

THE INCIDENCE AND EPIDEMIOLOGIC FACTORS OF COMMUNITY-ACQUIRED  
METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS SKIN AND SOFT TISSUE  
INFECTIONS IN A SUBURBAN FAMILY PRACTICE IN FLORIDA

by

IVONNE JOHNSON  
M.S.N. University of Florida, 1997  
B.S.N. Union College, 1987

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Major Professor: Elizabeth Rash

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## ABSTRACT

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a serious public health problem nationwide, threatening to develop into an epidemic. Many of these patients are presenting to their primary care clinics with skin and soft tissue infections (SSTIs). The CDC has reported that in 2005, MRSA was responsible for an estimated 94,000 life-threatening infections and 16,650 deaths. The purpose of this study is to estimate the incidence of CA-MRSA within a specific family practice in Florida and to identify epidemiologic factors, classify antibiotic susceptibility patterns, and evaluate patient education in regard to disease management and prevention.

This study was a descriptive, epidemiologic, three-year retrospective medical record review of all wound cultured skin and soft tissue infections that presented to a family practice between January 2007 and December 2009.

Sixty-two medical records met the inclusion and exclusion criteria for the study. Of these 62 SSTIs, 44 cultures grew one or more bacterial organisms. The incidence of CA-MRSA was 66% (n=29). The mean age of those with CA-MRSA was 40 years old, with a range from 7 to 90 years old. Sixty-two percent (n=18) were male and 38% (n=11) were female; additionally 69% (n=20) lived within a 10 mile radius from the family practice, while 31% (n=9) lived in a surrounding suburb. The most frequent race was Caucasian 83% (n=24), with African American at 10% (n=3) and Hispanics 7% (n=2). Risk factors associated with CA-MRSA was obesity 41% (n=10), diabetes mellitus 24% (n=7), and a previous history of MRSA infection 24% (n=7). Skin and soft tissue infections were diagnosed as either an abscess 62% (n=18), boil 24% (n=7), pustule 10% (n=3), or cellulitis 4% (n=1). CA-MRSA isolates were susceptible to trimethoprim-sulfamethoxazole 100% (n=29), doxycycline 93% (n=27), and rifampin 100% (n=14).

Clindamycin susceptibility was 65% (n=15) with resistance at 30% (n=7) and 5% (n=1) intermediate. Both cephalexin and erythromycin were 100% resistant. Documentation in the medical record on wound care was found in 45% (n=13) of the records.

The incidence of CA-MRSA SSTI was 66%, which identifies this suburban community at high risk for this bacterial infection. Risk factors associated with CA-MRSA included obesity (BMI >30), history of previous MRSA infection, and diabetes mellitus. There were no clinical characteristics that helped distinguish MRSA infection from other bacterial SSTIs. Most SSTI were treated with incision and drainage and a susceptible antibiotic. Judicious use of antibiotics not only provides appropriate treatment, but is also critical in prevention of antibiotic resistance. Lastly, patient education in adequate hygiene is essential in preventing the spread of CA-MRSA.

I wish to dedicate this thesis to my husband Dave and two daughters, Amanda and Megan.  
Thank you for being at my side and giving me the support and encouragement through this  
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## CHAPTER 1: INTRODUCTION

Methicillin-resistant *Staphylococcus aureus* (MRSA) has become a major public health concern in the last 10 years. This type of infection was traditionally acquired in hospitalized, immuno-compromised, severely ill, or chronically ill patients, but now it is increasing in the community among people without these health risks (Ellis et al., 2007). The global epidemiology of MRSA continues to change, as recent studies have demonstrated that MRSA has diverged into two separate categories known as community-acquired MRSA (CA-MRSA) and healthcare-associated MRSA (HA-MRSA) (Cohen, 2007a; Elston, 2007; Farley, 2008). HA-MRSA has more antibiotic-resistant genes than CA-MRSA; however, CA-MRSA may be more virulent, more frequently causing serious and fatal infections in healthy individuals. Currently, up to 25% of MRSA with onset in the hospital or community is due to CA-MRSA USA300 (Klevens RM, 2006; Liu C, 2008; Popovich, 2008).

The clinical distinctions between HA-MRSA and CA-MRSA are becoming blurred, with both strains causing disease in community and healthcare settings. Though distinct, these strains are highly virulent and are increasing in incidence. In particular, the new strain of CA-MRSA has become a serious public health problem nationwide, beginning to reach epidemic proportions (Hawkes et al., 2007; Hinckley & Allen, 2008; Klevens et al., 2007). Researchers at the Centers for Disease Control and Prevention have reported that MRSA was responsible for an estimated 94,000 life-threatening infections and 18,650 deaths in 2005 (Klevens et al., 2007). Klevens (2007) concluded that in the same year, roughly 16,000 people in the U.S. died from Acquired Immunodeficiency Syndrome (AIDS).

The impact of MRSA extends beyond afflicted patients to include clinicians, insurance industries, pharmaceutical companies, federal and state governmental agencies, healthcare

facilities, and society in general. Each of these are stakeholders who have an interest in implementing programs that treat MRSA in a more efficacious, timely, and cost-effective manner. Medical costs due to MRSA infections are rising rapidly (Scott et al., 2005; Shorr, 2007). This is due to the many potential problems associated with treatment failure, including additional outpatient office visits, hospitalizations often requiring isolation, increased lab testing and surveillance, longer length of inpatient stay, more aggressive surgical intervention, and poorer patient outcomes. Implementing a program that treats MRSA more effectively and rapidly would make a significant impact on reducing cost and improving patient outcomes. It would lessen the risk to society by reducing carriage rates and preventing transmission of MRSA infection to others in the community (Abrahamian & Shroff, 2007).

## **Background of the Problem**

### **Rising Incidence of CA-MRSA SSTI**

Several problems related to *Staph*-resistant infections have been identified. First, there has been a dramatic increase in the number of patients who have presented to outpatient offices and emergency rooms with skin and soft tissue infections (SSTIs) that have cultured positive with CA-MRSA ("CA-MRSA shown to be an emerging problem," 2008). Unfortunately, most purulent skin infections are not routinely cultured. Rather, they are frequently treated empirically with antibiotics, which are ineffective against MRSA and can compound antibiotic resistance.

Another problem is that MRSA is affecting pediatric and adult populations that are relatively healthy, which until recently were an uncommon occurrence (Hinckley & Allen, 2008). Furthermore, the progression of the MRSA infection does not typify the established

characteristics associated with patients known to have hospital-acquired MRSA. The circulation of CA-MRSA strains in hospitals has already been described, with several reports suggesting that CA-MRSA may be replacing HA-MRSA strains, with potentially catastrophic consequences. CA-MRSA strains are usually considered to be more virulent than HA-MRSA, leading to an important problem in terms of morbidity and mortality if they reach the hospital population (Patel, 2008; Popovich, 2008; Seybold et al., 2006).

Because of these factors, MRSA is spreading rapidly and becoming a serious healthcare problem (Klevens et al., 2007). National awareness of this problem has been dramatized by reports of young athletes and other healthy adults dying from CA-MRSA. The threat of transmission has led to canceled sporting events and the closing of schools (C. J. Weber, 2008).

There are conflicting expert opinions related to the management and treatment of SSTI that need further investigation. Some practitioners treat SSTI with incision and drainage only, without prescribing antibiotics (Fridkin et al., 2005; Lee et al., 2004). Others start empiric antibiotics without first obtaining a wound culture for sensitivity testing (Cohen, 2007b; Miller & Spellberg B., 2004). Consistency in treatment approach is lacking.

### **Growing Antibiotic Resistance**

Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections (Merriam-Webster, 2009). How do bacteria become resistance to antibiotics? The CDC states:

Antibiotics kill or inhibit the growth of susceptible bacteria, but sometimes some bacteria can survive and multiply and replace all the bacteria that were killed off.

Exposure to antibiotics therefore provides selective pressure, which makes the

surviving bacteria more likely to be resistant. In addition, bacteria that were at one time susceptible to an antibiotic can acquire resistance through mutation of their genetic material or by acquiring pieces of DNA that code for the resistance properties from other bacteria (Center for Disease Control and Prevention, 2010).

Antibiotic-resistant infections have produced a significant increase in morbidity and mortality for individuals that contract these illnesses. At best, intermediate resistant antibiotics promote a slower response and delay in achieving effective treatment; at worst, they may produce increased antibiotic resistance, additional outpatient office visits, hospitalizations, loss of work or school, outright treatment failure, and death (Gorwitz, Jernigan, Powers, Jernigan, & Participants in the CDC-Convened Experts' Meeting on Management of MRSA in the Community, 2006).

### **Assessment of Need for Study**

In Florida, outpatient reporting of diagnosed cases of CA-MRSA to county health departments is not mandatory. In fact, there are only two instances when MRSA is required to be reported to the local health department: when there is an outbreak of MRSA infections or when there has been a death associated with MRSA infection (Sanderson, 2008). Only one report discussing the rise of MRSA in the state could be found. Based on statistics provided by Quest Diagnostic Laboratory between 2003 and 2006, the Department of Health (DOH) reported that the prevalence of MRSA is increasing (Sanderson, 2008). This laboratory, which serves clinics and physician offices, provided the Department of Health DOH with all of its *S. aureus* culture results for the entire state over this four-year period, with incidence broken down by county. The results demonstrated an increase from 8,299 isolates in 2003 to 48,953 isolates for

2006. More specifically, and more ominously, the proportion of these isolates that was specifically recognized as MRSA rose from 35% in 2003 to 50% in 2006 (Sanderson, 2008).

### **Varying Standards of Treatment for SSTIs**

Current standards for treatment of skin and soft tissue infections in an outpatient setting include incision and drainage with subsequent antimicrobial therapy prescribed empirically (Cohen, 2007a; Elston, 2007; Fleming, Brown, & Tice, 2006; Fridkin et al., 2005). However, many of the antibiotics being prescribed are ineffective against MRSA. As a result of this, researchers are endorsing the importance of obtaining wound cultures for all purulent or incised and drained SSTIs (Abrahamian & Shroff, 2007; Pallin et al., 2008). Identifying the specific microorganism causing STTIs using a wound culture would provide essential information needed by the clinicians to maximize antimicrobial potency (Cohen, 2007a; Elston, 2007; Farley, 2008; Fleming et al., 2006; Moran et al., 2006).

The Centers for Disease Control and Prevention (CDC) has developed a treatment guideline to help direct decision making in the treatment of suspected CA-MRSA SSTI's (Gorwitz et al., 2006). Studying practice patterns to determine whether clinicians are incorporating current evidence-based research is imperative. This is especially important for primary healthcare providers who are at the frontline and are assessing individuals with SSTI's that may have contracted CA-MRSA.

