EARLY IDENTIFICATION OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS IN HOSPITALIZED PATIENTS USING THE MRSA RISK FACTOR ASSESSMENT TOOL

By

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STATEMENT BY AUTHOR

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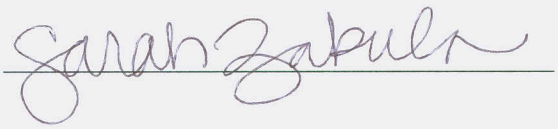
Signed: 

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Abstract

The purpose of this project was to develop an evidence-based assessment tool to improve early detection of Methicillin Resistant Staphylococcus Aureus (MRSA) among hospitalized patients and to plan the implementation and evaluation of this tool. MRSA is a potentially deadly bacteria that is highly transmissible in the acute care setting. Existing protocols for initiating personal protective equipment may be inadequate for early detection, resulting in increased risk of transmission and delayed treatment. The five-item MRSA Risk Factor Assessment Tool is efficient (less than five minutes to complete), and utilizes a simple checklist format. The MRSA Risk Factor Assessment Tool was evaluated by a panel of infection control and bedside nurses for practicality and likeliness for use. Proposed implementation and evaluation plans are described.

CHAPTER ONE

Background

The purpose of this project is to develop a new assessment tool to improve early detection of Methicillin-Resistant *Staphylococcus aureus* (MRSA) among hospitalized patients and to present a plan for its implementation and evaluation. Each year, thousands of patients acquire an infectious disease while in the hospital, despite implementation of personal protective equipment (PPE). One important factor for the failure of existing protocols may be the delayed identification of patients with MRSA. This has been noted by providers first-hand on more than one occasion. One common example is a patient who receives care for several days before being diagnosed with MRSA and placed on contact precautions. Another example is when a patient is admitted and in taking the patient's medical history, it is missed that the patient had been treated for MRSA in the past. This delay in MRSA risk identification is unnecessary and puts other patients at risk. To prevent these kinds of mishaps in the healthcare setting, healthcare workers need to take a more judicial approach to infection control. That is, assuming all patients are infected with MRSA until MRSA culture results are negative.

This chapter will present the significance of the MRSA, the purpose of the project, clinical research questions that guided the project, the theoretical foundation for infection control, the project design, and levels of evidence for research.

Significance

Infectious disease, when acquired in the hospital setting, can be devastating to the health of the patient. Multi-drug resistant organisms have been linked to longer hospital stays, increased costs, and a higher mortality rate (Siegel, Rhinehart, Jackson, Chiarello, & the Healthcare Infection Control Practices Advisory Committee, 2006). As of October, 1, 2008, Medicare is no

longer paying hospitals for select diagnoses that were not present on admission (Hospital-Acquired Conditions, 2009). These costs will be absorbed by the individual hospitals where these infections occur. These selected diagnose include catheter-associated urinary-tract infections, vascular-catheter associated infections, and surgical site infections following coronary artery bypass grafting, bariatric surgery, and orthopedic procedures (Hospital-Acquired Conditions, 2009). This has caused hospitals to increase their surveillance of hospital acquired infections and to implement programs to aid in infection prevention. This project will focus on MRSA prevention, because though there are many Multi-Drug Resistant Organisms, MRSA affects large numbers of patients who receive healthcare every year and has been given much attention by healthcare and the media alike. MRSA was estimated to have caused 94,360 invasive infections in 2005, which were associated with 18,650 deaths (Klevens, et al., 2007).

Purpose

The purpose of this project is to develop an assessment tool for nurses to use in the screening of all patients to help determine if isolation precautions are necessary upon admission. First, a review of literature was completed to determine recognizable risk factors of MRSA. Based on this information, the MRSA Risk Factor Assessment Tool (MRSA RFAT) was developed. The MRSA RFAT was reviewed by a panel of expert nurses in infection control for practicality and by bedside nurses for application in clinical practice. With this information, the MRSA RFAT was revised and guidelines developed for its use.

Clinical Practice Questions

1.) Why has MRSA emerged so suddenly and why is it such a devastating complication for patients of the acute care setting?
2.) What are the significant risk factors for MRSA?

3.) How effective are isolation precautions in preventing the spread of MRSA?

4.) How do nurses view the MRSA Risk Factor Assessment Tool and do they believe it is effective for clinical use?

5.) What is the lag time between MRSA testing and placement of patient on isolation precautions?

Theoretical Foundation for Infection Control in Hospitals

The theoretical basis for infection control efforts in the hospital settings draws heavily from epidemiology and microbiology. Epidemiological theory identifies the process of disease transmission by modes of contact or indirect contact and can happen by either horizontal or vertical means. Horizontal transmission is at the root of infection control. Horizontally transmitted diseases spread through a population, from person to person, whereas vertical transmission implies infection from parent to offspring (Cowan and Talaro, 2006, p. 407).

A traditional view of how infection takes place is defined by the Epidemiologic Triangle (Anderson & McFarlane, 2008, pp. 39-40). This model describes health and disease as a result of an agent, a host, and environment. The agent is the pathogen that may cause harm to the body, the host is any at risk person or population for the disease, and the environment includes the factors which influence the agent and the host (Anderson & McFarlane, 2008, p. 40). The Epidemiologic Triangle shows that the three factors may coexist, and that disease and injury occur when there is an interaction or altered equilibrium between the three (Anderson & McFarlane, 2008, p. 40).

Transmission of infection from one host to another can be described by the Chain of Transmission. There are six defined links in the chain, including infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, and host susceptibility (Anderson &

McFarlane, 2008, p. 184). The infectious agent is any pathogen that may invade a host, which could be a bacteria, virus, fungi, or protozoa. (Anderson & McFarlane, 2008, p. 184). The reservoir is the place where the agent lives and multiplies, and can include such places as humans, animals, and soil. (Anderson & McFarlane, 2008, p. 184). Elimination of a reservoir can sometimes be useful in preventing transmission, for example, elimination of standing water can eliminate the reservoir for mosquitoes which may breed West Nile Virus. The portal of exit is the means of transport of the agent from the reservoir to the host, and the portal of entry is the means through which the agent enters the host (Anderson & McFarlane, 2008, p. 186). Portals of exit and entry usually correspond to each other, for example, respiratory secretions are taken in through the respiratory passages of another individual (Anderson & McFarlane, 2008, p. 186).

Modes of transmission are the key in preventing the spread of disease, as they are the method of transmission from a reservoir to a new host (Anderson & McFarlane, 2008, p. 185). Direct contact transmission is through direct skin or mucous membrane contact between an infected person and non-infected person. This occurs through kissing, sexual contact, or direct contact with an open area of infected skin. The tiny particles released when a person coughs or sneezes on another are another form of contact transmission (Cowan and Talaro, 2006, p. 407). Contact also includes transmission of an organism through a vector. A vector is an organism that transmits a disease from an infected person to other people, while remaining free from infection itself. A well-known example of this is the transmission of Lyme disease through ticks. Contact transmission may be thought of as a portal of exit meeting a portal of entry, with no object in between (Cowan and Talaro, 2006, p. 407). Since a vector does not become infected itself, it may still be classified as a form of contact transmission.

