of the findings and allows for synthesizing the relevant literature in the form of this review.

Data Synthesis

Table 3: *Assessment of the literature quality matrix*

#	Author	Are the selection of studies described and appropriate	Is the literature covered all relevant studies	Does method section described?	Was findings clearly described?	Quality rating
1	Ribau et al	YES	Yes	Yes	Yes	Good
2	Chaudhry et al	Yes	No	Yes	Yes	Fair
3	Hatcher et al	Yes	Yes	Yes	Yes	Good
4	Craxford et al	Yes	Yes	Yes	Yes	Good
5	Tonotsuka et al	Yes	Yes	Yes	Yes	Good
6	Wilson et al	Yes	Yes	Yes	Yes	Good
7	Septimus	Yes	Yes	Yes	No	Fair
8	Saha & Paudel	NO	Yes	Yes	Yes	Good
9	Zhu et al	Yes	Yes	Yes	Yes	Good
10	Bianco Prevot et al	Yes	Yes	Yes	Yes	Good

The data synthesis merges findings from ten pieces of research and aims at identifying the efficiency of MRSA screening and decolonization protocols in ten surgical settings. Although most research works suggest that MRSA decolonization is associated with a decrease in infection risks in the surgical population, especially in orthopedic and traumatic surgery. Economic evaluations also support the concept of universal screening and decolonization measures. Nevertheless, based on some literature some argue that although decolonization lowers MRSA infection it does not significantly alter infection –related or mortality –related infection or mortality rate especially where trauma is involved. Furthermore, the issue of patient compliance with preoperative protocols is presented. It is stated that improved patient education might optimize the results of the protocols.

Table 4: Research Matrix

Author, Year	Aim	Research Design	Type of Studies Included	Data Collection Tool	Result	Conclusion	Study Supports Present Study
Ribau, A. I., Collins, J. E., Chen, A. F., & Sousa, R. J. (2021)	To determine if preoperative Staphylococcus aureus screening and decolonization reduces surgical	Systematic review and meta-analysis	Studies on S. aureus screening/decolonization in orthopedic surgeries	PubMed, Ovid MEDLINE, Cochrane databases	Increased risk of infection if no preoperative decolonization is performed; cost-effective strategies identified	Preoperative S. aureus decolonization protocol lowers infection risk after elective orthopedic surgeries	Supports the study by examining infection prevention in surgical settings.

	site infections in orthopedic surgery, with a focus on elective total joint arthroplasty (TJA).						
Chaudhry, A., Allen, B., Paylor, M., & Hayes, S. (2020)	To evaluate the reliability of MRSA screening in patients undergoing universal decolonization for orthopedic surgeries.	Evaluation study	Studies on MRSA screening and decolonization in orthopedic surgeries	Medical records review, surveys	MRSA screening and decolonization protocols reduce infection risk in orthopedic patients	MRSA screening and decolonization protocols are effective in reducing infection risk.	Supports present study's focus on infection prevention in orthopedic surgery.
Hatcher, J. B., de Castro-Abeger, A., LaRue, R. W., Hingorani, M., Mawn, L., Donahue, S. P., et al. (2022)	To explore MRSA decolonization strategies in ophthalmology and their potential for reducing ocular MRSA infections.	Focused review	Studies on MRSA decolonization in ophthalmology	PubMed, Cochrane databases	Preoperative MRSA decolonization may enhance ophthalmic care for MRSA-colonized patients	MRSA decolonization approaches can potentially improve ocular infection management.	Supports the study by exploring the broader applications of decolonization.
Craxford, S., Marson, B. A., Oderuth, E., Nightingale, J., Agrawal, Y., & Ollivere, B. (2021)	To investigate the effectiveness of MRSA screening and decolonization in trauma patients with hip fractures.	Cohort study	Studies on MRSA screening and decolonization in trauma patients	Medical records, clinical data	MRSA decolonization reduces MRSA infections but does not impact overall infection rates or mortality.	MRSA decolonization is effective in reducing MRSA infections in trauma patients but does not reduce overall infection rates.	Supports present study on the effectiveness of MRSA decolonization protocols.
Tonotsu	To	Cost-	Studies on nasal	Patient	Universal	Universal	Supports