The purpose of this research is to assess and support strategic measures that improve identification of microorganisms resistant to conventional antimicrobial drug therapy, improve bacterial surveillance within communities, and reduce the spread of the infection (Bach, Steffin, Chhadia, Kovachevich, & Gonzalez, 2007; Pallin et al., 2008). A description of this problem



within a specified population subgroup in a community might lead to improved outcomes in MRSA treatment due to an increase in the awareness of the problem, as well as a mobilization of resources needed to solve problems specific to this issue.

### **Specific Aim of the Project**

Due to emerging drug-resistant pathogens and antibiotic susceptibility, the purpose of this project is threefold (Owens, 2009). The first aim is to estimate the incidence of CA-MRSA in cultured SSTI's found in patients presenting to a suburban Florida family practice. Secondly, the study results identify empiric antibiotic prescribing patterns for skin and soft tissue infections. The final aim is to identify patient demographic characteristics, risk factors, and clinical characteristics and evaluate patient education of this specific population that has been cultured positive with MRSA SSTIs.

Consistent identification of CA-MRSA improves laboratory epidemiological reporting and provides the appropriate agencies with the ability to better address these trends. Nursing research that contributes to improving treatment guidelines directly impacts patient outcomes, one of the primary goals of the nursing discipline.

### **Study Objectives**

- Determine the incidence of CA-MRSA SSTI in an outpatient family practice in Apopka, Florida, and improve surveillance and reporting of this emerging bacterial infection within that community.
- Identify patient demographic, patient risk factors, clinical characteristics, and antibiotic susceptibility associated with patients that have culture positive MRSA.

- Determine if family practice policy change is needed for the treatment of suspected CA-MRSA that includes recommending that purulent or incision and drained wounds have a culture performed on the initial visit and incorporate patient educational material aimed at preventing the spread of infections to others.

### **Research Questions**

*Question One:* What is the incidence of community-acquired MRSA in cultured skin and soft tissue infections in a suburban Florida family practice?

*Question Two:* What are the selected demographic characteristics associated with the culture positive CA-MRSA skin and soft tissue infections?

*Question Three:* What are the selected clinical characteristics associated with the culture positive CA-MRSA skin and soft tissue infections?

*Question Four:* What are the selected risk factors associated with the culture positive CA-MRSA skin and soft tissue infections?

*Question Five:* What are the antibiotic susceptibilities associated with the culture positive CA-MRSA skin and soft tissue infections?

*Question Six:* How many patients diagnosed with a SSTI had education regarding wound care documented in their medical record?

### **Conceptual and Operational Definition of Variables**

A conceptual definition presents the abstract or theoretical meaning of the concepts being studied. Operational definitions for each variable are intended to narrow the number of details measured by eliminating elements not relevant to the study. These definitions specify which variables to study and what methods to use to study them. Each variable is assigned a label

along with a list of all possible responses of the most common attributes (Oman, 2003). Each variable's level of measurement had been assigned (see Appendix A). The responses are mutually exclusive so that only one answer for each item is selected on the data collection tool (see Appendix B).

### **Adverse Event (AE)**

*Conceptual:* Defined as any unfavorable and unintended sign or symptom, including any new subjective complaint, or objectively definable illness, injury or abnormal laboratory finding, during the period of treatment (Oman, 2003)

*Operational:* Any adverse change in health or "side effect" that occurs in a person who participates in a clinical trial, either while the patient is receiving the treatment or within a pre-specified period of time after the treatment has been completed (Oman, 2003).

### **Antibiotic Susceptibility**

*Conceptual:* Vulnerability of a specific bacterial strain to antibiotic treatment (Mayer, 2009).

*Operational:* Antibiotic susceptibility is determined using the VITEK 2 system according to the National Committee for Clinical Laboratory Standards guidelines and reported on the culture and sensitivity report. Organism is identified and reported as "resistant," "susceptible," or of "intermediate" resistance to specific antibiotics based on the mean inhibitory concentrations (MIC) standards of the Clinical and Laboratory Standards Institute (Mayer, 2009).

## **Community-Acquired MRSA (CA-MRSA)**

*Conceptual:* An infection with a strain of *Staphylococcus aureus* bacteria that is resistant to beta-lactam antibiotics (Center of Disease Control and Prevention, 2005). These antibiotics include methicillin, amoxicillin, and penicillin. This infection is a strain from the community and not health-associated MRSA.

*Operational:* Diagnosis of MRSA was made in the outpatient setting or by a culture positive for MRSA within 12 months post hospital admission. No medical history in the past 12 months of hospitalization, admission to a nursing home, skilled nursing facility, hospice, dialysis, or surgery. No permanent indwelling catheters or medical devices that pass through the skin into the body (Center of Disease Control and Prevention, 2005).

## **Demographic**

*Conceptual:* Vital and social statistics of a population (Oman, 2003).

*Operational:* Age in years, gender, ethnicity, occupation, home location, and whether patient has health insurance (Oman, 2003).

## **Iatrogenic High Risk Invasive Procedure**

*Conceptual:* A medical treatment, examination, or diagnostic procedure that involves entry into the body either by incision or by insertion of an instrument through the skin, body cavity, or organ prescribed by a physician (Merriam-Webster, 2009).

*Operational:* A medical procedure or treatment in the previous three months that includes laparoscopic, endoscopic, or interventional radiologic procedure.

## **Incidence of CA-MRSA**

*Conceptual:* A measure of the frequency with which new cases of illness, injury, or other health condition occurs among a population during a specified period (U.S. Department of Health and Human services, 2004).

*Operational:* Incidence is the measure of the frequency with which new cases of CA-MRSA SSTI occurred among a population during a specified period of time (U.S. Department of Health and Human services, 2004)

## **Patient Clinical Characteristics**

*Conceptual:* A feature that helps to identify, tell apart, or describe the character of someone or something (Merriam-Webster, 2009). Presence of fever, size of wound, wound purulence (pus), whether incision and drainage and/or, wound packing were required duration of symptoms before presentation and clinical diagnosis.

*Operational:* Oral temperature is taken and documented in Fahrenheit degrees. Fever is defined as a temperature equal to or greater than 100.4° F. Size of wound is measured in centimeters or inches. The data collection tool documents if the wound was purulent (draining pus) and required incision and drainage or packing. The duration of symptoms before presentation is recorded in days on the data collection tool.

## **Patient Risk Factor**

*Conceptual:* A characteristic, condition, or behavior that increases the possibility of disease or injury (Merriam-Webster, 2009).

*Operational:* Document co-morbidities defined as a condition existing simultaneously and independent of another medical condition (Merriam-Webster, 2009): Obesity (BMI >30),

immune compromised, attends daycare/child care center, diabetes or renal failure, previous MRSA infection in the last 12 months, surgery in the last 12 months, dialysis patient, hospitalization in the last 12 months, long-term care resident in the last 12 months, indwelling catheters, chronic skin conditions such as eczema or psoriasis, or use of IV drugs.

### **Recurrent Skin Infection**

*Conceptual:* Reinvasion or multiplication of a bacterial microorganism in a previously treated body tissue, which causes new local cellular injury, though not necessarily the same anatomic site or strain (Gorwitz et al., 2006).

*Operational:* A patient who has been treated with an antibiotic for a SSTI within the previous 60 days who presents with a recurrent skin infection.

### **Skin and Soft Tissue Infection (SSTI)**

*Conceptual:* Invasion and multiplication of microorganisms in body tissue that causes local cellular injury (Merriam-Webster, 2009).

*Operational:* Skin infection may include but not limited to: boil, folliculitis, furuncle/carbuncle, abscess, insect/spider bite, cellulitis, paronychia, or impetigo (Center of Disease Control and Prevention, 2005).

### **Wound Care**

*Conceptual:* A set of instructions on how to reduce risks that can inhibit wound healing and enhance the healing process (Gorwitz et al., 2006).

*Operational:* Documentation of at least one of the following: Instructions on how to clean and dress the wound, frequent hand washing or use of an alcohol-based hand sanitizer, or education on how to prevent spread of skin infection to others (Gorwitz et al., 2006).

### **Importance of the Study and Knowledge to be Gained**

There is a need for healthcare professionals, such as primary care nurse practitioners, to investigate the demographic and incidence of this emerging infection not only in their community but also within their geographic practice area. Identifying epidemiological factors of patients who develop CA-MRSA is important, as clinical findings can be a key to treating patients correctly from the initial contact with a practitioner. The paucity of information regarding the MRSA epidemic within the community should be of great concern to all healthcare providers. Unaware of the potentially dramatic increase of MRSA locally, the practitioner may not feel compelled to stay abreast of current guidelines that would improve the efficacy of his or her treatment. The purpose of this study is to estimate the incidence of CA-MRSA, identify clinical characteristics, risk factors, and antibiotic susceptibility, and evaluate patient education specifically at Central Family Practice located in the city of Apopka, Florida.

Establishing a clearer understanding of the incidence of CA-MRSA within the setting one works in, including clinical indicators for appropriate antibiotic treatment and wound culturing, should result in better understanding of the evolution of the disease in the community.

### **Outline of the DNP Study**

Chapter 2 is a synthesis of relevant and related research studies. This chapter concludes with a summary of the research evidence and applicability that supports the proposed DNP research questions under study. Chapter 3 describes the project implementation plan, which

includes study design, description of population, and sample method of participants, setting, and ethical consideration such as protection of human by the Institutional Review Board (IRB).

Specific study procedures are outlined, which includes the use of the data collection tool and the statistical testing to be done. Chapter 4 presents the findings and discusses how the data answers each of the research questions. Finally, Chapter 5 is where the discussion of the findings of the study, which include implications for nursing and recommendations for further related projects, as they relate to each question is explored.



## **CHAPTER 2: SYNTHESIS OF THE RESEARCH EVIDENCE**

The following chapter is a review and synthesis of the relevant and related research studies regarding CA-MRSA. The project proposed in this study is aimed at estimating the prevalence of CA-MRSA of SSTI that are cultured in an outpatient family practice and identifying clinical characteristics along with antibiotic sensitivity results. The epidemiology of MRSA is discussed to better understand populations at risk and this infection's incidence. The next section addresses the escalating health care costs associated with CA-MRSA and the growing concern of antibiotic resistance. In conclusion, a brief summary of the implications to the research problem under study and the applicability to the DNP thesis is outlined.