Transmission of agents by the indirect route allows for some intermediate conveyor that aids in transmission (Cowan and Talaro, 2006, p. 407). These intermediate objects are known as vehicles of transmission. They include fomites, which are inanimate objects that retain and transmit microbes after an infected person has touched them. Fomites can include door handles, improperly cleaned call lights, and toilet seats, to name a few. Food water, and biological products may also serve as vehicles, and their contamination may lead to infection transmission. Transmission of a microbe through the air is also a form of vector transmission, and this includes droplets and aerosols. Droplet nuclei are "dried microscopic residues created when microscopic pellets of mucus and saliva are ejected from the mouth and nose" (Cowan and Talaro, 2006, p. 408). Droplets can remain suspended in the air and upon being breathed by another host can cause infection. Aerosols contain live pathogens, and are very fine particles of dust or moisture. Diseases that can be transmitted through the air include tuberculosis and varicella zoster virus, otherwise known as the chicken pox (Potter and Perry, 2005, p. 776).

The final link in the Chain of Transmission is host susceptibility. The risk for developing an infection or disease varies from person to person (Anderson & McFarlane, 2008, p. 187). General health status, as well as personal habits such as hand-washing, are a cause for varying susceptibility in humans. Also important is the immune system of a person. Those who are immunized are less likely to have susceptibility to certain diseases, and those who are immune-compromised have more susceptibility (Anderson & McFarlane, 2008, p. 187). This explains, in part, the incidence of MRSA transmission in hospitalized patients, who usually experience weakened immune systems during hospitalization.

Infection control in hospitals is designed to prevent horizontal infection transmission at the level of the host and of the vector. When a patient is diagnosed with a nosocomial infection,

they are placed on isolation precautions. Isolation precautions are important because they not only prevent the spread of the nosocomial infection to other patients, but they also help prevent this spread to healthcare workers. The isolation precautions implemented in hospitals were developed by the Center for Disease Control, and are described in the document "Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007," (Siegel, Rhinehart, Jackson, Chiarello, and the Healthcare Infection Control Practices Advisory Committee, 2007) which will be summarized in the Literature Review section.

Project Design

This project is modeled as a best practice project. Best practice may be defined as nursing practice that is based on the best available research evidence (C. Lacasse, personal communication, April 30, 2009). The first step in the development of a best practice is conducting a review of literature to discuss the research available that supports clinical practice. The next phase in the process is to develop clinical practices which reflect current research and have a positive impact on patient care outcomes. In addition, a plan for implementation and evaluation of the best practice is also described.

Levels of Evidence

When executing a review of literature, it is important to take into account the level of evidence of each study reviewed and used as evidence. A level of evidence describes the design of a research study, so that its reliability and findings can be verified (Melnyk and Fineout-Overholt, 2005, p. 248). The strongest type of research studies are those that test cause and effect relationships, because in these studies, a control group is used and results compared against a group that has had an intervention (Melnyk and Fineout-Overholt, 2005, p. 248). Randomized controlled trials are the best for reporting valid evidence, because not only do they use a control

group, but the participants are randomly assigned to either the control or experimental groups. These kinds of studies are difficult to accomplish where health care is concerned because of the use of human subjects. There cannot be control groups that do not receive treatment for a complication or disease, as this would be unethical. It is also difficult to standardize results when human subjects are used because each person is unique and different, with characteristics that will make them different from all other study subjects. The best that researchers can do is to group similar subjects together, however, this eliminates the randomization of the study.

Summary

This chapter has introduced MRSA and its problem in the acute care clinical setting. It has presented the clinical practice questions to guide research and given the theoretical foundation for the project. The purpose of this project is to develop a nurse-friendly assessment tool for the early recognition of patients with MRSA. The goal is to then present this assessment tool to various infection control nurses as well as bedside nurses to determine if it follows the trends of hospital MRSA infection and if the tool would be easy to use and appropriate for the acute care setting.

CHAPTER TWO

Review of Current Evidence

This review of evidence will include information about MRSA, information about the levels of isolation precautions, and expert opinion was used to develop the MRSA RFAT.

Introduction

Methicillin-Resistant *Staphylococcus aureus* (hereafter referred to as MRSA,) is a strain of *S. aureus* bacteria which is resistant to beta-lactam antibiotics. *S. aureus* is known for being a highly resilient bacterium, which can easily develop antimicrobial resistance (Moreillon, 2008). The beta-lactam antibiotics, which MRSA is resistant to, include the penicillins, cephalosporins, aztreonam, imipenem, meropenem, and ertapenum (Lehne, 2007, p. 962). These anti-microbials all contain a beta-lactam ring in their structure. The way that these medications work on bacteria is by targeting their cell walls. These antibiotics have a bactericidal action—meaning that their action is to completely kill bacteria (Lehne, 2007, p.962 and 972). The MRSA strain of *S. aureus* has evolved so much that the bactericidal action of these antibiotics is ineffective.

Diagnosis

For optimal effectiveness in infection prevention, every patient would be screened for MRSA colonization upon admission. This, however, is not very cost effective. The screening requires a nasal swab, which introduces the need for nurse training of how to swab correctly, as well as the cost of supplies and the associated laboratory costs to perform this type of a test. According to hospital policy, correct swabbing includes the culturing of both anterior nares using one culture swab, by rotating the swab in the nares two to five times clockwise and counterclockwise (Carondelet Corporate Policy, revised 2008). The goal is to rub the swab gently across mucous membranes of the nares, about three-fourths of an inch into the nasal

passage, so that squamous epithelial cells can be obtained (Carondelet Corporate Policy, revised 2008). Therefore, since screening of every patient is not feasible, the skilled nurse needs to be aware of risk factors that pose further investigation of specific patients.

Treatment and Resistance

Moreillon's review article about *S. aureus* discusses what is being done about MRSA's resistance and what can be expected in the upcoming years. One problem facing the treatment of MRSA is that some strains are now becoming resistant to Vancomycin, the original MRSA super-drug. Vancomycin has a broad spectrum, and is given intravenously for maximum effectiveness. However, now that some strains of *S. aureus* are becoming resistant to Vancomycin, newer, stronger drug therapy is needed. The Vancomycin resistant strains of *S. aureus* are being identified as VRSA (Vancomycin-Resistant *S. aureus*). Moreillon also mentions some problems with other drugs that have been used to treat *S. aureus* infections. Due to multi-resistance, clindamycin, erythromycin, fluoroquinolones, and aminoglycoside antibiotics are all ineffective (Moreillon, 2008). Rifampin has a rapidly-developing resistance. The drug Trimethoprim-Sulfamethoxazole has some activity against MRSA and Vancomycin-intermediate *S. aureus*, but in serious infections, the results of this drug are inconclusive (Moreillon, 2008). Tetracyclines seem to be effective against community-acquired MRSA skin infections, but their use in more serious infections has not been established (Moreillon, 2008).

