ENHANCING MRSA PREVENTION IN HOSPITALS THROUGH PATIENT EDUCATION: A LITERATURE REVIEW FROM NURSING PERSPECTIVE

Flaurelle Ilunga, Srijana Shahi

Degree Thesis
Bachelor of Health Care, Nursing
2024

Degree Thesis

Flaurelle Ilunga
Srijana Shahi

MRSA Prevention in Hospital Settings by Educating Patients.
Arcada University of Applied Sciences: Bachelor of Health Care, Nursing, 2024.

Abstract:

MRSA, a leading cause of hospital-associated infections, imposes high risk in an individual's health and can even cause mortality. It is a well-known fact that controlling the spread of MRSA in hospitals and treating MRSA is very challenging and imposes a substantial burden in the healthcare sector. This thesis investigates the critical role of patient education and nurses' intervention in preventing MRSA in hospital settings, as well as the potential spread of MRSA to other patients, healthcare workers, and families.

In this thesis, we have identified the potential causes of MRSA spread in hospital settings and compiled various aspects of patient education and the nursing role that can minimize MRSA-related infections. Our study is based in selected journals emphasized in MRSA preventions.

Our findings suggest that a combined approach, emphasizing patient education which is often overlooked in hospital, along with effective nursing practices and proper hand hygiene, can significantly help limit the spread of MRSA.

Keywords: MRSA Prevention, Patients Education, Hospital-associated Infection, Nurse's role, Patient role, Hygiene.

FOREWORD

This thesis marks the culmination of several months of dedicated effort and in-depth research. Throughout this period, we delved into the complexities of the research process, acquiring invaluable insights into efficient time management, group work collaboration, adept resolution of conflicting ideas, and the nuances of scholarly inquiry. Through this experience, we have broadened our abilities in critical thinking, analysis, synthesis, and overall research processes.

We would like to express our utmost gratitude to Lotta Eronen and Daniela Pyhäjärvi for their valuable guidance and time. Their knowledge and experience in this field helped us surpass different obstacles we faced during this research. We admire their patience, inputs and feedback, and consistent support in different circumstances.

We would also like to thank the University of Arcada and Applied Sciences for accepting us as nursing students and for opening more opportunities to our career and thesis journey.

We are grateful to our friends for their willingness to assist us and for readily agreeing to share their knowledge and skills with us whenever we needed their help.

Ultimately, our heartfelt appreciation goes out to our families for offering unwavering support throughout the past few months whenever we needed it.

We are pleased to present this academic thesis to our readers, colleagues, and scholars with deep appreciation. It is our aspiration that this work provides valuable insights and lays the groundwork for continued exploration of this important subject matter.

Contents

Abbreviation

MRSA	Methicillin-resistant *Staphylococcus aureus*
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HA-MRSA	Hospital-Acquired MRSA
CA-MRSA	Community-Associated MRSA
LA-MRSA	Livestock-Associated MRSA
THL	Terveyden ja hyvinvoinnin Laitos
EARS	European Antimicrobial Surveillance System
HAI	Hospital Associated Infection
ARDS	Acute respiratory distress syndrome
CDC	Centers for Disease Control and Prevention
WHO	World Health Organization
ICU	Intensive Care Unit
IPS	Infection Prevention Society
HIS	Healthcare Infection Society
PPE	Personal Protective Equipements

List of Tables

List of Figures

1 INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) is the gram-positive bacteria which is one of the many strains of *Staphylococcus aureus.* MRSA is considered as a threat and a huge societal, medical and economical challenges as it is identified as one of the major pathogens causing infections sometimes leading to sepsis or death. A comprehensive analysis done on bacterial antimicrobial resistance estimated 1.27 million people died worldwide in 2019 of MRSA which is more than deaths caused by HIV/AIDS or malaria and aided for 4.95 million deaths (Murray *et al.*, 2022).

MRSA is difficult to treat as this exhibit resistance to common antibiotics like methicillin, penicillin, amoxicillin, oxacillin etc. Overuse of antibiotics makes MRSA more resistant to antibiotics over the time making it more difficult to cure the infection (Derek et. al., 2001).

MRSA is categorized by the setting in which it is acquired. Hospital acquired infection or nosocomial infection of MRSA is known as HA-MRSA (hospital-acquired MRSA). Other types of MRSA acquisitions include community settings and livestock associated which are known as CA-MRSA (community-associated MRSA) and LA-MRSA (livestock-associated MRSA) respectively (Shoaib *et al.*, 2023).

The places we live, learn or work are not free from the MRSA. One can easily get contaminated through skins, wounds or via air that might cause pneumonia. In hospital or nursing home MRSA infection poses serious problems like pneumonia, bloodstream infections, surgical site infections etc (Shoaib *et al.*, 2023).

MRSA causes challenging hospital setting infections in general ward patients. Its resistance to numerous antibiotics leads high mortality rate and extended hospitals stays. MRSA can reside on the skin or in the nasal passages without symptoms buts high significant risk of infection and complications, during surgery or hospitalization (Huang SS 2013- Liu C 2011).
The Nordic countries have historically maintained a low MRSA prevalence (<2.5% of S. aureus bacteraemia isolates) through sensible antibiotic use, extensive screening, and strong infection control programs. Public funding supports programs despite this, there´s a rise in new MRSA cases and challenging existing control practices (Stenhem et al., 2006; Larsen et al., 2009, Holzknecht et al., 2010; Elstrom et al., 2012; Larsson et al., 2014; Swedres-Svarm, 2016; Junnila et al., 2020).

According to Finnish Institute for Health and Welfare, THL, Register, 1,450 new MRSA infections were found in Finland in 2018, which is the same as in 2017. The number of positive blood culture infections has also remained the same in recent years unchanged, in 2017 there were 44 and in 2018 43 positive blood culture infections. Although absolute the number has increased somewhat from five years ago (30 cases annually), the share of MRSA in invasive S. aureus infections has remained unchanged and was 2% in 2018 European Antimicrobial Surveillance System (EARS 2018).

2 BACKGROUND

Healthcare associated infections (HAI) are common and usually manifested after 48 hours of hospitalization or within 30 days after receiving the healthcare (Revelas, 2012). The infection may occur at different healthcare settings like acute care at hospitals, long-term care, clinics, home care and ambulatory care. HAIs pose heightened concerns for several reasons. Hospitals now host many individuals with compromised immune systems, amplifying the risk. With outpatient treatments on the rise, patients admitted to hospitals tend to be more severely ill. Additionally, medical procedures often circumvent the body's natural defences, facilitating infection transmission. Inadequate sanitation protocols and lax adherence by hospital personnel further compound these risks. Furthermore, the routine use of antimicrobial agents in medical settings contributes to the emergence of resistant microbial strains. Some of the common healthcare associated infections are surgical site infections, urinary tract infections, pneumonia, and systemic infection. In Finland, approximately 100,000 HAIs are reported combining hospitals and long-term cares (Healthcare-associated infections - THL).
Differential diagnosis of Clostridium Difficile Colitis, Pseudomonas, Acinetobacter, Enterococcal Infections, MRSA, Legionella, Viral Hepatitis, HIV, Tuberculosis rising to complications like sepsis, Meningitis, Endocarditis, Osteomyelitis, Peritonitis, Acute respiratory distress syndrome (ARDS) has been identified (Monegro AF, Muppidi V and Regunath H, 2024, p. 14).