### **Epidemiology**

There are distinctly different characteristics between the strains of MRSA isolated from the community compared to the nosocomial strains (Grundmann, Aires-de-Sousa, Boyce, & Tiemersma, 2006). These community-acquired strains often express resistance to beta-lactams alone, in contrast to the multidrug-resistance pattern that typifies nosocomial strains, which has implications for appropriate antibiotic selection in the community. Community-acquired MRSA has been isolated in both children and adults, with outbreaks occurring in several discrete patient populations. Identified at-risk populations include children in daycare centers, soldiers, intravenous drug users, prisoners, homeless persons, men who have sex with men, and competitive athletes (Kowalski, Berbari, & Osmon, 2005). Common to these groups are the following factors that aid the spread of infection: crowding, frequent skin-to-skin contact between individuals, participation in activities that result in compromised skin surfaces, sharing of personal items that may become contaminated with wound drainage, and challenges

maintaining personal cleanliness and hygiene (Gorwitz et al., 2006). Other outbreaks have occurred in certain ethnic groups, including Pacific Islanders, Native Americans/Alaska Natives, and Pacific and Canadian aboriginals (Center for Disease Control and Prevention, 2004).

Patients present in the outpatient setting with skin and soft tissue infections (SSTIs), which are commonly diagnosed as furuncles, carbuncles, abscesses, or cellulitis. At times, these infections can initially go unnoticed or be misdiagnosed by primary care staff. For example, the sudden appearance of a raised red skin lesion causes many patients to present with complaints of a spider bite, even though they do not recall being bitten. In fact, the lesion is often the beginning of a MRSA infection. In contrast, presentations of severe invasive MRSA infections in the community requiring hospitalization have included septic arthritis, bacteremia, toxic shock syndrome, necrotizing fasciitis, and necrotizing pneumonia (Cohen, 2007b; Grundmann H, Aires-de-Sousa M, Boyce J, & Tiemersma E, 2006). These types of infections usually require surgical intervention for incision and drainage, followed by a course of intravenous antibiotics. Being able to detect and treat infections earlier in their trajectory can result in reduced cost and improved patient outcomes.

The burden of morbidity and mortality caused by MRSA is staggering. The Centers for Disease Control (CDC) estimated the number of people developing a serious MRSA infection in 2005 was about 94,360 and that 18,650 persons died during a hospital stay related to these serious MRSA infections (Center for Disease Control and Prevention, 2007a). The incidence rate in 2005 of invasive MRSA rate was 31.8 per 100,000, and the mortality rate was 6.3 per 100,000 patients (Klevens et al., 2007). The Institute of Medicine estimates the annual cost of infections caused by antibiotic-resistant bacteria in the United States to be \$4 to \$5 billion (McGowan, 2001).

## **Prevalence of CA-MRSA**

The leading epidemiologic expert on MRSA at the Florida Health Department reports only one known study conducted in the state of Florida that tries to identify the prevalence of CA-MRSA (Sanderson, 2008). This descriptive epidemiology study of outpatient illnesses in Florida, reported that those infected with CA-MRSA had risen from 35.1% in 2003 to 49.7% in 2005 (Kolar, 2007). Another recent study implicated CA-MRSA as the most common cause of community-acquired SSTIs in California (Moran et al., 2006). An additional study found that CA-MRSA had exceeded 70% of all SSTIs in Atlanta and Houston (Hawkes et al., 2007). A 14-year surveillance study at Driscoll Children's Hospital in Texas reported a rapid emergence in the number of hospitalizations for CA-MRSA from 1990-2003 (Purcell & Fergie, 2002). The same researchers analyzed the data collected from 1990-2001 and compared the data from 2002-2003, finding that the prevalence of CA-MRSA cases rose exponentially from 0-9 per year before 1999, to 36 in 2000, to 459 in 2003. The authors concluded that the rapid surge of CA-MRSA as a cause of noninvasive and invasive infections in children started occurring in the 1990s and has now reached epidemic proportions (Purcell & Fergie, 2005).

The incidence of CA-MRSA in skin abscesses presenting to a pediatric emergency department over an 18-month period was studied. The results of 68 patients enrolled and cultured identified that 85% were culture positive CA-MRSA (Magilner, 2008). In another study, researchers examined the incidence of CA-MRSA in SSTI in suburban dermatology private practice. The authors concluded that of 170 cultures taken, 21% were positive for CA-MRSA (Bruce, 2008). Lastly, an 18-month retrospective chart review between January 2004 and August 2005 to assess prevalence in two major military hospital emergency departments was

conducted. The results found the prevalence rate of 68% of CA-MRSA in soft tissue abscesses (Dufresne, 2008).

The literature review supports the escalating rates of MRSA infections in a variety of patient settings. The vast majority of this literature comes from urban settings with high population densities. Determining the incidence of CA-MRSA in SSTI in smaller suburban communities needs to be established.

### **Healthcare Costs Associated with CA-MRSA**

Whereas previously most hospitalizations for MRSA were attributable to HA-MRSA, CA-MRSA strains are now being identified as the primary cause for hospitalization. Understanding the impact of MRSA is important for clinicians, hospital administrators, and policy makers. Multiple studies have been conducted to measure the direct medical costs of MRSA infection. This information justifies using the necessary resources to combat antibiotic resistance and to prevent the spread of resistant organisms. -

One study looked at the economic impact of *Staphylococcus aureus* infections in New York hospitals. The death rate of patients admitted with MRSA was 8%, while direct medical costs of community-acquired infections per patient was \$35,300 (Rubin et al., 1999). Another cohort study of patients admitted into a teaching hospital in Boston, Massachusetts, with MRSA bacteremia revealed a length of stay of nine days, costing \$26,424, whereas methicillin-sensitive *Staphylococcus aureus* (MSSA) required a stay of only seven days, costing \$19,212 (Cosgrove et al., 2005). A retrospective case control analysis comparing MSSA with MRSA infections revealed that the increased median hospital cost associated with MRSA was \$16,575 per admission (Kopp, Nix, & Armstrong, 2004). Seven other studies on the direct medical costs of

resistant nosocomial infections listed costs per admission that ranged from as low as \$9,275 and as high as \$82,020 (Scott et al., 2005).

### **Antibiotic Resistance – A Growing Concern**

With the rise of infections of microorganisms resistant to conventional antimicrobial drug therapy, choosing the correct antibiotic for treatment is essential. In order to more effectively accomplish this, some of the literature reviewed mentions or supports the use of incision and drainage of SSTI and also supports doing wound cultures for sensitivities (Cohen, 2007a; Delit, Duchin, Hofmann, & Gurmai, 2004; Elston, 2007; Fleming et al., 2006; Gorwitz et al., 2006; J. T. Weber, 2005).

One prospective study of 62 children in Texas who had culture positive CA-MRSA SSTI concluded that incision and drainage without antibiotics was effective management for wounds less than five centimeters in diameter in immuno-competent children (Lee et al., 2004). Treatment consisted of drainage of 96% of patients and wound packing in 65%. All children were treated with antibiotics; however, four of the 62 patients (6%) that received this treatment were subsequently admitted to the hospital at the first follow-up; these patients had been empirically treated with a resistant antibiotic against CA-MRSA before wound culture results were available (Lee et al., 2004). Another study evaluated positive MRSA infections in 1,647 patients in the communities of Atlanta, Baltimore, and Minnesota from 2001-2002 and found that between 8% and 20% were community-acquired. The authors concluded that clinicians need to consider MRSA as a potential pathogen and, to prevent clinical complications, should obtain bacterial wound cultures and recommend surgical drainage of skin and soft tissue infections when feasible (Fridkin et al., 2005).

Guidelines of the Infectious Disease Society of American (IDSA) recommend that purulence containing infections should alert clinicians to suspect CA-MRSA. They recommend that refractory infections that do not respond to beta-lactam antibiotics should have a wound culture and sensitivity done, particularly in high-risk groups (Stevens et al., 2005). Recent health updates from the infectious disease task forces of several Departments of Health Services have released treatment guidelines to healthcare providers, stating that bacterial culture and antimicrobial sensitivity testing be done in all community-acquired SSTI (County of Sonoma Department of Health Services, 2008; Public Health Seattle & King County, 2007). A combined effort between the CDC, American Medical Association and the IDSA have developed and recommended a treatment algorithm for outpatient management of skin and soft tissue infections in the era of CA-MRSA (see Appendixes B and C).

### **Implications for Research**

Several key findings of the literature synthesis have made clear some areas in need of further research. A literature review matrix to organize the data extraction was created that included methodology study results and critique of selected research studies (see Appendix E and F).

First, the literature review indicates that there are different methods being employed by providers in the treatment of CA-MRSA. The CDC has created clinical guidelines that are not being consistently implemented. A key finding is that wound culturing of SSTIs is not routinely being done. As antibiotic resistance in our society is escalating, it becomes even more important to understand the prevalence of MRSA infections within the communities where clinicians practice. This information is critical when making decisions regarding treatment of skin and soft

tissue infections. Secondly, the need to document the incidence of CA-MRSA for the purposes of surveillance and antibiotic susceptibility is another key finding in this literature review. The nursing profession is expected to base their professional practice on emerging evidence from research; that is, nurses need to adopt an evidence-based practice (EBP). This study should help facilitate examination of one suburban outpatient family practice's current treatment of SSTI and associated epidemiologic factors. Based on this study's findings, the researcher may have evidence to support policy change within the practice for the treatment of SSTI, with the goal of enhancing patient outcomes.

## **CHAPTER 3: STUDY DESIGN**

This study is a descriptive epidemiologic retrospective medical record review of all wound cultured SSTI that presented to a family practice between January 2008 and December 2009. The aims of this study are to estimate the incidence of CA-MRSA, identify clinical characteristics, risk factors, antibiotic susceptibility, and evaluate patient education in this specific population.

Epidemiologic studies examine differences in disease rates among populations in relation to age, gender, race, and differences in temporal or environmental conditions. In general, these studies can only identify patterns or trends in disease occurrence over time or in different geographical locations but cannot ascertain the causal agent or degree of exposure. These studies are often very useful for generating hypotheses for further research.

Epidemiology is the quantitative study of the incidence and distribution of infectious diseases in the general population with the added goal of preventing and controlling the spread of these infections. This study describes the incidence of CA-MRSA in SSTI that were cultured and also describes the characteristics of the disease, such as patient demographics, health-related characteristics, risk factors, and treatment within the specific population sampled in the primary care setting (Hulley, 2007).

### **Strengths and Limitation of Proposed Design**

One of the strengths of a descriptive study is that it gives the researcher an opportunity to collect data that describes the frequency of a condition though it does not study relationships. Descriptive studies can be invaluable in documenting the incidence, nature, and intensity of health-related conditions and behaviors and are critical in the development of effective



interventions (Polit, 2008). This descriptive epidemiology study is the quantitative study of the incidence and distribution of an infectious disease in a specific clinical family practice.

The weaknesses of a descriptive study are that it can describe what seems to be a relationship but cannot support a prediction about cause and effect in how the relationship works, nor can cause and effect be tested with a descriptive study (Oman, 2003).

### **Setting**

The setting of the study is an outpatient primary care practice in Apopka, Florida. The practice has a diverse group of patients that includes both children and adults who range in age from newborn to geriatric. This practice sees on average approximately 75 patients a day. Ninety percent of these patients have either a private healthcare plan or Medicare, while the remaining 10% are uninsured. The practice has one physician, one nurse practitioner, and one physician assistant.