There are several new drugs in the making with the intention of treating MRSA. The first is Ceftobiprole, a cephalosporin, (which consequently makes it a beta-lactam,) under development specifically with the purpose to kill MRSA and other nosocomial infections that create problems for treatment in the hospital setting (Anderson & Gums, 2008). Ceftobiprole has the ability to bind with a specific polypeptide in the bacterial cell wall of MRSA and thereby

cause cell death (Anderson & Gums, 2008). Fritsche, Sader, and Jones performed a study in which they took 40,675 isolates of different bacteria from North America, South America, and Europe, and tested the potency of Ceftobiprole against these strains (Fritsche, Sader, & Jones, 2008). Forty-two-point-one percent of all isolates studied were resistant to oxacillin—meaning that these isolates were MRSA strains. The researchers found that all of these strains were inhibited by Ceftobiprole (Fritsche, et al., 2008). Ceftobiprole's potency was matched by only two other drugs: Daptomycin and Imipenum. A number of other drugs were tested as well, including some of the penicillin family, cephalosporins, fluoroquinolones, and Vancomycin. While these drugs also showed some effective activity against *S. aureus* strains, it seems that this varies by strain of *S. aureus* (Fritsche, et al., 2008). The maker of Ceftobiprole received a letter from the FDA in 2008, stating that it had been approved for use in complicated skin and skin structure infections, including foot infections of diabetic patients ("FDA Issues Approvable Letter for Ceftobiprole for Treatment of Complicated Skin Infections," 2008). However, the most recent update is that Ceftobiprole has received a Complete Response Letter from the Food and Drug Administration, stating data integrity issues (Micromedex Healthcare Series, 2008). The Complete Response Letter issuance means that the drug has not been approved in its present form, and in this case, further research will be needed. No action by the drug's developers for one year will be considered a request to withdraw the drug (FDA, 2008).

Several other drugs in testing for the treatment of MRSA include Dalbavancin, Oritavancin, and Telavancin. Dalbavancin is currently undergoing an additional Phase three trial, but along with Oritavancin is intended for the treatment of skin and skin structure infections, including MRSA (Micromedex Investigational Drugs, 2008). Additional clinical studies have been requested by the FDA before Oritavancin will be approved (Micromedex Healthcare Series,

2008). Televancin has achieved greater success, as the FDA is currently reviewing its marketing application (Micromedex Healthcare Series, 2008). Televancin will have application against skin and skin structure infections, as well as pneumonia caused by gram-positive bacteria, including MRSA (Micromedex Healthcare Series, 2008).

Transmission of MRSA

The key point to MRSA and its problem in the acute care setting is the occurrence of its transmission. Infection control measures are in place to work on MRSA reduction through the means of transmission prevention. To do this, practitioners from doctors, nurses, support staff, dietary aids—all people who may come into contact with a patient in MRSA isolation, must understand the transmission of MRSA, so that they will understand why isolation protocol is necessary and why it should be followed.

MRSA is transmitted through direct or indirect contact, and is most frequently passed through hands, especially those of healthcare workers (CDC, 2007). This happens when healthcare workers come into contact with colonized or infected patients, devices or surfaces that have been contaminated with MRSA-containing body fluids, or when the healthcare worker is colonized or infected (CDC, 2007). Fomites can be a cause of MRSA, as well as vectors, in that healthcare workers may pass MRSA from patient to patient without becoming infected themselves.

The clothing of healthcare workers has also been found to act as a vector in the transmission of MRSA. One study gave healthcare workers plastic aprons to use as protection when performing patient care (Gaspard, Eschbach, Gunther, Gayet, Bertrand, & Talon, 2008). Without the protective aprons, MRSA contamination of the uniforms was found to be 27.3-80% (Gaspard, et al., 2008). With the protective aprons and "pocket control" advice given to

employees, researchers noted a much lower contamination rate (Gaspard, et al., 2008). For facilities that do not offer protective plastic aprons, which likely includes a number of local hospitals, pocket contamination serves as a reservoir for MRSA bacteria. Uniforms themselves may also serve as vectors of MRSA transmission. Furthermore, in the Gaspard, et al. study, healthcare workers' uniforms were provided and washed by the facilities at a minimum of 70 degrees Celsius, but many facilities do not provide uniforms. The workers at these facilities must purchase and wash their own uniforms, and so will likely use cooler water on any uniform that is dark or brightly colored. These practices may not kill MRSA bacteria, and so there is no break in the cycle of infection. MRSA will follow the uniforms home and back again, increasing the risk of spreading bacteria to other patients.

Risk Factors

See Appendix A for Table of Evidence of MRSA Risk Factors. The articles summarized in this table were chosen for recent publication, (within the last four years), and for their application to the risk factors anticipated. All studies chosen are either descriptive or correlational. The Pub Med search engine was used to compile these articles. Search terms included: MRSA, methamphetamine, opiates, communal living, indwelling devices, and nursing homes.

With the emergence of MRSA in the community, it is becoming more difficult to quantify what the real risk factors for MRSA include. Four main risk factors are summarized in Appendix A, Table of Evidence of MRSA Risk Factors. These risk factors are: residence in a nursing home or long-term care facility, indwelling device such as a urinary catheter, drug use, and history of crowded or communal living.

Nursing Homes and Long-term care facilities

Thirty to forty percent of nursing home residents were found to have MRSA (Furuno, et al., 2008; Mody, Kauffman, Donabedian, Zeros, & Bradley, 2008). One study suggested that the reason nursing homes and long-term care facilities have such high rates of MRSA is that it is nearly impossible to maintain isolation of these patients because it would interfere with their treatment (Mody, Maheswari, Galecki, Kauffman, & Bradley, 2007). Many activities that take place in these facilities, such as rehabilitation and social activities, would not be possible if residents had to be maintained in isolation and away from other patients (Mody, et al., 2007). Nursing homes do the best they can to prevent transmission of infectious diseases such as MRSA, while realizing that infection control must be kept simple and obtainable from staffing, budget, and care perspectives (Mody, et al., 2007).

Indwelling Devices

The risk factor of indwelling devices includes devices such as urinary catheters, peripherally inserted central catheters (PICC lines), and feeding tubes (Mody, et al., 2007). MRSA was predominantly found at the site of the indwelling device, though in some patients it was also cultured from the nares (Mody, et al., 2007). Any indwelling device should be considered a portal of entry for bacteria, and should be cultured upon the patient's admission to the acute care setting.

Drug Use

Having had the chance to observe an intensive out-patient treatment program for people addicted to methamphetamines during a clinical rotation, this author heard the complaints of this population regarding numerous hospital visits for MRSA infections. Since MRSA is known for causing skin infections, any skin lesion, especially if it is open, should be suspected of MRSA. In

several studies, MRSA was found more frequently in drug users as compared to non-users (Cohen, et al., 2007; El-Sharif & Ashour, 2008,). The presence of other risk factors associated with a MRSA skin infection as well as drug use makes it impossible to say if it is in fact drugs that make MRSA skin infection slightly more common, or whether it is the culture of addiction common to drug users. MRSA incidence may be due to factors such as poor hygiene and unsafe sexual practices, or because of drug induced hallucinations that lead users to scratch at their skin, creating open lesions and therefore a portal for bacteria.

Crowded Living

The final risk factor to be used in the MRSA RFAT is history of crowded living. This can include time spent in prison, in the military, or in any setting that a person spends an extended amount of time in close contact with people who are not family members (Aiello, Lowy, Wright, & Larson, 2006). For example, this can include athletes. One study found that the crowded environment of athletic training, combined with the everyday injury caused to athletes and the sharing of equipment, made a risk factor for MRSA (Lu & Holtom, 2005). Football was singled out especially due to the high incidence of skin abrasions obtained during training and games (Lu & Holtom, 2005).