MRSA thrives as a commensal organism and spreads in both healthcare facilities and communities. It is a significant contributor to various infections such as bacteraemia, endocarditis, skin, and soft tissue infections, as well as hospital-acquired infections. MRSA is

highly formidable, adaptable, and its behaviour can be unpredictable. Its ability to genetically adapt and the continuous emergence of successful epidemic strains make it a persistent and significant threat to human health (Turner et al., 2019). Therefore, more understanding of MRSA and its prevention is required in modern healthcare settings.

In a global study involving patients admitted to intensive care units (ICUs) in September 2017, there was a notable prevalence of suspected or confirmed HAIs, accompanied by a considerable risk of mortality during hospitalization. Among patients with confirmed or suspected infections, the mortality rate within hospitals was recorded at 30% (Vincent *et al.*, 2020). MRSA is one of the leading causes of HAIs. Healthcare-associated infections caused by MRSA impose a significant burden on both the healthcare sector and socio-economic factors. It is necessary to prevent the spread, to reduce morbidity and mortality.

There have been several efforts to improve the guidelines to prevent MRSA transmission and infection in hospitals since 2008. Then an updated guidelines to improve the transmission and prevention of MSRA in hospitals (Calfee *et al.*, 2008, 2014; Kyle J. Popovich *et al.*, 2023) The latest guideline discusses 11 basic practices for institutes, summarized as implementing an MRSA monitoring program, conducting risk assessment, promoting compliance with CDC (Centers for Disease Control and Prevention) or WHO (World Health Organization) hand hygiene recommendations, using contact precautions for MRSA-colonized and MRSA-infected patients, ensuring the cleaning and disinfection of equipment and the environment, implementing an alert system providing MRSA data to stakeholders for analysis and understanding, educating healthcare personnel, patients, and families, and implementing an antimicrobial stewardship program. Among the above-mentioned best practices, educating healthcare personnel, patients, and families has not been researched much. We aim to improve our understanding of how educating patients and their families affects MRSA transmission and prevention in the hospital setting from the nursing perspective.

3 THEORETICAL FRAMEWORK

3.1 Main concept and definition

A theoretical framework plays a key role in providing relevance and structure to an academic study. It provides “The nursing glasses” through which helps in interpreting results. Also, it

provides an insight into understanding and analysing results. (Luft, J. A., Jeong, S., Idsardi, R., & Gardner, G; 2022).

Dorothe Orem's self-care theory is considered as a theory that enable and emphasizes the importance of everyone to take care of themselves, their health and well-being by preforming self-care. This theory promotes the aspect that patients should keep their independence with their own self-care activities. (Sapam, Lamnunnem & Ringkangmai; 2023)

According to the *Cambridge University dictionary*, the word self-care means "The practice of caring for yourself when you are ill.", and it also means "the practice of caring for yourself to stop or prevent yourself from becoming ill"

3.2 Dorothea Orem's selfcare theory

The Self-care theory is on of Orem's three consistent theories, others be self-care deficit theory and the theory of nursing system.
We chose this theory for our thesis because it collides with our aim and purpose which focuses on educating patients on MRSA and how to prevent it.
By using Orem's self-care theory, we want to understand how self-care plays a key role in MRSA prevention and how patient education is one of the core values of preventing infection.
The self-care theory has also been chosen for our thesis because of its tendency to focus on the individual and the empowering of the individual that allows the individual to play the main role into acting both as the one performing and the performed upon the self-care. (Denyes, M. J., Orem, D. E., & Bekel, G. 2001). By this we want to emphasize the important of impowering patients with knowledge on MRSA as patients also have a role in preventing the spread by performing on themselves personal hygiene, for those who can and following the regulation and instructions given to them when they have contracted the infection.

4 PURPOSE, AIMS AND RESEARCH QUESTIONS

4.1 Aim & Purpose

This literature review aims to explore the significance of patient education in preventing MRSA infections in hospital settings, while investigating the nature of MRSA infection and elucidating the nurse's role in patient education in infection prevention and containment of the spread. The main objective of this study is to enhance care, promote health and raise awareness on MRSA.

4.2 Research Questions

- What kind of strategies can nurses employ to prevent the spread of MRSA infections in hospital settings?

5 METHODS

Data collection is a process of collecting different data on a thematic and turning the collected data into a content.
There are numerous ways of collecting data, the qualitative way of collecting information focuses more on the deep understanding of the theme or subject of the study. (Bhaskar & Manjuladevi; 2016)
For this study, we took a more qualitative approach of research by systematically analysing and screening different sources of articles. This Approach was chosen because it was the fastest way to gather recent research within our topic.

5.1 Data Collection

A Literature review in systematic way is a reviewing is a method that focuses on the quality of the content by collecting as much as possible studies related to the theme, then analyse, design and review their result. (Ahn & Kang, 2018)

The data for this study was collected in PubMed, EBSCO, ScienceDirect and CINAHL. Additional search was done in another search engine such Google Scholar.
In the search for data, the criteria found in *Table 1. Exclusion and inclusion criteria.* has been utilised throughout the search on diverse database.