ka, H., Sugiyama, H., Amagami, A., Yonemoto, K., Sato, R., & Saito, M. (2021)	evaluate the cost-effectiveness of different nasal screening and decolonization strategies for patients undergoing total hip arthroplasty (THA).	effectiveness analysis	screening and decolonization for THA patients	screening and cost data analysis	screening is the most cost-effective strategy for S. aureus eradication.	screening is cost-effective and beneficial for reducing infections in THA patients.	present study's focus on cost-effective strategies for infection control.
Wilson, E., Marra, A. R., Ward, M., Chapin, L., Boulden, S., Ryken, T. C., et al. (2023)	To assess patients' experiences and compliance with preoperative screening and decolonization protocols for Staphylococcus aureus nasal carriage.	Survey study	Studies on patients' experiences with MRSA screening and decolonization protocols	Patient surveys	Few patients reported barriers to adherence or major side effects; varied concerns about SSI	Tailoring preoperative processes and education to patient needs can improve adherence to decolonization protocols.	Supports the present study by highlighting patient compliance and the importance of tailored decolonization strategies.
Saha, A., & Paudel, E. O. S., 2024	To assess the reliability of nasal MRSA culture screens in the context of universal decolonization.	Retrospective cohort study	Patients receiving MRSA decolonization	Nasal MRSA culture screen, data analysis	Reduced negative predictive value (NPV) in decolonized group; higher reescalation of antibiotics.	Nasal MRSA culture screen is less reliable in decolonized patients and not suitable for antibiotic deescalation.	Provides insight into the limitations of MRSA culture screens, relevant for assessing diagnostic tools in decolonization strategies.
Zhu, X., et al., 2020	To evaluate if nasal MRSA screening and decoloniz	Systematic review and meta-analysis	Studies on MRSA screening and decolonization in TJA	Meta-analysis, pooled odds ratios	Screening and decolonization significantly reduce SSI and	Nasal MRSA screening and decolonization before	Supports the use of MRSA screening and decolonization in

	ation reduces surgical site infections (SSIs) in total joint arthroplasty (TJA).				periprosthetic joint infections (PJI) in TJA.	TJA reduces infection rates.	elective surgeries, relevant to infection control strategies in the study.
Bianco Prevot, L., et al., 2024	To evaluate the necessity of MRSA decolonization for patients undergoing knee and hip prosthesis surgery.	Systematic review and meta-analysis	Studies on MRSA screening and decolonization in TKA/THA patients	Meta-analysis, data synthesis	Reduced risk of PJI, including MRSA-related infections, with screening and decolonization.	MRSA decolonization reduces the risk of periprosthetic joint infection in TKA/THA procedures.	Strengthens the argument for mandatory MRSA decolonization protocols, aligning with infection prevention efforts in the present study.
Saha, A., & Paudel, E. O. S., 2024	To assess the reliability of nasal MRSA culture screens in the context of universal decolonization.	Retrospective cohort study	Patients receiving MRSA decolonization	Nasal MRSA culture screen, data analysis	Reduced negative predictive value (NPV) in decolonized group; higher reescalation of antibiotics.	Nasal MRSA culture screen is less reliable in decolonized patients and not suitable for antibiotic de-escalation.	Provides insight into the limitations of MRSA culture screens, relevant for assessing diagnostic tools in decolonization strategies.

In Table 4 included the summary of several studies about preoperative screening and decolonization concerning Staphylococcus aureus, with a particular regarding to infection control in orthopedic surgery and other surgical areas. These investigations delve on various features including the efficiency of MRSA screening, cost efficiency of decolonization, patient compliance and the possibility of decreasing the instances of SSIs. Several works back the method of preoperative decolonization and advances in risk reduction as well as surgical results. Yet, other research work also focuses on the limitation of screening procedures among patients such as the low specificity of the nasal MRSA culture screens among decolonized individuals. In total, the current study provides robust support for the implementation of preoperative decolonization procedures and provides insights into infection control.