With all of the risk factors and populations that can come into contact with MRSA, it is intimidating to imagine being able to identify every case. With risk factor analysis, however, the skilled nurse will be able to identify potential cases, thus protecting other acute patients to the best of the nurse's ability.

The above risk factors are all represented in the MRSA RFAT. Please see Appendix B.

Isolation Precautions

There are four categories of isolation precautions. The first is Standard Precautions. Standard Precautions "are based on the principle that all blood, body fluids, secretions, excretions except sweat, nonintact skin, and mucous membranes may contain transmissible infectious agents" (Siegel, et al., 2007, p. 66). Standard Precautions are intended for use by healthcare workers when providing care to all patients, regardless of whether an infection is suspected or confirmed. These precautions include the use of hand hygiene, safe injection practices, respiratory/cough etiquette, gloves, gowns, eye protection, and masks (Siegel, et al., 2007). These precautions also include the cleaning or disposal of contaminated items and equipment. In order to implement Standard Precautions correctly, bedside nurses need to use prudent judgment to determine what kind of personal protective equipment (PPE) should be used. For a task such as starting an IV, the nurse needs to keep in mind that exposure to blood is very likely. The nurse should then be prepared and use gloves for this task. Depending upon the nurse's comfort level, he or she may also want to use eye protection. Each facility should be responsible for educating employees about when and how to use PPE, so that all healthcare workers have an understanding of what each needs to do to prevent potential contamination.

There are three types of Transmission-Based Precautions as outlined by the CDC. These are used when transmission of a microbe cannot totally be prevented by the use of Standard Precautions alone (Siegel, et al., 2007). Contact Precautions are used in the presence of a patient with a Multi-Drug Resistant Organism (MDRO) or where there is the "presence of excessive wound drainage, fecal incontinence, or other discharges from the body suggest an increased potential for extensive environmental contamination and risk of transmission" (Siegel, et al., 2007, p. 70). Contact Precautions should include the use of at least a gown and gloves.

Droplet Precautions are used when pathogen transmission may occur through close respiratory or mucous membrane contact (Siegel, et al., 2007). Precautions need to be taken only when a healthcare worker is within close proximity to a patient with a respiratory-transmitted illness. A special room is not necessary because these pathogens will not travel long distances within a healthcare facility (Siegel, et al., 2007). Healthcare workers should don gloves, a gown, and a mask upon entry in the patient's room, and any other PPE the worker believes will be necessary to prevent droplet transmission.

The use of Airborne Precautions is indicated with pathogens that remain infectious over long periods of time when suspended in the air. Patients infected with these types of pathogens, or suspected of this type of an infection, should be roomed in an airborne infection isolation room (AIIR). AIIRs have negative pressure systems, with air exchanges occurring six to twelve times every hour (Siegel, et al., 2007). Healthcare personnel entering the room of a patient on airborne precautions need to apply a mask or respirator with a N95 or higher level of respiratory protection (Siegel, et al., 2007). These masks prevent healthcare personnel from breathing in airborne pathogens.

Expert Opinion by Infection Control Nurses

The author conducted interviews with several Infection Control nurses from several local hospitals for input on the severity of MRSA in the acute care setting and if this is in fact decreasing. These hospitals were selected because two are very large, with rapid inflow and discharge of patients, so one would expect to see trends representative of a larger population. The smaller specialty hospital was chosen for comparison with the larger two. The input of these nurses is considered input from a panel of experts, and has been greatly influential on the MRSA RFAT and its implementation plan. All nurses have worked in the current setting for several

years and are well respected as infection control experts. The responses from these interviews are displayed in Table 1.

Table 1: *Responses of Infection Control Nurses*

	Setting 1	**Setting 2**	**Setting 3**
Description of Setting	355-bed academic medical center	210-bed Veterans' Medical Center	60-bed community-based cardiac specialty hospital
Question 1: What are your hospital's protocols regarding when to begin isolation of patients for MRSA? Does this start at the time MRSA is suspected or at the time the nasal swab results are known?	Standard precautions utilized until results of MRSA swab are know	All acute and intensive care patients swabbed for MRSA on admission, the PCR test used only takes several hours to result, and then patients are placed on isolation. All transfers to other units or discharges are swabbed to identify transmission occurring on a particular unit.	Place on contact precautions if MRSA is suspected until confirmation is received
Question 2: How were these protocols developed?	Based on recommendations from organizations such as CDC, HICPAC (Healthcare Infection Control Practices Advisory Committee), and APIC (Association for Professionals in Infection Control and Epidemiology, Inc.)	System-wide policy for Veterans' Healthcare	Based on recommendations from organizations such as CDC, HICPAC, APIC, and IHI (Institute for Healthcare Improvement)
Question 3: How are employees educated about infection control and how to use personal protective equipment?	• Orientation • Intranet • Posters on units	• Orientation • Intranet	• Orientation • Intranet • Regular re-education/review of policies

Question 4: How has MRSA affected your hospital? How significant is the spread of MRSA/how profound is the problem of MRSA on your patients?	Present, not out of control	Has always been present, but never in large quantities	Always seems to be present, not overwhelming
Question 5: Have you seen a decrease in MRSA diagnosis since the implementation of active surveillance?	Decrease in number of cases since implemented	Slow decrease seen since surveillance began, is now under control	Decrease, success credited to utilization of hand-washing and extra prevention
Other Comments:	• Infection Prevention Committee surveys the hospital every three years unless needed sooner • Infection control statistics are reported to Quality Management Core Groups	• Patients should be a partner in preventing spread of infection in the acute setting • MRSA is the gateway to a much-larger, expected shift towards the prevention of more serious MDROs (Multi Drug Resistant Organisms)	• More strict surveillance here than at other hospitals • Attempts to try to differentiate between the community-acquired and hospital-acquired cases

Responses to specific questions about MRSA identification and prevention of spread were reviewed for common themes. One surprising fact found here was that only one of the hospitals treated MRSA the way that the MRSA RFAT does—that is, by isolating the patient before the results of the nasal swab are known. Another theme is that MRSA seems to be on the decline since the beginning of active surveillance. The Infection Control nurse from Setting two is currently involved with reporting data on transmission of MRSA within the hospital setting so

that a set of baseline data for transmission will be available. To date, no baseline data of what is acceptable in terms of MRSA transmission has been developed.

Summary

Chapter two has discussed current knowledge of MRSA diagnosis, treatment, transmission, and relevant risk factors. It has also reviewed what is expected by the Centers for Disease Control for Isolation Precautions in the hospital setting. Expert opinion of experienced infection control nurses has also been reviewed. With this knowledge compiled in Chapter two, the MRSA RFAT was developed along with instructions for its use and instructions for what to do when patients present to the acute care setting with these risk factors.

CHAPTER III

Chapter three addresses the proposed plan for implementing the MRSA RFAT, as well as the plan to interview various nurses around the region for insight and information specific to local hospitals.

Plan

The MRSA RFAT was taken to a panel of experts from local hospitals. First, the author interviewed infection control nurses about the policies and procedures outlining infection control at each of several local hospitals around the city. Infection control nurses were interviewed about the severity of MRSA at each of their hospitals, and about the prevalence of MRSA at each. This was labeled "expert feedback" and will help visualize the problem of MRSA at the different hospitals around the region.