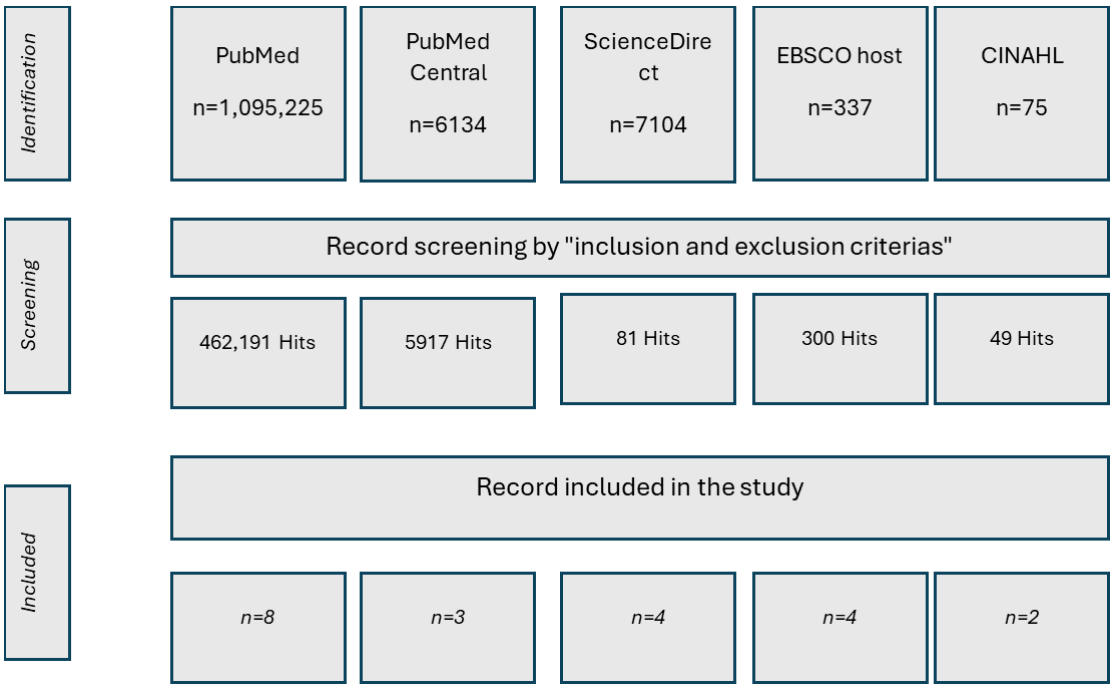
Table 1: Exclusion and inclusion criteria

Inclusion criteria	**Exclusion criteria**
• Hospital contracted infections, MRSA, MRSA infection prevention, MRSA infection control, patient education. • Data written between the year 2006-2024 • Language of search: Both English and/or Finnish • Data collected from: Academic Journals and Articles • Nursing related • Full text only • Free full text and open access	• Other types of infections • Old data • Data that was written in other languages • Data that was not full text • Data that was not free of charge

The content search was done with keywords combination in the search engines using "AND" and/or "OR".
The keyword search used for this for this study was; MRSA prevention AND hospital infections or hospital acquired infections AND patient education or knowledge on ***PubMed***. MRSA AND MRSA prevention AND hospital infections AND patient education on ***PubMed Central***. MRSA prevention AND hospital infections AND patient education (*n=3,360*), MRSA prevention patient education (*n=3744*) on ***ScienceDirect***. MRSA prevention AND patient education (n=58), MRSA prevention AND hygiene (*n=285*) on *EBSCOhost*. MRSA prevention AND nursing role (*n=17*), MRSA prevention AND patient education (*n=58*) on

CINAHL. The amount gotten from each separate keyword on the same database has been combined in the flow chart.

Figure 1: Research flow chart



For this study we collected as much articles as possible and we screened among them to collect only the articles that are relevant to our topic and to our study aim as the focus of the study is to promote health by preventing and controlling the infection from spreading and patient education and chose articles that are relevant to the study.

As displayed on *Table 2*, the majority of the chosen articles are based on MRSA itself and its prevention and control, followed by their sub-categories, patient education and nurse's role. And the data collection of chosen articles has been partly collected through the result of these subtitles search results.

5.2 Data Analysis

According to Braun & Clarke (2006) Thematic analysis is a method of analysing data that consist of identifying, analysing and reporting founded themes and patterns within the

collected data and it is a tool used to interpret, organise and describe the data; and is qualitative research; Therefore, it has been utilized for this study.

After doing our research and data collection we screened and code our found data through which we chose our sources for our study.

The choice of data for this study has been based firstly on our inclusion and exclusion criteria and followed by its content.

The analysis was made by firstly reading the title and sub-titles of the article and the abstract of the article and only the articles that met the requirements was maintained.

During the collection and analysing of our sources, our research question and always in consideration and only articles that answered to our research question and to the purpose of this study was retained.

Table 2: Presentation of chosen articles

	Author	Title	Source
1	Mody, L., Gontjes, K. J., Cassone, M., Gibson, K. E., Lansing, B. J., Mantey, J., … Min, L. (2021).	Effectiveness of a Multicomponent Intervention to Reduce Multidrug-Resistant Organisms in Nursing Homes. *JAMA Network Open*, *4*(7), e2116555. https://doi.org/10.1001/jamanetworkopen.2021.16555	PubMed
2	Huang, S. S., Singh, R., McKinnell, J. A., Park, S., Gombosev, A., Eells, S. J., … Peterson, E. (2019)	Decolonization to Reduce Postdischarge Infection Risk among MRSA Carriers. *The New England Journal of Medicine*, *380*(7), 638–650. https://doi.org/10.1056/NEJMoa1716771	PubMed
3	Noble, D. B. (2009)	Patient Education on MRSA Prevention and Management: The Nurse's Vital Role. *MEDSURG Nursing*, *18*(6), 375–378.	EBSCOhost
4	Romero, D. V., Treston, J., & O'Sullivan, A. L. (2006)	HAND-TO-HAND COMBAT: Preventing MRSA. *The Nurse Practitioner*, *31*(3), 16–23.	EBSCOhost
5	Schultz, M. (2010)	Methicillin-resistant Staphylococcus aureus (MRSA): what the nurse should know. *Professional Nursing Today (PROF NURS TODAY)*, *14*(5), 12–14	CINAHL
6	Robinson, J., Edgley, A., & Morrell, J. (2014)	MRSA care in the community: why patient education matters. *British Journal of Community Nursing*, *19*(9), 436–441	CINAHL
7	Donskey, C. J. (2023)	Empowering patients to prevent healthcare-associated infections. *American Journal of Infection Control*, *51*(11), A107–A113	ScienceDirect
8	Hammoud, S., Amer, F., Lohner, S., & Kocsis, B. (2020)	Patient education on infection control: A systematic review. *American Journal of Infection Control*, *48*(12).	ScienceDirect
9	Miller, L. G., Singh, R., Eells, S. J., Gillen, D., McKinnell, J. A., Park, S., … Launer, B. (2022)	Chlorhexidine and Mupirocin for Clearance of Methicillin-Resistant Staphylococcus aureus Colonization After Hospital Discharge: A Secondary Analysis of the Changing Lives by Eradicating Antibiotic Resistance Trial. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*, *76*(3), e1208–e1216	PubMed
10	Cluzet, V., Gerber, J. S., Metlay, J. P., Nachamkin, I., Zaoutis, T. E., Davis, M. F., … Fishman, N. O. (2016).	The Effect of Total Household Decolonization on Clearance of Colonization With Methicillin-Resistant *Staphylococcus aureus*. *Infection Control and Hospital Epidemiology*, *37*(10), 1226–1233.	PubMed