### **Sample**

Convenience sampling is utilized in this study for the ease of the researcher to access appropriate patients. The medical records of patients diagnosed with a STTI and whose wounds were cultured and treated in a family practice in Apopka, Florida, serve as the sample size. It is estimated that at least twelve patients are diagnosed with a skin and soft tissue infection per month. This average was determined after creating a list of all patients seen between January 2007 and December 2009 with a skin infection who were given a diagnosis that included the following: boil, abscess, paronychia, pustule, insect/spider bite, pilonidal abscess, furuncle/carbuncle, cellulitis, impetigo, and folliculitis.

## **Strategies for Gaining Access to Medical Records**

The study design is based on a medical record review. The medical records were obtained from existing patient populations within the practice that met the study inclusion and exclusion criteria. After IRB approval, one more year was added to the study, which provided additional medical records for review in order to conduct a meaningful analysis.

### **Exclusion Criteria**

1. Initial diagnosis and treatment of SSTI at another location other than family practice
2. Patients with dental abscess
3. Patients without documented wound culture laboratory reports
4. History of hospitalization, admission into nursing home, skilled nursing facility, or hospice within the last 12 months
5. Dialysis patient
6. Iatrogenic high-risk invasive procedure in the previous three months
7. Indwelling catheters or medical devices

### **Inclusion Criteria**

1. Patient presenting with a cultured SSTI diagnosed as folliculitis, pustular lesions, boil, furuncle/carbuncle, abscess, “insect/spider bite,” cellulitis, paronychia, pilonidal abscess, impetigo
2. Initial visit and treatment for SSTI at the family practice
3. Laboratory wound culture and sensitivity report in the medical record

### **Institutional Review Approval**

Institutional Review Board approval was obtained before initiating this study. Permission was also obtained from the clinical administrator of the family practice. For the purpose of this study, a waiver of consent was approved by the IRB as it met the criteria for a non-Food and Drug Administration regulated research (Department of Health and Human Services, 2005).

### **HIPAA Guidelines and Confidentiality**

The Health Insurance Portability and Accountability Act (HIPAA) form has been signed by all existing patients within the family practice and can be found in their medical records. The investigator, as a provider in the practice, has authorization to review clinic records.

Strategies for protecting this information include coding research data, storing it in a secure location, protecting or destroying the key that identified participants, and limiting personnel who have access to identifiers. The subject's identifying information is kept in a separate log form and stored in a secure area with accessibility only to the principle investigator (see Appendix G).

### **Study Instruments and Tools**

For the purpose of this study, a data collection tool developed by the researcher to capture data to answer the research questions was used (see Appendix B). The data tool was reviewed by expert researchers on the thesis committee who are also practicing healthcare providers.

## **Study Procedures**

A descriptive epidemiologic study involving patients with a skin and soft tissue infection who presented to Central Family Practice in Florida was conducted. A medical record review of all patients who were diagnosed with an SSTI and wound culture obtained between the years of January 2007 to December 2009 were audited for the studies inclusion and exclusion criteria. The list of eligible participants that met the inclusion criteria was generated after reviewing laboratory logs that were kept within the practice that document all wound cultures obtained. The list was verified to not miss any potential participants by comparing reports received by three laboratory centers that service the practice. The family practice has a specific account with each of these laboratories, and a report had been generated by each center of all wound cultures that were sent to them within the months of January 2007 to December 2009.

Information on demographic characteristics, clinical characteristics, potential risk factors, co-morbid conditions, clinical presentation, and treatments provided was collected by the investigator using a data collection tool and procedure form (see Appendix B). A table was created that lists the variable codes; the SPSS label, the SPSS value, and measurement level for SPSS 16 (see Appendix A).

## **Study Protocol/Procedures**

1. A list of eligible patients was compiled after reviewing the family practice laboratory log that documents all wound cultures obtained between the months of January 2007 to December 2009. This was compared to the generated reports from the three laboratory centers to verify there were no missed potential participants.

2. All medical records of eligible patients were reviewed. This was determined by the CPT code list generated from the billing department of patients who had a diagnosis of an SSTI between January 2007 and December 2009.
3. Verification that a wound culture performed and that the laboratory reports, including antibiotic sensitivities, were available in the medical record.
4. Investigator reviewed each medical record for inclusion and exclusion criteria to determine subject eligibility.
5. Demographic information (age, gender, home location, ethnicity, insurance payer) was collected and documented on the data collection tool.
6. Potential risk factors were collected and outlined on the data collection tool.
7. Patient clinical characteristics (temperature, date onset of symptoms, and skin infection diagnosis) were collected and outlined on the data collection tool.
8. Collect SSTI characteristics (purulent drainage present, incision and drainage performed, wound packing required, wound size, and antibiotic prescribed) as outlined on data collection tool.
9. Microbiology reports were reviewed to determine the bacterial organism(s) identified on the wound culture and antibiotic susceptibilities and document as outlined on data collection tool to evaluate treatment.
10. Documented if follow-up visits were recommended and whether they occurred; report any adverse events, including complications or hospitalizations.
11. Reviewed and documented recurrent skin infections up to three months post initial infection.
12. Reviewed and documented if patient was given wound care instructions.

13. Document all data on data collection tool.

### **Data Collection Tool**

Demographic, patient risk factors, clinical characteristics, SSTI wound characteristics, including culture and sensitivity report data, was captured and documented utilizing the data collection tool. The tool was designed so that each variable being measured was assessed and coded for ease of entering into an SPSS statistical software file for data organization and analysis (see Appendix A).

### **Data Analysis**

This section describes the statistics used to answer each research question and the rationale for the statistics chosen. The data is analyzed using the SPSS 16.0 Windows statistical program (Chicago, Ill). Six research questions were proposed:

- Question One: What is the incidence of community-acquired MRSA in cultured skin and soft tissue infections in a suburban family practice setting in Apopka, Florida?
- Question Two: What are the selected demographic associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Three: What are the selected clinical characteristics associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Four: What are the selected risk factors associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Five: What are the antibiotic susceptibilities associated with the culture positive CA-MRSA skin and soft tissue infections?

- Question Six: How many patients diagnosed with a SSTI had education regarding wound care documented in the medical record?

This study is descriptive epidemiology retrospective study to report the incidence rate of CA-MRSA, identify patient demographics, clinical characteristics, and risk factors associated with culture positive CA-MRSA SSTIs, and, lastly, analyze antibiotic culture and sensitivity reports. Descriptive statistics analyzed and summarized the patient risk factors, patient clinical characteristics, and SSTI wound characteristics. The data was organized, explored, and described. Any data identified as an out-of-range value, obvious error, miscoded data, and outlier was queried for accuracy and corrected. Missing data was coded appropriately as to not skew statistical analysis. Descriptive frequency was used to calculate frequency of distribution, measure of central tendency (mean, median, and mode), and dispersion shape of distributions. Measure of dispersion, such as variance and standard deviation was calculated.

### **Limitations of the Study**

Several potential issues were identified that may be encountered with this proposed study. The first issue is that only patients that had wound cultures done were included. This likely introduces a selection bias as patients who had SSTIs that were not purulent or had not required an incision and drainage performed were potentially excluded.

The second issue is that the patients' medical and social histories are also limited by the retrospective design of the study. The researcher is relying on the accuracy of documentation on the medical record by the providers or office staff.

The third issue is that the data collection questionnaire was developed specifically for purpose of this study. The data collection tool has not been validated. The content, predictive, and construct validity of the tool can be established by a panel of experts in the research topic.



## **CHAPTER 4: RESULTS**

This chapter describes the sample and reports the results of the statistical analysis of the data collected to determine the incidence of CA-MRSA in a suburban family practice and describes associated demographic, clinical characteristics, risk factors, antibiotic susceptibility, and evaluate patient education. The statistical computer program, SPSS 16.0, was used to analyze and evaluate the variables for the purpose of answering the research questions for this study:

- Question One: What is the selected incidence of community-acquired MRSA in cultured skin and soft tissue infections in a suburban Florida family practice?
- Question Two: What are the selected demographic characteristics associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Three: What are the selected clinical characteristics associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Four: What are the selected risk factors associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Five: What are the antibiotic susceptibilities associated with the culture positive CA-MRSA skin and soft tissue infections?
- Question Six: How many patients diagnosed with a SSTI had education regarding wound care documented in their medical record?

### **Description of the Sample**

An extensive review of the medical records in the practice between January 1, 1997 and December 31, 2009, was completed. During that period, there were 225 medical records that had

some type of skin or soft tissue infection (SSTI). Of those medical records, 62 met the inclusion and exclusion criteria for the study. One hundred percent (100%) of the medical records documented that a wound culture had been completed, and the laboratory report describing antibiotic susceptibilities were available for review for each of these records.

Of the 62 wound cultures obtained, 71% (n=44) grew one or more organisms. Of the 44 culture positive samples that grew one or more organisms, 84% (n=37) were identified as *Staphylococcus aureus*. Other non-*Staphylococcus* isolates included gram- positive 7% (n=3), gram-negative organisms 5% (n=2), and other bacterial organisms 5% (n=2) (see Table 1). Of note, 29% (n=18) of all wounds that were cultured showed no bacterial growth.

Table 1. Characteristics of Isolated Organisms

<b>Organisms (N=44)</b>	<b>Percent %</b>
Staphylococcus aureus	84% (n=37)
MRSA	66% (n=29)
MSSA	18% (n=8)
Non-staphylococcus aureus	16% (n=7)
Gram positive	7% (n=3)
Gram negative	4.5% (n=2)
Other	4.5% (n=2)

Further analysis of the 44 culture positive wounds revealed that the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) was 66% (n=29), while 18% (n=8) were methicillin-sensitive *Staphylococcus aureus* (MSSA).

Demographic characteristics of the patients' medical records (n=29) that cultured positive CA-MRSA skin and soft tissue infection are shown in Table 2. The mean age of those with CA-MRSA was 40 years, with a range from 7 to 90 years. Sixty-two percent (n=18) were male, and 38% (n=11) were female; additionally, 69% (n=20) lived within a 10-mile radius from the family practice, while 31% (n=9) lived in a surrounding suburb. The most common race was Caucasian at 83% (n=24), with African Americans totaling 10% (n=3) and Hispanics tallying 7% (n=2). In regards to payor sources, a study of the medical records determined that 90% (n=26) had private insurance and 10% (n=3) were self-pay.