The second step of the plan is to have a panel of clinical care experts from around the region look at the MRSA RFAT and determine its relevancy and use with patient admissions. Please see Appendix C for the list of interview questions for clinical care experts. Nurses were asked for their general opinion about the MRSA RFAT, if they think it would help to improve the diagnosis of MRSA, and if it would add unnecessary documentation to the patient admission process. The most important information obtained is their willingness to complete another required assessment during the patient admission process. With all of the documentation and other required assessments that nurses have to complete during their shifts, especially for a number of patients, it is plausible that nurses will not like the MRSA RFAT and that they would not want to see it implemented. The feedback of bedside nurses is very important, since these nurses are the ones who will be responsible for completing the MRSA RFAT and ensuring its success in the acute care unit.

Lastly, an initial evaluation of the MRSA RFAT will be planned and instructions for its implementation will be developed with a specific unit in mind. This pilot project will be done to evaluate if the MRSA RFAT is effective and to evaluate if it will be useful for implementation on other units.

Sample

The ideal unit for the proposed implementation of the MRSA RFAT would be a small unit that can be closely monitored. This unit would have the means to add a new form to their existing electronic documentation system. This unit would ideally have a system for monitoring MRSA infections already in place, so that the number of infections discovered after the implementation of the MRSA RFAT can be compared to the number seen before its use.

The target for the proposed implementation will be one that the author is familiar with, the Patient Care Unit at a community specialty hospital. This hospital is a 60-bed hospital, with 15 beds in the Intensive Care Unit, and 45 in the Patient Care Unit. The patients who are usually seen at this hospital are largely cardiac patients, who may be experiencing chest pain, those having cardiology interventions such as the placement of stents, pacemaker placements, and those experiencing arrhythmias, such as atrial fibrillation. There are a number of medical patients admitted to the Patient Care Unit also, including those with Chronic Obstructive Pulmonary Disease and pneumonia. The nurses at this community specialty hospital are experienced in dealing with cardiac patients, and most have a number of years of nursing experience. At this hospital, MRSA is present on a daily basis. There are usually a small number of patients admitted who have MRSA. Some are known because they have a history, and some are discovered through the hospital's active surveillance program, which includes the screening of all surgical patients, all admitted to the Intensive Care Unit, and those that meet certain risk factors.

In the Patient Care Unit, however, MRSA is monitored less often and therefore it is not diagnosed in a timely fashion. Common risk factors are overlooked and it is several days into a patient's hospital stay before a MRSA swab is done. This author has observed this occurrence on more than one occasion. One patient, with a skin infection, stayed for several days before he was diagnosed with being MRSA positive. Another patient had spent time living among a very close community, and it was not identified upon the patient's admission that he had had MRSA in the past. Therefore, this proposal, to institute a routine MRSA screening upon admission, will focus on early identification and prevention of spread.

Design

The hospital selected for this implementation does not have a protocol in place for swabbing every patient on admission. However, it does have a list of people who should be swabbed for MRSA which includes people who have some of the risk factors identified in the MRSA RFAT. In the Patient Care Unit (PCU), however, nurses are expected to know these “at risk” populations, and obtain an order for a MRSA swab whenever necessary. This project proposes the implementation of the MRSA RFAT as part of the nurse's routine admission assessment. Since the hospital being studied has recently gone to full computer documentation, adding a form for the MRSA RFAT should be fairly simple. Completing the MRSA RFAT should take less than five minutes for the admitting nurse to complete, and can easily be incorporated into the assessment time period. When a nurse identifies a patient as “at risk” or as having any of the defined risk factors present on the MRSA RFAT, the nurse will swab the patient's nares for MRSA, and implement the use of contact precautions. Contact precautions includes requiring all who enter the patient's room to wear at least a gown and gloves. Please see Appendix D for a schematic of what to do when using the MRSA RFAT.

Next, a proposal will be made to the hospitalist doctors at the selected hospital to allow MRSA swabbing without a doctor's order. This "per-protocol" policy will facilitate faster identification and screening of “at risk” patients. In addition, this will allow quicker identification of non-MRSA patients, and will ultimately help reduce isolation costs for the hospital. Non-MRSA patients who were initially identified as “at risk” will no longer require isolation.

Summary

Chapter three has presented the basic outline for how to implement the use of the MRSA RFAT. It has introduced the sample and identified preliminary areas that will need to be addressed in order to implement such a change for the selected unit.

CHAPTER IV

Chapter four addresses the implementation stage of the MRSA RFAT at the selected hospital. Implementation of a change may be one of the more difficult aspects of introducing the MRSA RFAT to the staff nurses. If the nurses who will be using the MRSA RFAT do not see it as valid or necessary, the change will not be successful. Chapter four begins with an overview of the Diffusion of Innovation Theory, which is a theory about influencing change among a group of people.

Theoretical Framework for Implementation

The Diffusion of Innovation theory, created by Everett Rogers, is a theory that describes how to institute a change among a group of people (Cain & Mittman, 2002). The change must diffuse through different channels, until all members of the involved social system are accepting and the change will occur (Cain & Mittman, 2002). Cain and Mittman describe ten critical dynamics of innovation diffusion that must be present in order for change to be accepted in healthcare. Those most relevant to the MRSA RFAT implementation are discussed here. The critical dynamics outline what must happen before, during, and after the implementation of an innovation (change) in the healthcare setting (Cain & Mittman, 2002).

The first critical dynamic discussed by Cain and Mittman is relative advantage. Relative advantage is knowing whether or not the benefits of a proposed change will outweigh the risks, and whether or not the change will be an improvement on the existing system (2002). Relative advantage must be established in order for the MRSA RFAT to be valid and to be reasonably implemented. The current system for identification of patients with MRSA in the selected unit has flaws that have left patients with MRSA unidentified. The advantage of this proposed change will benefit both employee and patients within the institution.

Another critical dynamic that must be present in order to induce change is communication channels. When implementing the MRSA RFAT, it will be very important to keep the channels of communication open, both to and from the management team who implements the change. According to Cain and Mittman, personal contact is still a very powerful channel of communication (2002). This will be the best way of informing employees about the change in process and the use of the new MRSA Tool. Personal communication will allow nurses to ask questions about how to use the tool. This type of communication will also facilitate discussion about the tool and allow nurse feedback to reach the management, including suggestions for improvements. Involving nurses in the tool review is also helpful in establishing peer input.

The Pace of Innovation is also a critical factor in the diffusion of a change in healthcare. The pace is set by the stages in the innovation-decision process. This process starts with the acquisition of knowledge about the change. Next is persuasion, when those receiving the knowledge form "a favorable or unfavorable attitude toward the innovation" (Cain & Mittman, 2002, p. 19). Next is the decision itself that leads the choice of whether or not to adopt an innovation. The implementation stage occurs when the innovation is put to use and a change in behavior begins. Lastly is confirmation, when it is decided to keep or discontinue an innovation. It may at some point be necessary to do what Cain and Mittman refer to as "reinvention." Reinventing an innovation is sometimes necessary so that the innovation can be useful, specific, and easier to implement.