11	Popovich, K. J., Aureden, K., Ham, D. C., Harris, A. D., Hessels, A. J., Huang, S. S., … Calfee, D. P. (2023)	SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update. *Infection Control & Hospital Epidemiology*, *44*(7), 1–29.	PubMed Central
12	Smith, P. W., Bennett, G., Bradley, S., Drinka, P., Lautenbach, E., Marx, J., Stevenson, K. (2008).	SHEA/APIC Guideline: Infection prevention and control in the long-term care facility. *American Journal of Infection Control*, *36*(7), 504–535.	PubMed Central
13	Chan, R., Fung, S., Chan, S., Chau, K., Yim, M., Li, M., … Tze, Y. (2013).	P164: Survey on patients' perception of methicillin-resistant Staphylococcus aureus (MRSA) prevention and control. *Antimicrobial Resistance and Infection Control*, *2*(S1). https://doi.org/10.1186/2047-2994-2-s1-p164	PubMed Central
14	Kilpatrick, M., Hutchinson, A., Manias, E., & Bouchoucha, S. L. (2021).	Paediatric nurses', children's and parents' adherence to infection prevention and control and knowledge of antimicrobial stewardship: A systematic review. *American Journal of Infection Control*, *49*(5), 622–639.	ScienceDirect
15	Kramer, T. S., Schröder, C., Behnke, M., Aghdassi, S. J., Geffers, C., Gastmeier, P., & Remschmidt, C. (2019).	Decrease of methicillin resistance in Staphylococcus aureus in nosocomial infections in Germany–a prospective analysis over 10 years. *Journal of Infection*, *78*(3), 215–219. https://doi.org/10.1016/j.jinf.2018.12.005	PubMed
16	Roghmann MC, Johnson JK, Sorkin JD, Langenberg P, Lydecker A, Sorace B, Levy L, Mody L. (2015)	Transmission of Methicillin-Resistant Staphylococcus aureus (MRSA) to Healthcare Worker Gowns and Gloves During Care of Nursing Home Residents. *Infection Control & Hospital Epidemiology*, *36*(9), 1050–1057.	PubMed
17	Gastmeier, P., Schwab, F., Behnke, M., & Geffers, C. (2012)	Decreasing healthcare-associated infections (HAI) is an efficient method to decrease healthcare-associated Methicillin-resistant S.aureus (MRSA) infections antimicrobial resistance data from the German national nosocomial surveillance system KISS. *Antimicrobial Resistance and Infection Control*, *1*(1), 3. https://doi.org/10.1186/2047-2994-1-3	PubMed
18	Humphreys, H., Grundmann, H., Skov, R., Lucet, J.-C. ., & Cauda, R. (2009)	Prevention and control of methicillin-resistant Staphylococcus aureus. *Clinical Microbiology and Infection*, *15*(2), 120–124. https://doi.org/10.1111/j.1469-0691.2009.02699.x	ScienceDirect
19	Gerlich, M. G., Piegsa, J., Schäfer, C., Hübner, N.-O., Wilke, F., Reuter, S., … Hoffmann, W. (2015)	Improving hospital hygiene to reduce the impact of multidrug-resistant organisms in health care–a prospective controlled multicenter study. *BMC Infectious Diseases*, *15*(1). https://doi.org/10.1186/s12879-015-1184-5	EBSCOhost
20	Alspach, G. (2008)	Protecting Your Patients, Colleagues, Family, and Yourself From Infection: First Wash. *Critical Care Nurse*, *28*(1), 7–12. https://doi.org/10.4037/ccn2008.28.1.7	EBSCOhost
21	Coia, J. E., Wilson, J. A., Bak, A., Marsden, G. L., Shimonovich, M., Loveday, H. P., … Wilson, A. P. R. (2021).	Joint Healthcare Infection Society (HIS) and Infection Prevention Society (IPS) guidelines for the prevention and control of meticillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities. *Journal of Hospital Infection*, *118*. https://doi.org/10.1016/j.jhin.2021.09.022	PubMed

We have established the themes, categories and sub-categories and created a new table, *Table 3*, based on the collection in *Table 2*. The table helped is to identify the key elements in the prevention and control of MRSA infection.

Table 3: Theme, categories, and sub-categories used for result section.

Theme	MRSA Prevention in Hospital Setting			
Major categories	Prevention methods.	Nursing role	Hygiene	Patient education
Minor categories	MRSA infection, prevention tools, patient background, control policies, guideline, education, awareness, hand hygiene	Education, communication, instruction, protection, guideline, health promotion, hygiene, awareness, health promotion, hand hygiene	Hand hygiene, personal hygiene, health promotion, education, awareness, empowerment	Guideline, literacy, patient & family, awareness, health promotion, education, hygiene, awareness, hand hygiene
Unit of analysis	*1,2,3,4,5,7,9,10,11,12,14,15,16,17,18,21*	*1,2,3,4,5,6,11,12,14, 15,18,20,21*	*1,4,5,7,16,18,19,20,21*	*1,2,3,4,7,8,9,10,11,12,13,14,15,16,18,21*

6 ETHICAL CONSIDERATIONS

According to the Cambridge Dictionary, the word Ethics is described as an established system of commonly agreed beliefs that should be followed. Ethics are based upon morals; therefore, it influences, guides and/or controls its believer's actions and behaviours. Morals are also described in the same dictionary as a standard or a way of behaving that is considered by the majority of people as good or bad. It is related to the standard of good behaviour, being fair, being correct, transparent and honest.

This study has been conducted and written ethically according to our university guidelines on scientific writings. This was ensured by not using other people's work without citing them

and showing where the work used was found. We also make sure to not plagiarize by paraphrasing someone else's content into our own words and mentioning them as reference. We also remained unbiased on the subject and wrote only things that are relevant and supported by reliable sources.
Articles that have been used in this study have been acquired though scientific databases.

7 RESULTS

MRSA is virulent and opportunistic pathogens which evolves and has shown resistant against wide number of antibiotics. Because MRSA is becoming more resistant to numerous antibiotics, it is imperative to explore alternative methods to mitigate both economic and human losses (Zhen *et al.*, 2020). Our findings are derived from the collected data presented in *Table 2.* The aim of this chapter is to present what we found from deeply analysing them.