Table 2. Demographics of Culture Positive SSTI CA-MRSA

<b>Variable (N=29)</b>	<b>Frequency</b>	<b>Percent</b>
<b>Age</b>		
<17 years old	4	14%
18-60 years old	24	80%
>61 years old	2	6%
<b>Gender</b>		
Male	18	62%
Female	11	38%
<b>Race</b>		
Caucasian	24	83%
African American	3	10%
Hispanic	2	7%
<b>Home Location</b>		
Apopka	20	69%
Orlando	1	3%
Other	8	27%
<b>Insurance</b>		
Yes	26	90%
No	3	10%

Clinical risk factors associated with culture positive CA-MRSA skin and soft tissue infections are summarized in Table 3. The most common risk factors identified was obesity 41% (n=11), diabetes mellitus 24% (n=7), a MRSA infection within the previous 12 months 24% (n=7), and attending daycare or school 10% (n=3). Other risk factors evaluated found that none of the positive culture CA-MRSA records had a history of illicit drug abuse or were immune-compromised. Additionally, only one medical record identified the presence of a chronic skin condition of psoriasis.

Table 3. Clinical Risk Factors Associated with Culture Positive CA-MRSA

<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
<b>Previous MRSA infection (n=29)</b>		
Yes	7	24%
No	22	76%
<b>Chronic skin condition (n=29)</b>		
Yes	1	3%
No	28	97%
<b>IV drug abuse (n=29)</b>		
Yes	0	0%
No	25	86%
Unknown	4	14%
<b>Attends day-care/school (n=29)</b>		
Yes	3	10%
No	26	90%
<b>Diabetes Mellitus (n=29)</b>		
Yes	7	24%
No	22	76%
<b>BMI (n=27)</b>		
<19	2	7%
19-29	14	52%
>30	11	41%
<b>Immune Compromised (n=29)</b>		
Yes	0	0%
No	29	100%

Clinical characteristics associated with the culture positive SSTIs are displayed in Table 4. The majority 86% (n=25) of those infected with MRSA showed no presence of fever, having a temperature of <99 degrees Fahrenheit at the time of presentation. The mean duration of symptoms at the time of presentation was 14 days, with a range from 3 to 60 days. Most of the skin and soft tissue infections had purulent drainage 90% (n=26), with 79% (n=23) of the

wounds requiring an incision and drainage; additionally, only 3 (10%) required wound packing. The mean size of the studied skin and soft tissue infections was 3 centimeters, with a range of 1 to 6 centimeters. There were 55% (n=16) of the medical records that lacked documentation of the skin and soft tissue infection size and 38% (n=11) missing day's onset of symptoms. There were four wound types identified for the skin and soft tissue infections, with the most common diagnosis being an abscess 62% (n=18). Others included boils 24% (n=7), pustules 10% (n=3), and cellulitis 4% (n=1).

Table 4. Clinical Characteristics Associated with Culture Positive MRSA SSTI

<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
<b>Presence of Fever (n=29)</b>		
< 99° F	25	86%
99-101° F	0	0%
>101° F	1	4%
Unknown	3	10%
<b>SSTI Size, cm (n=23)</b>		
< 6 cm	21	91%
> 6 cm	2	9%
<b>Symptom Duration, d (n=18)</b>		
< 6 days	5	28%
6-14 days	7	39%
> 14 days	6	33%
<b>Purulent Drainage (n=29)</b>		
Yes	26	90%
No	3	10%
<b>Incision &amp; Drainage (n=29)</b>		
Yes	23	79%
No	6	21%
<b>Wound Packed (n=29)</b>		
Yes	3	10%
No	26	90%
<b>SSTI Diagnosis (n=29)</b>		
Abscess	18	62%
Boil	7	24%
Pustule	3	10%
Cellulitis	1	3%

Each of the skin and soft tissue infections that were culture-positive for CA-MRSA were prescribed a broad-spectrum antibiotic designed to eliminate the most likely suspected organisms. The six antibiotics in this study show a variety of susceptibility and resistance features in regards to CA-MRSA that are displayed in Table 5. Of these six, the most efficacious

ones were trimethoprim-sulfamethoxazole and doxycycline. The CA-MRSA isolate were susceptible to trimethoprim-sulfamethoxazole 100% (n=29) of the time, while the susceptibility of doxycycline was 93% (n=27). Clindamycin was the next most effective drug, successfully targeting CA-MRSA 65% (n=15) of the time; however, the organism was resistant to this medication 30% (n=7) of the time, while 4% (n=1) were intermediate. Susceptibility and resistance testing for the drug rifampin was only done on 14 of the 29 wounds in these particular pathology records; however, the medication was 100% effective against CA-MRSA in combination with another antibiotic. The last two antibiotics tested were cephalexin and erythromycin. The results of both these antibiotics were identical in their ineffectiveness, in that 93% (n=27) of the time the MRSA isolates were resistant to these medications.

Table 5. Frequency of Susceptible Antibigram Results in CA-MRSA Isolates

<b>Antibiotics (N=29)</b>	<b>Susceptible</b>	<b>Resistant</b>	<b>Intermediate</b>	<b>Not Done</b>
Trimethoprim-sulfamethoxazole	29 (100%)	0%	0%	
Doxycycline	27 (93%)	1 (3.5%)	1 (3.5%)	
Clindamycin	15 (65%)	7 (31%)	1 (4%)	6 (21%)
Cephelaxin	2 (7%)	27 (93%)	0%	
Rifampin	14 (48%)	0%	0%	15 (52%)
Erythromycin	2 (7%)	27 (93%)	0%	



In regards to patient education, wound care instructions were clearly documented in 45% (n=13) medical records. However, no documentation was found in 55% (n=16) of the records.

Recurrence of infection in the clinical record was also assessed. The review determined that of the 29 cases, 10% (n=3) developed recurrence of an SSTI three months after the initial diagnosis. All of these patients had been treated with trimethoprim-sulfamethoxazole at their first presentation. Also of note is that the organisms isolated in these three patients were reported to be susceptible to trimethoprim-sulfamethoxazole according to the wound culture report.

## CHAPTER 5: CONCLUSION

In this chapter, the findings of the study as related to each research question regarding incidence of CA-MRSA, demographics, clinical characteristics, risk factors, antibiotic susceptibility, and patient education will be discussed. Limitations of the study will be identified and study conclusions stated. Finally, the implications for nursing practice and recommendations for future projects and research will be presented.

### Discussion

With the recent trends toward increased incidence of MRSA in the general community, the number of patients presenting with SSTI treatment for CA-MRSA infections is becoming more common in ambulatory settings beyond the emergency department or specialty practices. In years past, uncomplicated skin and soft tissue infections were caused by methicillin-susceptible *Staphylococcus aureus* (MSSA) and were effectively treated with beta-lactam antibiotics. However, due to the rise in antibiotic resistance, this is no longer the case, even in healthy individuals (Moran et al., 2006). Additionally, recent studies have concluded that *Staph aureus* incidence is higher in certain geographic locations with high poverty rates and community housing (Owens, 2009). A review of the literature identified a need for further studies to be undertaken among different types of patients in a variety of different outpatient settings in order to confirm this alarming trend of increasing CA-MRSA. This study was conducted at a suburban family practice in Florida for the purpose of determining the incidence of CA-MRSA SSTIs, as well as to identify relevant epidemiologic factors, antibiotic susceptibilities, and to evaluate patient education.

## **Incidence of CA-MRSA**

One of the major objectives for conducting this study was to determine the incidence of CA-MRSA of cultured SSTIs in a suburban Florida family practice. The terms prevalence and incidence are often used interchangeably even though their definitions are distinct. The patient population at risk included all patients that had some form of a positive STTI culture. Cultures that yielded no growth were not analyzed, as this was taken to be a result of inadequate sampling or potentially a sterile wound (Bruce, 2008). In this study, 71% of the SSTI cultures were positive for one or more bacterial organisms. Based on microbiology resistance analysis, it was found that the incidence of CA-MRSA strains was 66%. This incidence appears to be similar to the incidence reported by several previously cited studies. In these three studies, the average incidence of MRSA found in a variety of SSTIs was calculated to be 73% (Jacobus, 2007; Kaplan, 2005; Magilner, 2008). Based on this information, this study would suggest that the community served by this family practice is at moderately high risk for CA-MRSA SSTIs. As a result, health care providers need to consider this bacterial pathogen in their treatment management and follow recommended clinical treatment guidelines.

## **Demographic Characteristics of CA-MRSA SSTI**

There has been a lack of comprehensive epidemiological studies of patients infected with CA-MRSA in part due to CA-MRSA not being a reportable disease, unless associated with a community outbreak or death of a patient. Outbreaks have occurred in several discrete patient populations. Identified at-risk populations include children, soldiers, prisoners, homeless persons, intravenous drug users, and men who have sex with men (Gorwitz, Jernigan, Powers, Jernigan, & Participants in the CDC-Convened Experts' Meeting on Management of MRSA in

the Community, 2006). In this study, the demographic characteristics evaluated included age, gender, ethnicity, place of residence, and health insurance coverage.

Demographic characteristics of the culture positive CA-MRSA SSTI for this study demonstrated that males (62%) were infected more frequently than females (38%). It has been reported in the literature, that risk of skin infection with CA-MRSA is higher in those involved in contact sports, sharing of personal items or sporting equipment. Men tend to participate in these activities more frequently which are postulated as a possible reason why males were infected at a higher rate than women in this study. The literature reports that children attending day care or school are at higher risk CA-MRSA SSTI (Hinckley & Allen, 2008; Hulten et al., 2006; Magilner, 2008; Purcell & Fergie, 2005). However, in this study, the median age was 40 years old, with a total of only three (14%) pediatric patients under the age of 17 that had culture positive CA-MRSA. This finding is not surprising for this practice, as pediatrics comprises less than 10% of the patient population. The incidence of CA-MRSA has been also been reported in younger patients (Kowalski, Berbari, & Osmon, 2005). In this study, 80% of the patients infected with CA-MRSA were between the ages of 18-60 years old. This is an important finding, as much of the literature on CA-MRSA focuses on the pediatric patient. This study clearly documents that adult patients are also at high-risk for CA-MRSA when presenting with SSTIs to suburban family practices. Older patients greater than 60 years of age are not infected as commonly with CA-MRSA strains as are the young and the healthy. It is postulated that this may be due to outbreaks primarily being reported in those who live in crowded conditions or have close physical contact with others (Kowalski et al., 2005). It is important to note that if an elderly person living in a nursing home or assisted living facility contracts MRSA; it is classified as healthcare-associated versus a community-acquired infection. Patients with risk factors that

fulfill these criteria include military personnel, prison inmates, athletes, IV drug users, and daycare centers. Individuals in these areas are primarily young people less than 60 years of age. Certain ethnic groups have also been identified as populations at risk for outbreaks of CA-MRSA; these include Pacific Islanders, Native Americans/Alaska Natives, and Pacific and Canadian Aboriginals (Centers for Disease Control and Prevention, 2006c). The most common race identifying as positive for CA-MRSA in this study was Caucasians (83%), followed by African Americans (10%), and lastly Hispanics (7%). These results are consistent with racial census reported for this geographic location in Florida ("Apopka Florida Census, and Community Profile," 2010). These findings demonstrate that there are other ethnic groups at high risk for CA-MRSA other than those previously reported in the literature, and primary care providers need to appropriately treat this bacterial pathogen.