The last of the critical dynamics that applies to the MRSA RFAT project is that of opinion leaders. When implementing a change in healthcare, Cain and Mittman suggest that the change be promoted to individuals who are able to influence their peers (2002). To implement

the MRSA RFAT, it will need to be advertised and promoted, with the feedback of the unit's opinion leaders taken into consideration. Since opinion leaders are generally well-respected and liked by their peers, their approval of the MRSA RFAT will help encourage the approval and willingness to adopt the assessment tool among the rest of the staff. Early adoption by an opinion leader helps to smooth the transition for other staff (Cain & Mittman, 2002). One can imagine the disaster that occurs when an opinion leader does not like a newly implemented change on a unit. This leader, who usually gives his or her opinion about the unit's happenings, will speak to other staff about the negative effects of the change, thereby increasing the amount of staff resistance to the proposed change. In the selected unit, there are several important opinion leaders that would need to be informed about the new implementation of the MRSA RFAT. Specifically, these people are the unit charge nurses and the Clinical Nurse Leaders. These people are highly respected on the unit due to their years of expertise and firm staff support. By allowing these opinion leaders to see the MRSA RFAT firsthand, and educating them about the reasons for this change and the expected benefits, it is more likely that the MRSA RFAT will be well-liked and readily completed by bedside nurses once it is fully implemented.

Phases of Implementation

Pre-Implementation

As a nurse striving to implement a new protocol for the selected unit, the first step to take would be to talk to the manager of the Patient Care Unit, where the MRSA RFAT will be implemented. Approval of the manager will exemplify the beginning of the process towards the "go live" date of the assessment tool. To gain the approval of the management of this unit, relative advantage will need to be explained, according to the Cain and Mittman model. This will include a discussion for the management outlining the benefits of the MRSA RFAT, and how

these benefits outweigh the risk of not implementing a change. Speaking with management will allow the nurse access to unit resources, reveal any potential problems, and further identify people who need to collaborate with the nurse for the implementation of this proposal.

Another important group of people to involve at the beginning stages of implementation is the opinion leaders. By gaining feedback and approval from the opinion leaders in the beginning, the rest of the implementation should go more smoothly. Opinion leaders will influence other staff members to be more receptive of the MRSA RFAT and to keep a positive attitude about its use.

The next group of people to meet will be the group of hospitalist doctors that is responsible for caring for the patients of the selected hospital. This will be in order to gain their approval for the use of the MRSA RFAT upon admission. In order to gain the approval of the hospitalists, the nurse will also need to explain the relative advantage of using the MRSA RFAT. It should also be explained that since the MRSA RFAT is going into place, by not approving the "per protocol" order for MRSA nasal swabs, each admitting nurse will need to phone the hospitalist on call to obtain this order. The entire plan will be explained to the hospitalists, and they will be given opportunities for input and suggestions for change in the MRSA RFAT protocol. If a patient is found to have risk factors for MRSA, then the standing orders agreed upon by this group of physicians will allow for the patient's nurse to obtain a nasal swab for MRSA and place the patient on contact isolation until the results of the swab are obtained. A collaborative approach between physicians and nurses is best, and will likely be more successful because of the support and skill that each discipline will bring. It is especially important to make sure that by adding this nurse-implemented protocol, that the nursing staff will not be seen as stepping outside of the scope of practice. It is important to work with an interdisciplinary team to

ensure the successful outcome of this project. The group of hospitalists that work at the selected hospital are a group of very experienced, very detail-oriented physicians. They are very clearly dedicated to improving patient care, and no problems are anticipated in gaining the approval of these physicians to make MRSA screening tests per a specific protocol.

After gaining physician approval, the nurse needs to meet with the people in the information technology department who will be in charge of developing the MRSA RFAT for addition to the electronic patient medical record. The selected project site recently began using computerized charting. At this time, all nursing assessments, medications, laboratory results, and physician reports are available in the patient's electronic medical record. The only parts of the chart that are not electronic are the physician's orders and progress notes.

When a nurse admits a patient to the Patient Care Unit, the nurse is required to complete a number of electronic forms. These include the patient's admission history, medication reconciliation list, a patient belongings list, and an admission assessment. All of these forms are available in the electronic medical record, and all are part of routine admission documentation. The forms are electronic versions of forms that were once completed on paper. Employees of the company that produces this program spent hours with unit managers making sure that the program could be tailored to the needs of such a specialty hospital. New additions to the program are ongoing and reflect changes in clinical practice, quality improvement, and national guidelines for practice and healthcare regulations. Though the addition of a new area of documentation takes time, it is possible and has been done in the past. The nurse will need to supply the computer technicians with a copy of the MRSA RFAT and ask that it be transferred to an electronic version, which is accessible by nurses when they complete their admission assessments.

Another group of employees that will need to be included in the preparation for project implementation are the employees of the selected hospital's laboratory. They will need to know that this change is occurring in the Patient Care Unit so that they will be prepared when more MRSA nasal swabs start arriving in the lab. This may require the addition of laboratory equipment or supplies in order to do more frequent MRSA swab analysis.

In keeping with the mention of additional supplies, the staff that manage the materials and supply department will also need to be notified of this change in protocol. This way, additional swabs can be obtained, if necessary, since the expectation is that MRSA swabbing will be done more frequently.

Implementation

A critical step in the implementation of the MRSA RFAT is introducing the tool to staff nurses. When changes in documentation occur at the selected hospital, nurses are usually required to attend a brief information session about the new change. In this case, a quick, twenty-minute inservice would be most efficient. This inservice should be held multiple times; so that both day and night shift nurses may attend at their convenience, and so that they can attend during work hours or immediately following. This meeting will be held during the preceding two weeks before the MRSA RFAT "goes live" into the computerized charting program. All nurses will receive an email detailing what will be taught at the meeting. This will be the use of the MRSA RFAT, how to find it in the electronic medical record, and what to do if a patient is found to have risk factors for MRSA (order a nasal swab, swab the patient, and place the patient on isolation precautions until the results of the swab are obtained).

All nurses will be given a "hot sheet" on how to access and use the MRSA RFAT. These "hot sheets" are made every time there is an important change to the computer program that

nurses need to know about. All nurses have their own reference binder, into which they put these hot sheets. This way, nurses always have a reference for the computerized charting program if they have a question about documentation. Most nurses keep these three-ring binders in their lockers, so that they may be accessed during their shifts as needed. The hot sheets have been very successful in aiding nurses when a question comes up with the documentation process. An example of what the "hot sheet" for the MRSA RFAT might look like is found in Appendix E.

Summary

Chapter IV has discussed how to implement change and the plan for implementation of the MRSA RFAT in the Patient Care Unit. This chapter has also discussed important stakeholders in the process as collaborators in project implementation. Successful implementation of this change will need the cooperation of management, computer technicians, laboratory staff, materials and supply staff, physicians, and nurses. With the use of a systematic, collaborative approach, the implementation of the MRSA RFAT should go smoothly.

CHAPTER V

Chapter V will address the evaluation, or post-implementation process. This will include the author's evaluation of the MRSA RFAT based on input from infection control nurses and staff nurses, as well as a plan for evaluating the assessment tool once it has been in place at the selected implementation site.