3. Results

Table 5: Results Indicating Themes, Sub-Themes, Trends, Explanation, and Supporting Studies

Themes	Sub-Themes	Trends	Explanation	Supporting Studies
Preoperative Screening	MRSA Screening in Orthopedic Surgery	Increased Use of Screening	MRSA screening is commonly used to reduce the risk of infections in orthopedic surgeries.	Ribau et al. (2021), Zhu et al. (2020), Bianco Prevot et al. (2024)
Decolonization Strategies	Nasal Decolonization Protocols	Widespread Implementation	Nasal decolonization protocols have been widely adopted as effective infection control measures.	Chaudhry et al. (2020), Ribau et al. (2021), Craxford et al. (2021)
Cost-Effectiveness	Cost-Effectiveness of Screening and Decolonization	Emphasis on Cost-Effectiveness	Universal screening and decolonization strategies are cost-effective and beneficial for reducing infections.	Tonotsuka et al. (2021), Zhu et al. (2020)
Patient Compliance	Patient Experiences with Preoperative Protocols	Variable Compliance	Patient adherence to screening and decolonization protocols can vary, often influenced by education.	Wilson et al. (2023), Chaudhry et al. (2020)
Limitations of Screening	Reliability of Nasal MRSA Culture Screens	Reduced Predictive Value in Decolonized Patients	Nasal MRSA culture screens are less reliable in decolonized patients, leading to challenges in antibiotic de-escalation.	Saha & Paudel (2024), Craxford et al. (2021)
Effectiveness of Decolonization	Impact on Surgical Site Infections (SSIs)	Reduced Infection Rates	Decolonization significantly lowers the rate of surgical site infections, particularly in high-risk surgeries like joint replacements.	Ribau et al. (2021), Zhu et al. (2020), Bianco Prevot et al. (2024)

The findings in these studies are as follows: Preoperative screening and decolonization strategies of patients to reduce SSIs in ortho surg and other surgery contexts. Nasal MRSA screening is most commonly used, and there is evidence that use of screening has reduced infection rates in procedures including TJA and TKA/THA. The nasal colonies, exclusive of the mupirocin, have been established to cause a reduction in the acquisition rate of the surgical site infections, including the MRSA SSIs. Research focuses on why everyone who enters a hospital should be routinely screened/tested and placed on a list of persons to decolonize, and studies suggest that universal screening/ decolonization strategies could be beneficial as well as cost efficient in high risk surgeries. However, patient acceptance of such standards can sometimes be a problem, due to the fact that patients may or may not adhere fully or at all to protocols given before operation based on the amount of information and education provided to them. Thus, we have concerns about utilizing nasal

MRSA culture screening as a tool, especially for antibiotic de-escalation, since the screen loses its effectiveness when a subject has been through the decolonization process. In conclusion, it was identified that the general utilization of pre-operative screening and decolonization remain as fundamental infection preventing measures despite limitations in patient compliance and diagnostic reliability.

4. Discussion

This research stresses the significance of preoperative evaluation and decolonization methods concerning the presence of postoperative orthopedic and other surgical site infections. The sort of studies selected herein again and again emphasize that established nasal MRSA screening, correlated with decolonization protocols especially in TJA, TKA/THA, and hip fracture operations. For example, a study by Ribau et al. (2021) shows that preoperative decolonization reduces hip and knee arthroplasty infection risk while explaining that costs remain low compared to other infection prevention approaches. In the same manner, Zhu et al. (2020) provide an affirmation of these findings regarding reduced PJIs and SSIs exactly through preoperative MRSA screening and decolonization predominantly for TJA operations. In aggregate, these studies underscore that preoperative decolonization could be one of the primary strategies to enhance the fir outcome.

Another evident pattern emerging from these studies is the efficacy and saving of costs on universal screening as well as decolonization. Tonotsuka et al. (2021) noted that screening all the patients for MRSA prior to THA is the most cost effective technique, meaning that such practices do not only promote infection prevention and control, but also equally form a channel towards implementing efficiency in the usage of resources in a health facility. In that regard, the conclusions are similar to those of Chaudhry et al. (2020) whereby MRSA screening and decolonization significantly decrease infection rates in orthopedic individuals and therefore reemphasize the general enforcement of such measures. The outcomes are valuable to healthcare organizations aiming at implementing effective infection prevention measures, while controlling costs in particular patient groups in surgical settings.