The majority of the medical records did document that 90% of the patients had some type of health insurance. Only 10% were uninsured and self-pay. This is a noteworthy finding because it is in contrast to what is usually reported; namely, that communities with higher poverty rates and no health insurance are generally considered to be at higher risk for CA-MRSA (Owens, 2009). This study refutes the previous conclusion because most of the patients had insurance and yet the incidence of CA-MRSA SSTI was still significantly elevated. As a result, clinicians need to be aware that there is still a high risk for CA-MRSA SSTIs even in patients from less impoverished communities. To note, the family practice under study reported that 8 to 10% of their patients were uninsured; thus, the sample may not have represented the lower poverty population in that community.

Researchers studying MRSA have recommended that studies be done in different types of outpatient health care settings. A gap identified in the literature review was studies of CA-

MRSA specifically in suburban settings to include suburban family practices. It was important that data collected is also reflective of this type of population. Ninety-eight percent of the medical records in this study documented that the home location was either in the suburb where the family practice was located or a nearby suburban town. Thus, the findings of this study do reflect a suburban community.

### **Clinical Characteristics of CA-MRSA SSTI**

It is important that health care providers are able to identify clinical characteristics associated with CA-MRSA, as these may help guide the practitioner in correctly diagnosing and treating skin and soft tissue infections that could have more serious consequences.

Unfortunately, there are no clinical features that clearly distinguish CA-MRSA from MSSA skin infections. The most common skin and soft tissue diagnosis in this study was an abscess. Most patients presented with no fever and the wound size was less than five centimeters. The only other significant difference noted was that CA-MRSA infections presented with less than six days' duration of symptoms; in contrast, all of those with MSSA had symptom duration of six days or greater. This finding is consistent with literature that reports that a typical CA-MRSA related SSTI can have the clinical characteristics of an acute abscess that can form almost overnight (Owens, 2009). Yet, based on these findings, there is no reassurance that less severe SSTI's are not also caused by CA-MRSA. This statement is supported by two other cohort studies looking at the usefulness of clinical characteristics to help differentiate MRSA from MSSA infections. The first, completed in 2002, was an observational study of 144 children. The second was done in 2007 and enrolled 180 adult patients. Both studies found no clear distinguishing hallmark features for MRSA (Miller, 2007; Sattler, 2002).

In regard to SSTI management, most CA-MRSA infections in this study were purulent and required an incision and drainage. The majority of CA-MRSA infections were less than six centimeters in size, which could be why only a few required wound packing. Incision and drainage continues to be a mainstay of treatment for a fluctuant abscess and is recommended by most infectious disease experts (Frazee, 2005; Gorwitz et al., 2006). If clinicians are unsure whether pus is present in a lesion, an attempt can be made to aspirate fluid from the lesion using an adequate size needle and syringe (Centers for Disease Control and Prevention, 2006c).

### **Risk Factors of CA-MRSA SSTI**

The only significant clinical risk factors associated with CA-MRSA found in this study was obesity (41%), BMI >30, a history of diabetes mellitus (24%), and a history of previous MRSA infection (24%). These findings are consistent with risk factors that the CDC reports (Gorwitz et al., 2006). This is important because clinicians need to consider prescribing an antibiotic that is effective against CA-MRSA to patients presenting with an SSTI who are diabetic, obese, or have had a previous MRSA infection...

### **Antibiotic Susceptibilities of CA-MRSA SSTI Isolates**

Similar to previous reports in other studies, CA-MRSA isolates in this study were generally susceptible to trimethoprim-sulfamethoxazole (100%) and doxycycline (93%), both of which were prescribed for 10-day courses of treatment. Trimethoprim-sulfamethoxazole and doxycycline are both Food and Drug Administration (FDA) approved for the treatment of SSTIs caused by *Staph aureus* but not specifically for MRSA isolate infections (Gorwitz et al., 2006). However, Lyer and Jones (2004) reported successful use of trimethoprim-sulfamethoxazole along with incision and drainage of abscesses for the treatment of CA-MRSA. In a small case

report, doxycycline and minocycline, which are both long-acting tetracycline class antibiotics, were successfully used in treating tetracycline-susceptible MRSA isolate SSTIs (Ruhe, 2005). On the other hand, in this study, clindamycin resulted in 24% resistance. This supports experts' recommendations of avoiding empirical therapy with clindamycin when local rates of clindamycin resistance exceed 10-15% among MRSA isolates causing skin and soft tissue infections cite (Kaplan, 2005).

In this study resistance to cephelaxin (93%) and erythromycin (93%) was similar to results reported in the literature, and along with beta-lactam antibiotics should be avoided in the treatment of suspected MRSA SSTI (Centers for Disease Control and Prevention, 2006c). This study identified that rifampin was susceptible only 48% of the time; because of this, it is recommended that rifampin primarily be prescribed in combination with another antibiotic known to be effective against CA-MRSA isolates. There have been studies conducted that support this finding. One such study found that when rifampin was given alone, resistance rapidly developed unless prescribed in combination with other antibiotics to which the isolate is susceptible (Iyer, 2004). A second study found that there is little data available supporting the incremental benefit of adding rifampin to the course of antibiotic therapy (Hinckley & Allen, 2008). However, an additional study suggested that a theoretical benefit may be derived from the high concentration level of rifampin achieved in mucosal surfaces, promoting eradication of MRSA isolate carriage (Simor et al., 2007).

Clinical guidelines for options for empiric outpatient antimicrobial treatment of SSTIs when MRSA is a consideration have been created and supported by the CDC, AMA and ISDA organizations as previously discussed in chapter 2 (Figure 2). The findings of this study suggest that the family practice under study did adhere to the recommendations and consistently were



prescribing appropriate empiric antibiotics. The CPG also recommends that fluctuant SSTI with purulent drainage have an incision and drainage performed. Again, the site under study did regularly perform this procedure when appropriate. Unfortunately, there was no consistency in obtaining wound cultures, as evidenced by the medical record review. Of the 225 charts initially identified, only 62 met the inclusion and exclusion criteria mostly because a culture was not performed. The practice does not follow any specific CPG, which is probably why this variation exists.

### **Patient Education and Documentation**

In addition to empiric antibiotic therapy, wound care education is critical to the management plan of SSTIs. This study found that 55% of the medical records lacked documentation that wound care instruction had been given to the patient. Fortunately, only three reported recurrent SSTIs cases occurred, of which only one of those cases had no wound care instruction documented. Despite this, patient education is considered an essential component of SSTI therapy, especially in regards to the strategies of adequate hygiene, hand washing, and cleaning and covering wounds. These standard infection control precautions are the most important methods for primary prevention and transmission reduction of MRSA. To that end, the CDC provides an informative handout titled “MRSA Information for Patients, which is available <http://www.cdc.gov/ncidod/dhqp/pdf/ar/MRSAPatientInfoSheet.pdf>.

### **Limitations of Study**

There are several limitations to this study that must be considered. Firstly, the study was a retrospective medical record review. Thus, the points of concern were limited by how well the provider and staff had documented the answers to the variables being studied.

Secondly, the search for records was based on the International Classification of Diseases (9<sup>th</sup> Revision, Clinical Modification) codes for the diagnoses of abscess, boil, pustule, cellulitis, impetigo, furuncle/carbuncle, paronychia, insect/spider bite, pilonidal abscess, and the procedure code for incision and drainage and wound cultures collected within 24 hours of diagnosis. Patients who presented with an abscess that was drained and cultured may have been missed if any of the above were not included in their coding.

Thirdly, there exists the possibility of selection biases in regards to which SSTIs were cultured, therefore skewing the results. It is possible that assumptions about the SSTI location, size, and duration of symptoms may have influenced the provider as to whether to culture or not. Clinical practice guidelines are systematically developed statements to assist practitioners with patient decisions about appropriate healthcare for specific clinical circumstances. Their successful implementation should improve quality of care by decreasing inappropriate variation in treatment. Unfortunately, despite the dissemination of clinical guidelines for MRSA, their effect on changing clinicians' practice behavior has been limited (Borry, 2006). The clinical guideline outlined in Figure 1 recommends that purulent lesions be cultured for susceptibility testing. In this study, there were medical records reviewed that met the inclusion criteria for a SSTI diagnosis but were excluded because a wound culture was not performed. As a result, this study sample size was smaller than expected and suggests that there was no consistent method or the clinical guideline routinely followed.

The fourth possible limitation is that in the suburban town studied, there are several other family practices as well as a hospital; because of this, many individuals with CA-MRSA skin infections are likely to have presented to other practices or to the emergency room. This could mean that the sample size of this study is not large enough to draw significant conclusions about

the population at large. Also, because less than 10% of this family practice's population was pediatric patients, this study is limited in its ability to make generalizations of the results to this specific population.

Finally, this study was limited only to those SSTIs in which a wound-site culture was obtained. Conclusions from this study, therefore, should not be extrapolated to all SSTIs but must be limited to those patients presenting to a family practice with culturable skin infections.

### **Conclusion**

The result of this study suggests similar incidence of CA-MRSA (66%) in cultured SSTIs presenting to this suburban family practice in Florida as compared to incidences found in the literature. Because of this, it is imperative that practitioners adopt evidence-based medicine into their practice in order to effectively treat this problem. The results of this study do support a policy change within the practice for the management of SSTI.

The policy change includes the integration of a clinical guideline for the management of CA-MRSA SSTI within the practice. The CDC, AMA, and IDSA have jointly developed a treatment algorithm guideline for the management of SSTI's (Figure 1). This guideline recommends that all purulent and/or incision and drained SSTIs be cultured for the purpose of antibiotic susceptibility testing and surveillance. Implementing this clinical guideline should improve patient outcomes, which is a primary goal of this practices clinicians.

In this study, over half of the medical records were lacking wound care documentation. To address this issue, the practice will incorporate into its medical record templates an area to document wound care instructions. Patients will also be given an educational pamphlet created by the CDC aimed at explaining what a MRSA infection is. This pamphlet also educates the

importance of hygiene, such as hand washing, cleaning, and covering of wounds to reduce the potential spread of this infection (Appendix H).

Only as research on CA-MRSA continues, with particular emphasis on standardizing treatment protocols for wound culturing, will clinicians be able to improve surveillance, increase tracking of incidence and strengthen current clinical treatment guidelines.

Lastly, the judicious use of antibiotics cannot only provide definitive cure but is also critical in the prevention of antibiotic resistance. Antibiotic susceptibility testing confirmed that those therapies provided in this study were consistent with CDC recommendations for appropriate empiric antibiotic treatment for suspected CA-MRSA; that is, trimethoprim-sulfamethoxazole and doxycycline. Practitioners should avoid beta-lactam, cephalosporins, and erythromycin as these have been found to be ineffective against MRSA.