Evaluation by Staff Nurses

This author had conversations with five staff nurses from the selected implementation site about the need for the MRSA RFAT. The general opinion of the nurses was that the MRSA RFAT would have a negative impact on their work. The nurses feel that there is already so much documentation that the addition of another form would be irritating. When told that the form would take less than five minutes to complete, and that it would probably include information that the nurses have already gained during the admission history, the nurses had a slightly more positive opinion of the MRSA RFAT. The nurses interviewed were all aware of their unit's current policy on active surveillance and were aware of when patients should be swabbed for MRSA upon admission. Therefore, according to the staff nurses who would be using the MRSA RFAT, it is deemed unnecessary at this time.

The belief of the author, however, is that though the nurses were all aware of the procedure of active surveillance that should begin upon admission, there have still been cases where an important piece of information was missed, and that the MRSA RFAT could help prevent this. Since the MRSA RFAT would be required upon the patient's admission to the acute care unit, this would eliminate any potential discoveries of MRSA at a later date. The assessment tool is quick, easy to use, and requires very little effort on the part of the nurse. All that needs to be done is to obtain a nasal swab, obtain the appropriate signage for contact precautions for

placement upon the patient's door, and obtain personal protective equipment for placement outside of the patient's room. All this can be completed within ten minutes or less. To influence the staff nurses of the unit to be more receptive of the MRSA RFAT, they will be further educated about the seriousness of MRSA and its potential for harm in the acute care setting. Nurses will also be encouraged to submit suggestions to revise the MRSA RFAT. Involving the nurses who will be responsible for using the MRSA RFAT will also help in increasing their receptiveness.

Plan for Post-Implementation Evaluation

The last part of the proposed implementation plan to implement the MRSA RFAT at the selected hospital will be the evaluation. What would be interesting to review would be the number of MRSA diagnoses made before the MRSA RFAT came into place as well as after. This prior information should be available from the unit's Infection Control nurse. The information about the number of cases of MRSA which were discovered after the MRSA RFAT was implemented should be available by doing regular chart checks and by reviewing laboratory results. Analysis of the number of new MRSA cases each month should give a good representation of the assessment tool's effectiveness. Details that should be reviewed will include: total number of patients admitted to the unit that were found to be positive for MRSA, what risk factors led to the swabbing and discovery of MRSA in the patient, on what day of the patient's stay was the MRSA confirmed, and at what point contact isolation was implemented. This will give some insight into the patients who are being admitted with MRSA and whether or not the MRSA RFAT is being used correctly and identifying MRSA as soon as possible.

Periodic checks on MRSA RFAT completion upon admission should also be done. The Clinical Nurse Leaders at the selected hospital do regular chart checks to make sure that nurses

are doing all required documentation, so the MRSA RFAT could be added as one of the checks. Though the MRSA RFAT will be required, it is still left to the admitting nurse to make sure that this will be documented.

Success of the MRSA RFAT will be designated by finding additional numbers of patients diagnosed with MRSA upon admission, as well as finding that at least 80% of nurses are completing the MRSA RFAT within the first three months after its implementation. By six months after the implementation of the MRSA RFAT, 100% of nurses should be completing the MRSA RFAT with routine admission documentation, or within 24 hours of each patient's admission. The purpose of the tool is to improve the time it takes to diagnose a patient as having MRSA. Therefore, completing the MRSA RFAT for each patient upon their admission will eliminate the discovery of MRSA later during the patient's stay.

Three months into the implementation of the MRSA RFAT, a meeting should again be planned with the unit's manager. This meeting will be to discuss the costs associated with the MRSA RFAT, and to determine whether or not the MRSA RFAT has caused a significant cost increase. Cost of the MRSA RFAT versus its perceived benefit should be discussed and a determination if whether or not to continue using the MRSA RFAT should be done at this time.

Strengths

The major strength of this project is that the opinions of staff nurses were taken into consideration when evaluating the usefulness and practicality of the MRSA RFAT. This shows consideration for the staff members who would actually be using the tool, and if they would be receptive to its use. Another strength of this project is that infection control nurses were interviewed regarding the incidence of MRSA and what kind of problem it is posing for local

hospitals. The use of infection control nurses in this project helped add in some expert feedback to further exemplify that MRSA continues to be a nuisance to healthcare and its staff.

Limitations

One limitation to this project is that it was a small project, with no quantitative data collected. Expanding on this and adding one's own study of the selected clinical setting, complete with real data, would further prove the need for the proposed change. Another limitation to this project is that there are a great number of potential risk factors for MRSA, so many, in fact, that it would be impossible to name all potential risk factors. MRSA can target any person, anywhere, whether it is in the hospital or in the community. Risk factors for MRSA, like any infection, can be something as simple as failing to wash one's hands. It is hard to pinpoint what the most important risk factors are for MRSA and to prevent all of these factors, so this was also a limitation to the study. Another limitation of this project as it is implemented in the clinical setting would be the challenges associated with influencing a institutional change. If the planning is weak at any stage, then the outcome of the implemented change will suffer. Some institutions are more receptive to change, just as some people are. It is possible that the selected unit would have a great many people who are unwilling to begin using a new assessment tool and the success of its implementation would be limited.

Ideas for Further Research

Future research should include a study that includes quantitative data. One idea is to begin a multi-site infection control study of several major hospitals around the region, to see which ones have a program in place that is able to prevent transmission of MRSA. Doing a large-scale review of data collected about MRSA from various hospitals and comparing them to national MRSA-related statistics would be informative to infection control practices within the

region. Each hospital's measures of infection control could be studied, and methods that work for the prevention of transmission could be identified. Another idea for future research could be to develop an entire MRSA protocol. This would be a much larger project than presented here, but instituting a change that would include the provision of uniforms to healthcare workers as well as the implementation of the MRSA RFAT would be a larger-scale defense against MRSA. Quantitative data for this type of a project would greatly impact its relevance and would be able to show that a multi-systems approach to MRSA may be the best available.

Summary

Chapter V has given the input received from bedside nurses in the acute care setting about the need for the MRSA RFAT. In addition, strengths, limitations, and ideas for how the MRSA RFAT can be used in the future are described. The opinion of the author is that although staff nurses may not be overly receptive of the MRSA RFAT at first, they may be influenced to accept this change through allowing them to give their opinions and by further educating these nurses about the need for such a tool. The MRSA RFAT is a practical tool that can help avert infection and will ultimately prevent complications for many patients, therefore saving funds and most importantly, saving lives.