7.1 MRSA Prevention Methods:

To be able to identify the prevention methods we need to understand the mode of transmission of MRSA. Numerous reports have suggested the most common outbreak of MRSA in hospital setting is patient-to-patient. Here we present the routes and causes of transmission from our findings [4],[7],[11],[12],[18],[19],[20],[21]:

Table 4: Routes and Causes of MRSA transmission

Routes and Causes of MRSA transmission
Contaminated hands/skin contact of staff/visitors/patients
Septic lesions and wounds
Body fluids and droplets from vigorous coughing, sneezing etc.
Contaminated hospital equipment
Beds, garments, towels etc.
Environmental surfaces (door, handles)
Personal protective equipment (gloves, gowns etc)
Healthcare wastes
Patient movement and transfer without precautions

The common approaches of preventing and controlling MRSA are adopting hand hygiene, isolation/cohorting, environmental decontamination, passing knowledge during patient transfers/discharges, decolonization of patients and health personnels. [18]

Infection Prevention Society (IPS) and Joint Healthcare Infection Society (HIS) guidelines for the prevention and control of MRSA in healthcare facilities. The detailed recommendations are categorized under Patient Screening, Staff screening and Management, Decolonization therapy, Environment sampling and cleaning/disinfection, Surveillance, Isolation/chortling, Patient transfer and transport, Shared equipment, Patient information, Handling deceased and Antibiotic stewardship. [4], [21].

In terms of patient information, it's important to ensure patients understand why MRSA screening and decolonization are necessary, and to promptly inform them of screening results. Patients should also grasp the distinction between colonization and infection, understand the nature of microorganisms, how MRSA is acquired, transmitted, and treated, and the rationale behind contact precautions or isolation measures. Upon discharge, both patients and household members should be aware of the risks of transmitting MRSA to others, and patients should be educated about the potential for recolonization and the significance of maintaining good hygiene practices. [9]

While performing the overall preventive measures against the Hospital Associate Infections (HAI), the collective incidence rate of nosocomial MRSA infection experienced a marked decrease alongside a proportional reduction in HAIs during the analysis of data over the period of 10 years. [15],[17], [19]

There has been tremendous effort in building the practice recommendation for preventing MRSA transmission and infection in hospital settings. Similar recommendations including additional alert systems are placed under essential practices for prevention of MRSA in acute-care hospitals [11]. Multicomponent intervention trial which included enhanced barrier precaution for high-risk patients, surveillance, chlorhexidine bathing, environmental cleaning, hand hygiene promotion and health workers education and their feedback found the reduced prevalence of hospital associated infection [1]. Another trial which included decolonization

followed by patient education helped reduce post-discharge infection risk among MRSA carriers [2].

7.2 Nurses Role

Patient-to-patient transmission of MRSA is believed to be primarily mediated by health care workers via direct and indirect contact. Therefore, all health care workers including nurses should maintain the utmost hygiene. For example, hand hygiene is most important as hand is used for personal interaction, administering drugs and foods, medical diagnosis, or placement of manipulation of indwelling devices etc. MRSA can be transferred to health worker gowns and gloves during the care of residents [16]. Standard protocols of hand washing, wearing gloves, disinfecting environment etc. should be followed to minimize the spread. [4]
We found that hands can be easily contaminated even if the care giver is wearing gloves for example after treating wounds or being in contact with body fluids or just after caring for a patient in general. It is still recommended to preform hand hygiene after removing gloves. [5]
Because MRSA infection can be transmitted on surfaces and all-round the patients such as on bedsheets, patient's clothes and towels etc.; It is the nurse and other hospital staff such as cleaning personnel for example who are responsible of making sure that the patient environment is clean [6].
MRSA may be transmitted from the nurses and health workers who are colonized or a carrier of the microorganisms. Health workers are colonized if the anterior nares or perianal skin swabs contains MRSA [16]. Decolonization of MRSA in nurses or healthcare workers should be done.
There are situations when the MRSA infected patient is isolated, the approach of cohorting is important. So, the nurses charting and communication among the nursing team also plays the crucial role, and it inhibits the spread or transmission within the hospital environment [11].
One effective program could be antimicrobial stewardship for nurses that entails a coordinated initiative aimed at encouraging the proper utilization of antimicrobial substances, which includes antibiotics, to enhance patient results, mitigate microbial resistance, and curb the transmission of infections caused by multidrug-resistant organisms like MRSA.
It has been shown that there are consistent gaps in nurses' adherence to infection prevention and control principles, with modest improvements observed through educational interventions. Additionally, consumers' role in infection prevention, along with nurses' and consumers' perspectives on antimicrobial stewardship, revealing misconceptions and barriers that warrant attention should be emphasized [14].

7.3 Hygiene

Hands serve as the means through which numerous tasks are carried out in clinical practice by healthcare personnel, patients, patients' relatives, and visitors. Common use cases are facilitating interactions with the physical environment, personal interactions such as shaking hands and comforting patients or relatives, diagnostic procedures like palpation and percussion, administration of food and medications, placement and manipulation of indwelling devices such as catheters, and performing hygiene-related tasks such as washing and cleaning [5]. Key 5 movements of hand to improve the hand hygiene of a health personnel (Safety and Organization, 2009) and patients (Rai *et al.*, 2017) are important to prevent the spread of infection.

Improvement in hand hygiene has been linked to the reduction in the occurrence of infections acquired in hospitals, including MRSA infections. [20]

A program was developed few years ago by Maryanne McGuckin that consists of not only empowering patients but also acted as a reminder to health-care personnel to mind their hand hygiene by firstly educating patients on the importance of hand hygiene and were encouraged to be vocal about it by asking care providers if they had performed hand hygiene before coming to theme. And because of this it was reported that there was a large increase in hand washing even among care providers. [7]

Patients who are colonised or infected with infections such as MRSA infection, often have contaminated hand and therefore can easily contaminated and spread infection pathogens around them and to anyone they may have close physical contact with. [4], [6]

We found that educated patients have a more positive hand hygiene culture. And we found also that hand hygiene with alcohol hand sanitizer paired with hand washing with soap and water is more effective in hand decontamination. [7]

Also, a simple reminder from the nurse, other care givers or other hospital staff to the patient can also be effective in encouraging the patient to perform hand hygiene. In additional it is also important to make hand hygiene products more accessible to the patient and inform about them as well. [7]

Also, a demonstration of techniques on how to properly perform hand washing can be and having the patient repeat the demonstration may be helpful and effective.[4]

7.4 Patient Education

The key to prevent and control of the infection is the practice of hygiene and education plays the pivotal role in this process. Because of the minimal provision of patient education and

awareness in hospitals regarding infection control, there is big necessity for increased focus on involving patient and potentially the family members in educational efforts. [8]
A study conducted in acute care regional hospital among the patients shows that more than 40 percent did not know about MRSA and general knowledge about the pathogens, communication mode and prevention mode was low. More than 60 % of interviewed patient did not consider visitor and family member's role are extremely important in MRSA control. But the patients were keen to know about MRSA transmission and prevention. [13]
Patient education, incorporating hygiene practices such as hand hygiene, avoidance of sharing towels, regular laundering of linens and towels, alongside decolonization efforts and reminders, contributed to a reduction in the time required for MRSA clearance [10]. Thus, patient education along with decolonization was more effective preventing and spreading the MRSA in families and relatives.
One of the methods of patient empowerment is disseminated via information sharing. Patient empowerment can be realized on Information on MRSA prevention and control could be the useful tool to diminish infection control. Survey suggested that the MRSA infected patients are interested to information on infection prevention and control [13].