### **Implications for Nursing Practice**

The rapid emergence of CA-MRSA has had an impact on all health care providers, and as the incidence rises in the outpatient setting, it has become a significant burden to society. These SSTI infections may appear relatively minor at first but can lead to life-threatening lung, heart, and bloodstream infections if not managed properly. Health care providers need to obtain specimens for culture and sensitivity testing and then direct their treatment according to generally known microbial susceptibility, especially in clinical situations where empirical therapy is initiated at first patient presentation. It is imperative that health care providers understand the importance of the judicious use of antibiotics for the prevention of antibiotic resistance. The National Institute of Allergy and Infectious Diseases formulated a strategy directed at reducing those factors that contribute to antimicrobial drug resistance (Peters, 2008).

Only by obtaining wound cultures will proper tracking and surveillance of CA-MRSA infections be better understood. A genetic distinction between CA-MRSA and HA-MRSA has been identified which affects treatment options. This genetic distinction indicates that HA-MRSA is not the same bacteria that cause CA-MRSA SSTIs. Community-acquired MRSA is often susceptible to many non-beta-lactam antibiotics, where as HA-MRSA is typically resistant to these antibiotics. Having made distinction, the CDC has defined different criteria to properly identify, diagnose, treat, and prevent the spread, and invasiveness of both CA-MRSA and HA-MRSA infections (Center for Disease Control and Prevention, 2007a). Nurse practitioners are positioned to be leaders in disease prevention and treatment in the community, as well as strong influences in the lives of our patients through the education we provide our patients regarding the risk factors for CA-MRSA.

### **Implications for Education**

Standard infection control precautions are the most important methods for prevention of transmission of MRSA. It is imperative that patients understand what MRSA is, who is at risk, the seriousness of this infection, and how to properly treat and keep from spreading this infectious bacterium. The CDC has created patient educational tools about CA-MRSA and has made them available online at: [http://www.cdc.gov/ncidod/dhqp/ar\\_mrsa.html](http://www.cdc.gov/ncidod/dhqp/ar_mrsa.html). These tools emphasize proper hand washing, good personal hygiene, contact precautions, and proper wound care.

It is also important that health care providers to stay abreast with continuing education on CA-MRSA. The incidence of resistant bacteria microorganisms has increased in this country and is now a serious public health problem. Nurse practitioners need to examine the evidence

and incorporate the findings into their practice as they manage and treat patients with SSTIs.

There is a wealth of information available at the CDC website for health care providers for the purpose of keeping abreast of the latest research and recommendations for treatment.

### **Recommendations for Future Research**

More clinical studies are warranted in primary care settings in order to better understand the incidence of CA-MRSA in variety of communities. Future research could include randomized controlled trials (RCT) of the use of antibiotics after drainage of abscesses on SSTI that are less than five centimeters versus five centimeters or greater; as well as randomized trials to determine whether packing an abscess with gauze improves wound outcomes or speed of wound healing.

## **APPENDIX A: SPSS VARIABLE KEY CODE**

SPSS Key Code 1

Variable Codes	SPSS Label	SPSS Value(s)	Measurement Level
Age	Age group	Enter Age	Scale
Gender	Gender	1 = Male 2 = Female	Nominal
Home Location	Home	1 = Apopka 2 = Orlando 3 = Longwood 4 = Mount Dora 5 = Tavares 6 = Clermont 7 = Maitland 8 = Other	Nominal
Ethnicity	Race/Ethnicity	1 = Hispanic 2 = Black 3 = White 4 = Asian 5 = Other	Nominal
Medical Insurance	Insurance	1 = Private 2 = Medicare 3 = Medicaid 4 = Self-pay 5 = Other	Nominal
Risk Factor #1	Previous MRSA	1 = Yes 2 = No	Nominal
Risk Factor #2	Chronic skin condition – eczema or psoriasis	1 = Yes 2 = No	Nominal
Risk Factor #3	IV drug use	1 = Yes 2 = No	Nominal
Risk Factor #4	Attends daycare/school	1 = Yes 2 = No 3 = Home school	Nominal
Risk Factor #5	Diabetes mellitus	1 = Yes 2 = No	Nominal
Risk Factor #6	Obesity – BMI >30	1 = Yes 2 = No	Nominal
Risk Factor #7	Immune compromised	1 = Yes 2 = No	Nominal
Clinical characteristic #1	Temperature (in Fahrenheit)	1 = < 99 2 = 99-101 3 = > 101	Scale
Clinical Characteristic #2	BMI	1 = Equal or <18 2 = 19-29 3 = Equal or >30	Scale
Clinical characteristic #3	Days symptoms present before presentation	Enter days	Scale



<b>Variable Codes</b>	<b>SPSS Label</b>	<b>SPSS Value(s)</b>	<b>Measurement Level</b>
Clinical characteristic #4	SSTI Diagnosis	1 = Boil 2 = Abscess 3 = Paronychia 4 = Pustular Lesion 5 = Insect/spider bite 6 = Pilonidal abscess 7 = Furuncle/carbuncle 8 = Cellulitis 9 = Impetigo	Nominal
Clinical characteristic #5	Purulent drainage	1 = Yes 2 = No	Nominal
Clinical intervention #6	I&D performed	1 = Yes 2 = No	Nominal
Clinical characteristic #7	Wound packing	1 = Yes 2 = No	Nominal
Clinical characteristic #8	Wound measurement (estimate)	1 = <5 cm 2 = 6 cm or greater	Ratio
Antibiotic prescribed	Antibiotic	1 = Septra 2 = Doxycyline 3 = Clindamycin 4 = Keflex 5 = Erythromycin 6 = Rifampin 7 = Bactroban 8 = Other	Nominal
Wound culture	Bacterial Pathogen type	1 = MRSA 2 = MSSA 3 = Other Gm positive 4 = Other Gm negative 5 = Other organism 6 = No growth	Nominal
Antibiotic susceptibility #1	Septra	1 = Susceptible 2 = Resistant 3 = Intermediate 4 = N/A 5 = Not done	Ordinal
Antibiotic susceptibility #2	Doxycycline	1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Not done	Ordinal
Antibiotic susceptibility #3	Clindamycin	1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Not done	Ordinal
Antibiotic susceptibility #4	Keflex	1 = Susceptible 2 = Resistant 3 = Intermediate	Ordinal

<b>Variable Codes</b>	<b>SPSS Label</b>	<b>SPSS Value(s)</b>	<b>Measurement Level</b>
		4 = Not done	
Antibiotic susceptibility #5	Erythromycin	1 = Susceptible 2 = Resistant 3 =Intermediate 4 = Not done	Ordinal
Antibiotic susceptibility #6	Rifampin	1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Not done	Ordinal
Antibiotic susceptibility #7	Bactroban	1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Not done	Ordinal
Adverse Events	A.E.	1 = Complications 2 = Hospitalizations 3 = None	Nominal
Patient education on wound care	Wound instructions documented	1 = Yes 2 = No	Nominal
Recurrent skin infection	Recurrent SSTI	1 = Yes 2 = No	Nominal

## **APPENDIX B: COLLECTION TOOL**

**DATA SHEET 1: COLLECTION TOOL**

**Medical Record Review**

Date: \_\_\_\_\_ Subject # \_\_\_\_\_ Study site: \_\_\_\_\_

**Exclusion Criteria:** (If any answers **yes** = do not enroll patient)

- 1. Initial diagnosis and treatment of SSTI at another location  
other than family practice. \_\_\_Yes      \_\_\_No
  
- 2. Patients with dental abscess \_\_\_Yes      \_\_\_No
- 3. Patients without documented wound culture reports \_\_\_Yes      \_\_\_No
- 4. History of hospitalization, admission into nursing home,  
skilled nursing facility or hospice within the last 12 months \_\_\_Yes      \_\_\_No
  
- 5. Dialysis patient. \_\_\_Yes      \_\_\_No
- 6. Iatrogenic high risk invasive procedure in the previous 3 months \_\_\_Yes      \_\_\_No
- 7. Indwelling catheters or medical devices \_\_\_Yes      \_\_\_No

**Inclusion Criteria:** (If any answers **no**, do not enroll patient)

- 1. Patient presenting with SSTI diagnosed as folliculitis, pustular lesions, boil,  
furuncle/carbuncle, abscess, “insect/spider bite”, cellulitis, paronychia, pilonidal abscess,  
impetigo. \_\_\_Yes      \_\_\_No
- 2. Initial visit and treatment for SSTI at Central Family Practice. \_\_\_Yes      \_\_\_No
- 3. A wound culture obtained. \_\_\_Yes      \_\_\_No

**SECTION 1 – DEMOGRAPHIC INFORMATION (1-6)**

Age: \_\_\_\_\_ yr old.                      Gender: (1) Male \_\_\_ (2) Female \_\_\_

DOB: \_\_\_\_\_

Home Location: (1) Apopka \_\_\_ (2) Orlando \_\_\_ (3) Longwood \_\_\_ (4) Mount Dora \_\_\_  
(5) Tavares \_\_\_ (6) Clermont \_\_\_ (7) Maitland \_\_\_ (8) Other \_\_\_

Race/Ethnicity: (1) Hispanic \_\_\_ (2) Black \_\_\_ (3) White \_\_\_ (4) Asian \_\_\_ (5) Other \_\_\_

Insurance payer: (1) Private \_\_\_ (2) Medicare \_\_\_ (3) Medicaid \_\_\_ (4) Self-Pay \_\_\_ (5) Other \_\_\_

**SECTION 2 – PATIENT RISK FACTORS (1-8)**

- 1. Diagnosed with MRSA within the past 12 months. (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 2. Chronic skin conditions (eczema or psoriasis) (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 3. Use of IV street drugs. (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 4. Attends a child care center or school? (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 5. Diabetes Mellitus (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 6. Obesity (BMI>30) (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown
- 7. Immune compromised in the last 12 months (1) Yes \_\_\_ (2) No \_\_\_ (3) Unknown  
(HIV, IV drug abuse, active Hepatitis C or receiving chemotherapy agents).