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Appendix A

Table of Evidence for MRSA Risk Factors

Study	Design	Sample	Variables	Findings
Aiello et al, 2006	Review (of Correlational and Descriptive studies)	Not specifically identified (Review Article)	-Military personnel -Prisoners	Military personnel and prisoners have high rates of MRSA colonization and infection.
Cohen et al, 2007	Descriptive Correlational Case-controlled	N=119 patients greater than 12 years old with skin infections, treated at one of six emergency departments and urgent care clinics in Georgia	-Methamphetamine use -MRSA isolation -MSSA isolation	MRSA caused the majority of skin infections. 10% of patients with MRSA infections reported methamphetamine use vs. 2% of controls.
El-Sharif & Ashour, 2008	Descriptive Correlational	N=60 opiate addicts at Al-Hussein Academic Hospital in Cairo, Egypt N=60 non-addict patients N=15 healthy volunteers	-MRSA colonization -Opiate addiction -Length of addiction	Colonization of addicts higher than in non-addicts (52% vs. 17%). Opiate addicts were found to have more MRSA infection than asymptomatic colonization (30% vs. 21%). Increased length of addiction indicated increased acquisition of MRSA.
Furuno et al, 2008	Descriptive	N=147 patients in a Baltimore long-tern acute care facility Mean age=52 years	-MRSA colonization -*A. baumannii* colonization	30% of patients colonized with MRSA (any site).
Lu & Holtom, 2005	Review	Not specifically identified (Review Article)	-Athletes	Closeness and frequent injury makes athletes an "at risk" population for the development of MRSA.
Mody et al, 2007	Descriptive Cross-Sectional	N=60 nursing home residents with indwelling devices in 14 nursing homes in southeast Michigan	-Age -Functional status -Comorbidity score	55% of patients with urinary catheters colonized with MRSA. 61% of patients with enteral feeding tubes colonized with MRSA.
Mody et al, 2008	Descriptive Cross-Sectional	N=213 nursing home residents from 14 nursing homes in Michigan N=105 residents with indwelling devices	-Indwelling devices -MRSA colonization	40% of patients colonized with MRSA. 76% of those with an indwelling device (urinary catheter, gastric tube, or central venous catheter).

Appendix B

MRSA Risk Factor Assessment Tool

	Risk Factor	**Yes**	**No**
1	MRSA on prior admission		
2	History of crowded/communal living (nursing home, assisted living, military, prison, etc)		
3	Open skin lesion		
4	Indwelling device (catheter, central venous access, etc)		
5	History of drug use		

If "Yes" to any item: place patient on Contact precautions and obtain a nasal swab
If swab is negative, isolation can be discontinued

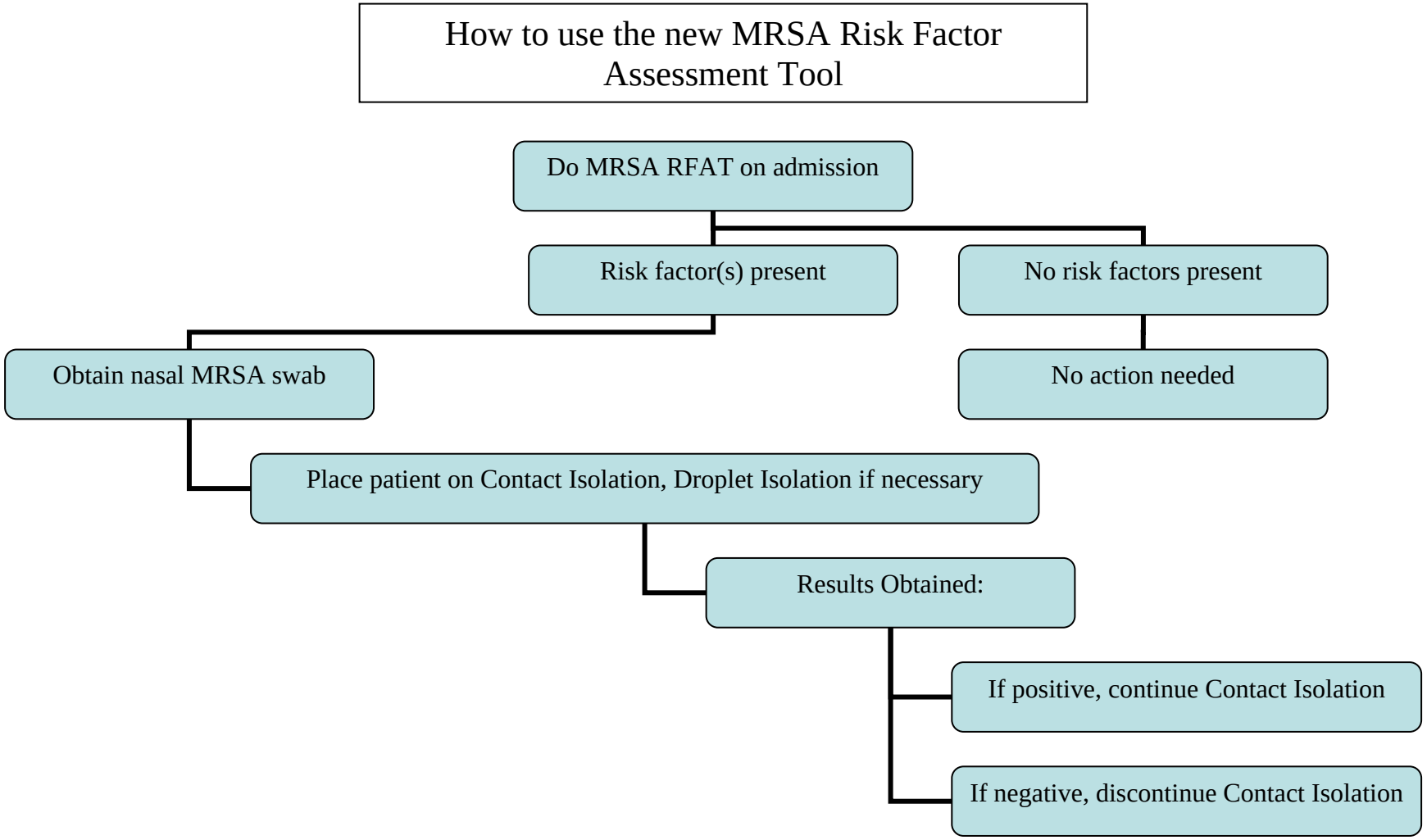
If "Yes" to Item 3: place patient on Contact precautions and obtain swab of the wound as well as a nasal swab
If swabs are both negative, isolation can be discontinued

Appendix C

Questions asked to staff nurses

1. How would you feel about an additional checklist that would screen each newly admitted patient for MRSA?
2. Are you aware of the current procedure regarding screening of patients for MRSA?
3. Do you feel that the current screening procedure and active surveillance are effective measures in identifying MRSA?
4. Is there a lag time between patient admission and the time that patients are discovered to have MRSA?

Appendix D


How to use the new MRSA Risk Factor Assessment Tool
Do MRSA RFAT on admission
Risk factor(s) present
No risk factors present
Obtain nasal MRSA swab
No action needed
Place patient on Contact Isolation, Droplet Isolation if necessary
Results Obtained:
If positive, continue Contact Isolation
If negative, discontinue Contact Isolation

Appendix E

Hot Sheet for the MRSA Risk Factor Assessment Tool

1. Log into computerized charting program, using login name and password
2. Select patient by using "Find" option or by locating patient per room number
3. Use browser to open up "Assessments" folder
4. Scroll to "Initial Assessment"
5. Once "Initial Assessment" is selected, scroll to find "MRSA RFAT"
6. Double clicking on "MRSA RFAT" will open up a new screen
7. Complete the assessment, answering all questions "Yes" or "No"
8. Once finished, click "Submit" to save and file the assessment

WAIT!
Your work is not done!

9. If ANY of the answers to the MRSA RFAT were "Yes," place the patient on contact isolation and obtain a nasal swab
10. Nasal swabs may be ordered by the nurse, PER PROTOCOL (no need to page the doctor)
11. If the patient has an open wound, swab the wound as well
12. When the results of the swab(s) are known, contact isolation for the patient should be discontinued or continued, as appropriate

Thank-you for your cooperation with this new assessment tool!