Although when it comes to infection prevention the focus is mostly laid upon the professionals who should know how to follow the hospital or ward's guidelines, we found that patients can participate better in the care if they have received enough information on their condition and about the infection itself and how it can affect others.
Patient education is one of the nurse's job or task and it is one of the most effective ways to impower and raise patient's awareness on the infection and its way of acquisition and dissemination, hence the patient will know how to behave accordingly to their situation.[3],[7].
It is found that effective treatment is better achieved when providing adequate information to patients and patients are more able to adhere to the care when they have a better understanding of the treatment. [6]

8 DISCUSSION

This chapter discuss the conclusion of our founded results, how it is linked to our nursing theory and strengths, limitations and some recommendations we found while doing this study.

As it was shown in previews chapters that MRSA is an infection that can spread from person to person, from A person to his surrounding environment also it can also be shedding into the air as it is the case for patients who has MRSA on the skin *(Robinson, Edgley & Morrell; 2014)*. Therefore, when choosing of a theory for this study the theory of Self-care by Dorothy Orem was founded useful.

In the article *Self-care: A Foundational Science (2001),* Orem and the other authors want us to understand that when it's comes to self-care human beings are also both the focus of their own actions and also the agents of their actions.

According to *Self-care: A Foundational Science (2001),* there are three main elements to the selfcare theory. The first being **self-care requisite** which are the factors that enable the person to perform self-care and it requires evidence about one's stats of human functioning and development and elements that influence them such as health state and age. The second element of the theory is **self-care agency** which is the ability of the person to engage in their own self-care and third the act of **self-care** itself. *(Denyes, Orem & Bekel, 2001)*

When it's comes to infection prevention, the patient also has a role to play in first of all so that they can avoid getting re-contaminated or contaminate others such as health care personnel and their visitors by simple things such as minding they own environment, minding their personal hygiene and cleanliness, for those who are capable to do it; following the instruction given by caregivers and also protecting their families and loved ones by informing them to protect themselves when visiting for example. However, studies shows that patients are more willing to adhere to the care when they understand the situation, the disease and it's impacted and how it can affect or/and contaminate to others. *(Romero,Treston & O'Sullivan, 2006); (Robinson, Edgley & Morrell; 2014)*

Also, it has been found that a nurse has such a vital role in preventing the infection from spreading both by following the guidelines and precautions and by educating the patient and their family/visitors upon the subject. *(Robinson, Edgley & Morrell; 2014); (Donskey, C. J. 2023)*

However, the challenge is that most patients have limited understanding of their condition or disease, therefore they have less awareness of acquisition, prevention and dissemination of hospital acquired infections such as MRSA and often have received quite limited information on how they can participate in the care to combat and prevent infections. *(Donskey, C. J. 2023)*

Also, we realise that nurses has a vital role in preventing MRSA infection from spreading also to other patients by using appropriate precautions such as using appropriate Personal Protective Equipment, using gloves and having a good hand hygiene as we realise that nurses typically have contacts also with other patients and they also have contact with other health care personal and colleagues. *(Noble, D. B. 2009); (Romero,Treston & O'Sullivan, 2006); (Schultz, M. 2010)*

As previously mentioned, patient education is quite important because we found out that although we found that it's also the nurse's role also to educate MRSA patient's visitors on MRSA infection and why they should protect themselves; Sometimes the nurse may not be present when the patient's visitor arrives, patients who have been educated on the infection can also be able communicate the information to their loved ones.

In combat against MRSA infection nurses and other personnel are very important therefore their education on the infection itself and what procedures to take and follow is very valuable. (*Schultz, M. 2010)*

Moreover, another challenge we found is that often even after the patient being educated on MRSA infection and are aware of the measure to take such have hand hygiene and personal hygiene, often times in hospital settings they may fail to recognise personal or just hygiene products such as soap, hand disinfectant and clean towels; And sometimes they may not be easily accessible or even foreign and difficult to use for patients. *(Donskey, C. J. 2023)*

We also realised that the MRSA infected patient environment should be also taken into consideration. Contrary to community-associated MRSA where the patients are being treated in the community, at home or nursing homes where often the patient have to manage their environment by themselves or hire help which can sometimes be a challenge to keep the environment clean and less contaminated; In hospital the patient environment is more easily managed and controlled; As usually hospitals and wards have cleaning personnels who insure of the cleanliness and sterilisation of rooms and surfaces. Also, patient's overall hygiene can be more efficient and controlled in hospital settings because there are all the time nurses around to perform basic care and recommend showering and can easily provide to patients clean towel, clothes and bedlinen for example. *(Romero,Treston & O'Sullivan, 2006);*

(Robinson, Edgley & Morrell; 2014)

In addition to patient education and the roles played by nurses in preventing MRSA, effective prevention requires coordinated efforts and collaboration among various stakeholders. Our research primarily focuses on the perspectives of patients and nurses regarding MRSA prevention. The comprehensive approach to preventing MRSA from all possible angles is still under investigation, as no guidelines or processes have been conclusively proven to entirely prevent MRSA outbreaks in hospital settings. However, we have referenced several pieces of evidence where patient education and nurse interventions have contributed to controlling or preventing MRSA to a certain extent in hospital settings. We believe that our results will contribute to improving the effectiveness of efforts to restrain the spread of MRSA infection. Studying the implementation and effectiveness of these findings within hospital settings could be a focus for future research work.

9 CONCLUSION

As seen in previews chapters MRSA is an infection that can spread easily and although patient education is essential in infection prevention, it is also just one part or one way of prevention in its whole. Actions such as being clean and taking care of our overall cleanness and our environment cleanness paired together with growth in awareness and educating ourselves as individual and others as a society is already a big step into good health, self-care and health promotion; as it is defined by the World Health Organisation (WHO), health is an association of both physical, mental and emotional wellbeing and not just a lack of sicknesses, afflictions and infirmities.

Here are some guidelines and recommendations that we collected for patients and nurse during our study:

We encourage is patient to be active in their care by asking more information about their condition and educate themselves on it. Also, we want to remind patients to take care of their hygiene by frequently showering, washing and disinfecting hands, and to maintain a clean environment around them.

We also want to encourage nurses to following hospital/ward guidelines for MRSA infection, to educate patients on MRSA infection, to perform hand hygiene and promote cleanliness and remember to protect themselves and others by wearing person protective equipment. [4], [5], [6],[11], [12].