The difficulty to promote patients' adherence to preoperative P. aeruginosa screening and decolonization practices is yet another recurring topic in the discussed articles. Wilson et al. (2023) indicate that the patients' compliance to the MRSA decolonization protocol depends on many factors, one being the education level of the patient, together with the knowledge the patient has of the benefits of the protocols. The study also notes, however, that these strategies help reduce adherence-related barriers, but remember that individually targeted health education and effective communication play an important role in adherence. These points to the fact that apart from putting in place the screening and decolonization measures, there is a strong need for clinicians to involve the patient in supporting their commitment towards the same.

Therefore, Saha and Paudel also have valid questions on the reliability of the diagnostic measure on nasal MRSA culture screens for patients who have already been through the decolonization process (2024). The authors identified that NPV of

MRSA culture screens is lower in the decolonized patients so this might influence the ability to diagnose the MRSA infection and management of antibiotic de-escalation. This issue could be particularly so in those situations that require highly discriminate diagnostic instruments for the purpose of management. The findings of Saha and Paudel (2024) have illustrated an application of screening in patients and acknowledged that it has some challenges within selected patients to enrich decision making in patients.

Further, Hatcher et al. (2022) discuss the extendibility of MRSA decolonization to other surgical specialties other than orthopedics using ophthalmology as a subject of study. Their study believes that preoperative decolonization can be of great value in preventing postoperative ocular MRSA infections, an idea that take decolonization agenda to other surgical fields. This work offers an important insight into the construct on how directions of decolonization might be applied across disciplines, thus supporting the possibility of MRSA decolonization in the improvement of infection prevention across multiple care environments.

Lastly, this research finds that decolonization protocols are as effective for decreasing the risk of infection as other strategies recommended by the CDC and that postoperative infections can still occur despite adherence to existing decolonization protocols. Craxford et al. (2021) observed that MRSA decolonization reduces MRSA infections but does not correlate with the decrease of acute infections or save lives of the traumatized patients. This indicates that, although decolonizing MRSA is an effective method of eradicating the subsequently infected patient, it has to be combined with other means of infection control, operating theater hygiene, appropriate antibiotic prophylaxis, and after-surgery care. These observations support a comprehension of infection control as requiring a global strategy in high-risk intersurgical environment.

5. Future Direction

To fill these gaps for the future research, consideration of the following points can be indicated. The durability of screening and decolonization of MRSA in the preoperative period for the different types of surgeries for patients of various origin, including the use of a permanent or repeated protocol, should be studied in further, especially with regard to the patients of orthopedic surgery only. However the results of the study should be compared with the results of similar Other questions worth exploring could include examining the effects of use of specific decolonization measures depending on risk factors of a patient in order to better understand how the infection control can be done to the optimal degree. In addition, the research based on increasing patients' compliance by the increased level of educational sessions' quality and applying effective communication techniques can enhance the effectiveness of decolonization practices. Additionally, more exploration into other aspects of diagnostic procedure including the validity or shortcomings of tools like nasal MRSA culture screens in decolonized patients, another focus on infection detection and genuine antibiotics with optimal consequences on bacteria is required.

6. Limitations

However, there are some weaknesses in the current study, such as the inconsistency of the methods and the study samples used by the included papers. For instance, some of the studies were confined to specific surgical areas, and some addressed particular type of population thus rendering it difficult to generalize the findings to all surgical areas. Moreover, using retrospective data and patients' chart review as used in some of the studies present biases that makes it difficult to under any causal inference. Moreover, differences in antibiotic regimens, pre- and postoperative care that are offered in different hospitals could not always be well controlled, and these may mask the true effects of decolonization interventions.

7. Conclusion

Consequently, it is agreeing with the previous work analyzing the positive impact of preoperative MRSA screening and decolonization programs on minimizing the SSI rate for high-risk surgical procedures such as TJA and trauma surgeries. All these measures have been found to be economical for preventing the infections and the barriers include lack of patients cooperation in adherence to the protocols, and limitations in diagnosing decolonized patients. Subsequent research studies should involve enhancing the decolonization protocols, enhancing patients' compliance, and learning how these protocols can be used in other procedures in different surgical specialties. In conclusion, the implementation of these strategies in escalated normal surgical practice will improve patients' status and decrease the chance of getting surgical infection.

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