10 REFERENCES

Chan, R.F.Y. et al. (2013) 'P164: Survey on patients' perception of methicillin-resistant Staphylococcus aureus (MRSA) prevention and control', Antimicrobial Resistance and Infection Control, 2. Available at: https://doi.org/10.1186/2047-2994-2-S1-P164.

Monegro AF, Muppidi V and Regunath H (2024) Hospital-Acquired Infections - Books - NCBI, StatPearls. Available at: https://www.ncbi.nlm.nih.gov/books?term=Hospital-Acquired%20Infections (Accessed: 26 March 2024).

Popovich, K.J. et al. (2023) 'SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update', Infection Control & Hospital Epidemiology. 2023/06/29, 44(7), pp. 1039–1067. Available at: https://doi.org/DOI: 10.1017/ice.2023.102.

Rai, H. et al. (2017) 'A randomized trial to determine the impact of a 5 moments for patient hand hygiene educational intervention on patient hand hygiene', American Journal of Infection Control, 45(5), pp. 551–553. Available at: https://doi.org/https://doi.org/10.1016/j.ajic.2016.12.022.

Revelas, A. (2012) 'Healthcare - associated infections: A public health problem', Nigerian Medical Journal, 53(2), p. 59. Available at: https://doi.org/10.4103/0300-1652.103543.

Safety, W.H.O.P. and Organization, W.H. (2009) A guide to the implementation of the WHO multimodal hand hygiene improvement strategy. World Health Organization.

Turner, N.A. et al. (2019) 'Methicillin-resistant Staphylococcus aureus: an overview of basic and clinical research', Nature Reviews Microbiology, 17(4), pp. 203–218. Available at: https://doi.org/10.1038/s41579-018-0147-4.

Vincent, J.L. et al. (2020) 'Prevalence and Outcomes of Infection among Patients in Intensive Care Units in 2017', JAMA - Journal of the American Medical Association, 323(15), pp. 1478–1487. Available at: https://doi.org/10.1001/jama.2020.2717.

Huang SS, Septimus E, Kleinman K, Moody J, Hickok J, Avery TR, 'et AL'. (2013). Targeted versus Universal Decolonization to Prevent ICU Infection. N Engl J Med, 368(24):2255-2265.

Liu C, Bayer A, Cosgrove SE, Daum RS, Fridkin SK, Gorwitz RJ 'et al'. (2011). Clinical practice guidelines by the Infectious Disease Society of America for the treatment of methicillin-resistant staphylococcus aureus infections in adults and children. Clin Infect Dis, 52(3):e18-e55.

Euroopan komission täytäntöönpanopäätös 2018/945 epidemiologisen seurannan piiriin kuuluvista tartuntataudeista ja erityisistä terveysasioista ja asian kannalta merkityksellisistä tapausmäärittelyistä. https://eur-lex.europa.eu/legal-content/FI/TXT/PDF/?uri=CELEX:32018D0945&from=EN

Ahn, E., & Kang, H. (2018). Introduction to systematic review and meta-analysis. Korean Journal of Anesthesiology, 71(2), 103–112. NCBI. Retrieved from NCBI.

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Huang SS, Singh R, McKinnell JA, Park S, Gombosev A, Eells SJ, Gillen DL, Kim D, Rashid S, Macias-Gil R, Bolaris MA, Tjoa T, Cao C, Hong SS, Lequieu J, Cui E, Chang J, He J, Evans K, Peterson E, Simpson G, Robinson P, Choi C, Bailey CC Jr, Leo JD, Amin A, Goldmann D, Jernigan JA, Platt R, Septimus E, Weinstein RA, Hayden MK, Miller LG; Project CLEAR Trial. Decolonization to Reduce Post discharge Infection Risk among MRSA Carriers. N Engl J Med. 2019 Feb 14;380(7):638-650. doi: 10.1056/NEJMoa1716771. PMID: 30763195; PMCID: PMC6475519.

D.D Sapam, H Lamnunnem, L Ringkangmai; international Journal of Innovative Science and Research Technology: Applicability of Orem's Self-Care Theory to Practice – A Narrative Review, (September – 2023), Volume 8, Issue 9, ISSN No:-2456-2165

Cambridge University Press. (n.d.). Cambridge dictionary. Retrieved March 29, 2024, from Cambridge Dictionary website: https://dictionary.cambridge.org/

Denyes, M. J., Orem, D. E., & Bekel, G. (2001). Self-Care: A Foundational Science. Nursing Science Quarterly, 14(1), 48–54. https://doi.org/10.1177/089431840101400113

Bhaskar, S. B., & Manjuladevi, M. (2016). Methodology for research II. Indian Journal of Anaesthesia, 60(9), 646–651. NCBI. https://doi.org/10.4103/0019-5049.190620

Luft, J. A., Jeong, S., Idsardi, R., & Gardner, G. (2022). Literature reviews, theoretical frameworks, and conceptual frameworks: An introduction for new biology education Researchers. CBE—Life Sciences Education, 21(3). https://doi.org/10.1187/cbe.21-05-0134

Zhen, X., Lundborg, C.S., Zhang, M. et al. Clinical and economic impact of methicillin-resistant Staphylococcus aureus: a multicentre study in China. Sci Rep ***10****, 3900 (2020).* *https://doi.org/10.1038/s41598-020-60825-6*

Mody, L., Gontjes, K. J., Cassone, M., Gibson, K. E., Lansing, B. J., Mantey, J., … Min, L. (2021). Effectiveness of a Multicomponent Intervention to Reduce Multidrug-Resistant Organisms in Nursing Homes. JAMA Network Open, 4(7), e2116555. *https://doi.org/10.1001/jamanetworkopen.2021.16555*

Huang, S. S., Singh, R., McKinnell, J. A., Park, S., Gombosev, A., Eells, S. J., … Peterson, E. (2019). Decolonization to Reduce Postdischarge Infection Risk among MRSA Carriers. The New England Journal of Medicine, 380(7), 638–650. *https://doi.org/10.1056/NEJMoa1716771*

Noble, D. B. (2009). Patient Education on MRSA Prevention and Management: The Nurse's Vital Role. MEDSURG Nursing, 18(6), 375–378. EBSCOhost . Retrieved from EBSCOhost .

Romero, D. V., Treston, J., & O'Sullivan, A. L. (2006). HAND-TO-HAND COMBAT: Preventing MRSA. The Nurse Practitioner, 31(3), 16–23. *https://doi.org/10.1097/00006205-200603000-00006*

Schultz, M. (2010). Methicillin-resistant Staphylococcus aureus (MRSA): what the nurse should know. Professional Nursing Today (PROF NURS TODAY), 14(5), 12–14. Retrieved from https://web-p-ebscohost-com.ezproxy.arcada.fi:2443/ehost/detail/detail?vid=0&sid=43ae3f23-42af-4141-b030-bbaacf70cd04%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=104143155&db=ccm

Robinson, J., Edgley, A., & Morrell, J. (2014). MRSA care in the community: why patient education matters. British Journal of Community Nursing, 19(9), 436–441. *https://doi.org/10.12968/bjcn.2014.19.9.436*

Donskey, C. J. (2023). Empowering patients to prevent healthcare-associated infections. American Journal of Infection Control, 51(11), A107–A113. *https://doi.org/10.1016/j.ajic.2023.03.008*

Hammoud, S., Amer, F., Lohner, S., & Kocsis, B. (2020). Patient education on infection control: A systematic review. American Journal of Infection Control, 48(12). *https://doi.org/10.1016/j.ajic.2020.05.039*

Miller, L. G., Singh, R., Eells, S. J., Gillen, D., McKinnell, J. A., Park, S., … Launer, B. (2022b). Chlorhexidine and Mupirocin for Clearance of Methicillin Resistant Staphylococcus aureus Colonization After Hospital Discharge: A Secondary Analysis

of the CLEAR Trial. Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America, 76(3), ciac402. https://doi.org/10.1093/cid/ciac402

Cluzet, V., Gerber, J. S., Metlay, J. P., Nachamkin, I., Zaoutis, T. E., Davis, M. F., … Fishman, N. O. (2016). The Effect of Total Household Decolonization on Clearance of Colonization with Methicillin-Resistant Staphylococcus aureus. Infection Control and Hospital Epidemiology, 37(10), 1226–1233. https://doi.org/10.1017/ice.2016.138

Popovich, K. J., Aureden, K., Ham, D. C., Harris, A. D., Hessels, A. J., Huang, S. S., … Calfee, D. P. (2023). SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update. Infection Control & Hospital Epidemiology, 44(7), 1–29. https://doi.org/10.1017/ice.2023.102

Smith, P. W., Bennett, G., Bradley, S., Drinka, P., Lautenbach, E., Marx, J., … Stevenson, K. (2008). SHEA/APIC Guideline: Infection prevention and control in the long-term care facility. American Journal of Infection Control, 36(7), 504–535. https://doi.org/10.1016/j.ajic.2008.06.001

Chan, R., Fung, S., Chan, S., Chau, K., Yim, M., Li, M., … Tze, Y. (2013). P164: Survey on patients' perception of methicillin-resistant Staphylococcus aureus (MRSA) prevention and control. Antimicrobial Resistance and Infection Control, 2(S1). https://doi.org/10.1186/2047-2994-2-s1-p164

Kilpatrick, M., Hutchinson, A., Manias, E., & Bouchoucha, S. L. (2021). Paediatric nurses', children's and parents' adherence to infection prevention and control and knowledge of antimicrobial stewardship: A systematic review. American Journal of Infection Control, 49(5), 622–639. https://doi.org/10.1016/j.ajic.2020.11.025

Kramer, T. S., Schröder, C., Behnke, M., Aghdassi, S. J., Geffers, C., Gastmeier, P., & Remschmidt, C. (2019). Decrease of methicillin resistance in Staphylococcus aureus in nosocomial infections in Germany–a prospective analysis over 10 years. Journal of Infection, 78(3), 215–219. https://doi.org/10.1016/j.jinf.2018.12.005

Roghmann, M.-C., Johnson, J. K., Sorkin, J. D., Langenberg, P., Lydecker, A., Sorace, B., … Mody, L. (2015). Transmission of Methicillin-Resistant Staphylococcus aureus (MRSA) to Healthcare Worker Gowns and Gloves During Care of Nursing Home Residents. Infection Control & Hospital Epidemiology, 36(9), 1050–1057. https://doi.org/10.1017/ice.2015.119

Gastmeier, P., Schwab, F., Behnke, M., & Geffers, C. (2012). Decreasing healthcare-associated infections (HAI) is an efficient method to decrease healthcare-associated Methicillin-resistant S.aureus (MRSA) infections Antimicrobial resistance data from

the German national nosocomial surveillance system KISS. Antimicrobial Resistance and Infection Control, 1(1), 3. https://doi.org/10.1186/2047-2994-1-3

Humphreys, H., Grundmann, H., Skov, R., Lucet, J.-C. ., & Cauda, R. (2009). Prevention and control of methicillin-resistant Staphylococcus aureus. Clinical Microbiology and Infection, 15(2), 120–124. https://doi.org/10.1111/j.1469-0691.2009.02699.x

Gerlich, M. G., Piegsa, J., Schäfer, C., Hübner, N.-O., Wilke, F., Reuter, S., … Hoffmann, W. (2015). Improving hospital hygiene to reduce the impact of multidrug-resistant organisms in health care–a prospective controlled multicenter study. BMC Infectious Diseases, 15(1). https://doi.org/10.1186/s12879-015-1184-5

Alspach, G. (2008). Protecting Your Patients, Colleagues, Family, and Yourself From Infection: First Wash. Critical Care Nurse, 28(1), 7–12. https://doi.org/10.4037/ccn2008.28.1.7

Coia, J. E., Wilson, J. A., Bak, A., Marsden, G. L., Shimonovich, M., Loveday, H. P., … Wilson, A. P. R. (2021). Joint Healthcare Infection Society (HIS) and Infection Prevention Society (IPS) guidelines for the prevention and control of meticillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities. Journal of Hospital Infection, 118(S1–S39). https://doi.org/10.1016/j.jhin.2021.09.022

Murray C et al. Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis [published correction appears in Lancet. 2022 Oct 1;400(10358):1102. doi: 10.1016/S0140-6736(21)02653-2]. Lancet. 2022;399(10325):629-655. doi:10.1016/S0140-6736(21)02724-0

WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge Clean Care Is Safer Care. Geneva: World Health Organization; 2009. 21, The WHO Multimodal Hand Hygiene Improvement Strategy. Available from: https://www.ncbi.nlm.nih.gov/books/NBK144032/

Derek F. J. Brown, Detection of methicillin/oxacillin resistance in staphylococci, Journal of Antimicrobial Chemotherapy, Volume 48, Issue suppl_1, July 2001, Pages 65–70, https://doi.org/10.1093/jac/48.suppl_1.65

Shoaib M, Aqib AI, Muzammil I, Majeed N, Bhutta ZA, Kulyar MF, Fatima M, Zaheer CF, Muneer A, Murtaza M, Kashif M, Shafqat F, Pu W. MRSA compendium of epidemiology, transmission, pathophysiology, treatment, and prevention within one health framework. Front Microbiol. 2023 Jan 10;13:1067284. doi: 10.3389/fmicb.2022.1067284. PMID: 36704547; PMCID: PMC9871788.