**SECTION 3 – Patient Clinical Characteristics**

Oral Temperature (Fahrenheit) \_\_\_ (1) < 99 \_\_\_ (2) 99-101 \_\_\_ (3) > 101 BMI \_\_\_\_\_

Date onset of symptoms (Day(s): \_\_\_\_\_ (length of symptoms before presentation)

Skin infection diagnosis:

- \_\_\_ (1) Boil                      \_\_\_ (4) Pustular lesion                      \_\_\_ (7) Furuncle/carbuncle
- \_\_\_ (2) Abscess                      \_\_\_ (5) Insect/spider bite                      \_\_\_ (8) Cellulitis
- \_\_\_ (3) Paronychia                      \_\_\_ (6) Pilonidal abscess                      \_\_\_ (9) Impetigo                      \_\_\_ (10) Folliculitis

**Wound Description:**

Purulent drainage present? (1) Yes \_\_\_ (2) No \_\_\_

Incision & Drainage performed? (1) Yes \_\_\_ (2) No \_\_\_

Wound Packed? (1) Yes \_\_\_ (2) No \_\_\_

Wound measurement (estimate): Length \_\_\_\_\_ Width \_\_\_\_\_ Depth \_\_\_\_\_

Antibiotic prescribed:

- \_\_\_ (1) Septra                      \_\_\_ (2) Doxycycline                      \_\_\_ (3) Clindamycin                      \_\_\_ (4) Keflex
- \_\_\_ (5) Erythromycin                      \_\_\_ (6) Rifampin                      \_\_\_ (7) Bactroban                      \_\_\_ (8) Other

**SECTION 4: Culture and Sensitivity Report**

Date: \_\_\_\_\_

Visit 1- wound culture result:

- List pathogen(s) \_\_\_\_\_ (1) MRSA  
 \_\_\_\_\_ (2) MSSA  
 \_\_\_\_\_ (3) Other Gram positive bacteria  
 \_\_\_\_\_ (4) Other Gram negative bacteria  
 \_\_\_\_\_ (5) Other: \_\_\_\_\_  
 \_\_\_\_\_ (6) No growth

**Antimicrobials Susceptibility:**

	(1) <u>Susceptible</u>	(2) <u>Resistant</u>	(3) <u>Not available</u>	(4) <u>Not done</u>
(1) Septra (TMP-SMX)	_____	_____	_____	_____
(2) Doxycycline	_____	_____	_____	_____
(3) Clindamycin	_____	_____	_____	_____
(4) Keflex	_____	_____	_____	_____
(5) Erythromycin	_____	_____	_____	_____
(6) Rifampin	_____	_____	_____	_____
(7) Bactroban	_____	_____	_____	_____
(8) Other	_____	_____	_____	_____

**SECTION 5:**

Any adverse events: (1) complications or (2) hospitalizations (3) None. Please describe: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Patient education documented regarding wound care. (1) Yes \_\_\_\_\_ (2) No \_\_\_\_\_

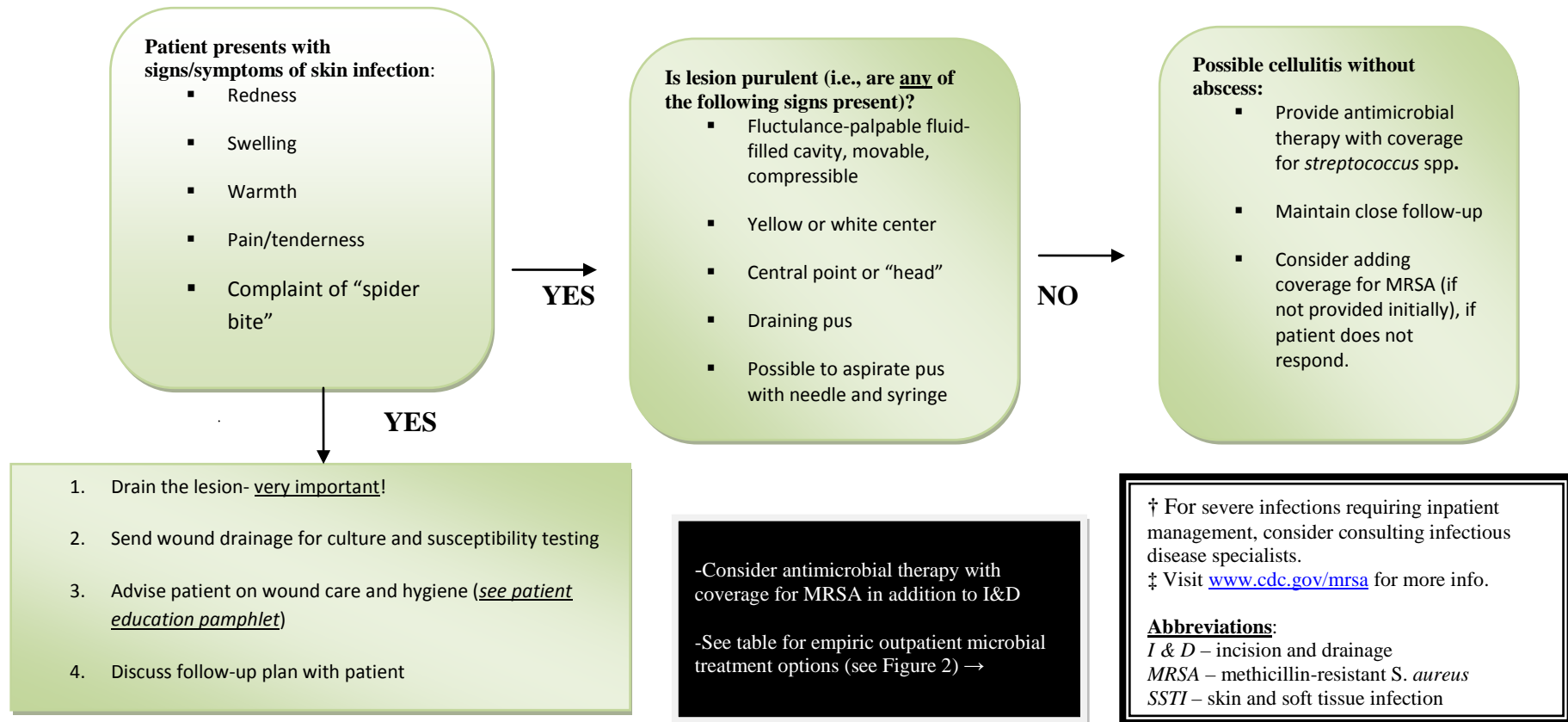
Recurrent SSTI 3 months after treatment. (1) Yes \_\_\_\_\_ (2) No \_\_\_\_\_

Investigator Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**APPENDIX C: OUTPATIENT MANAGEMENT OF SKIN AND SOFT TISSUE  
INFECTIONS IN THE ERA OF COMMUNITY-ASSOCIATED MRSA**

## OUTPATIENT<sup>†</sup> MANAGEMENT OF SKIN AND SOFT TISSUE INFECTIONS IN THE ERA OF COMMUNITY-ASSOCIATED MRSA<sup>‡</sup>



Centers for  
Control and

Disease  
Prevention

**AMA**  
AMERICAN MEDICAL ASSOCIATION

**IDSA**  
Infectious Diseases Society of America



**APPENDIX D: OPTIONS FOR EMPIRIC OUTPATIENT ANTIMICROBIAL  
TREATMENT OF SSTIS WHEN MRSA IS A CONSIDERATION**

Drug name	Considerations	Precautions**
<p><b>Clindamycin</b>  <u>Dose:</u> 450 mg tid po x 10 days</p>	<ul style="list-style-type: none"> <li>▪ FDA-approved to treat serious infections due to <i>S. aureus</i></li> <li>▪ D-zone test should be performed to identify inducible clindamycin resistance in erythromycin-resistant isolates</li> </ul>	<ul style="list-style-type: none"> <li>▪ <i>Clostridium difficile</i>-associated disease, while uncommon, may occur more frequently in association with clindamycin compared to other agents</li> </ul>
<p><b>Tetracyclines</b></p> <ul style="list-style-type: none"> <li>▪ Doxycycline 100 mg bid po x 10 days</li> <li>▪ Minocycline 100 mg bid po x 10 days</li> </ul>	<ul style="list-style-type: none"> <li>▪ Doxycycline is FDA-approved to treat <i>S. aureus</i> skin infections.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Not recommended during pregnancy.</li> <li>▪ Not recommended for children under the age of 8.</li> <li>▪ Activity against group A streptococcus, a common cause of cellulitis, unknown.</li> </ul>
<p><b>Trimethorpin-Sulfamethoxazole</b>  <u>Dose:</u> TMP/SMX DS – 1 po bid x 10 days</p>	<ul style="list-style-type: none"> <li>▪ Not FDA-approved to treat any staphylococcal infection</li> </ul>	<ul style="list-style-type: none"> <li>▪ May not provide coverage for group A streptococcus, a common cause of cellulitis</li> <li>▪ Not recommended for women in the third trimester of pregnancy.</li> <li>▪ Not recommended for infants less than 2 months.</li> </ul>
<p><b>Rifampin</b>  <u>Dose:</u> 300 mg bid po to add to TMP/SMX or doxy for synergy</p>	<ul style="list-style-type: none"> <li>▪ Use only in combination with other agents.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Drug-drug interactions are common.</li> </ul>
<p><b>Linezolid (Zyvox)</b>  <u>Dose:</u> 600 mg po bid for 10 days</p>	<ul style="list-style-type: none"> <li>▪ Consultation with an infectious disease specialist is suggested.</li> <li>▪ FDA-approved to treat complicated skin</li> </ul>	<ul style="list-style-type: none"> <li>▪ Has been associated with myelosuppression, neuropathy and lactic acidosis during prolonged therapy.</li> </ul>

Drug name	Considerations	Precautions**
	infections, including those caused by MRSA.	
	<ul style="list-style-type: none"> <li>▪ MRSA is resistant to all currently available beta-lactam agents (penicillins and cephalosporins)</li> <li>▪ Fluoroquinolones (e.g., ciprofloxacin, levofloxacin) and macrolides (erythromycin, clarithromycin, and azithromycin) are not optimal for treatment of MRSA SSTIs because of resistance is common or may develop rapidly.</li> </ul>	
	<p>* Data from controlled clinical trials are needed to establish the comparative efficacy of these agents in treating MRSA SSTIs. Patients with signs and symptoms of severe illness should be treated as inpatients.</p> <p>** Consult product labeling for a complete list of potential adverse effects associated with each agent.</p>	
<p><b>Role of decolonization</b> Regimens intended to eliminate MRSA colonization should not be used in patients with active infections. Decolonization regimens may have a role in preventing recurrent infections, but more data are needed to establish their efficacy and to identify optimal regimens for use in community settings. <i>After treating active infections and reinforcing hygiene and appropriate wound care</i>, consider consultation with an infectious disease specialist regarding use of decolonization when there are recurrent infections in an individual patient or members of a household.</p>		

Published September 2007 at: [http://www.ama-assn.org/ama/pub/upload/mm/36/ca\\_mrsa\\_desk\\_102007.pdf](http://www.ama-assn.org/ama/pub/upload/mm/36/ca_mrsa_desk_102007.pdf)

**APPENDIX E: SUMMARY OF ARTICLES REVIEWED ON CA-MRSA**

<b>Authors</b>	<b>Year of Pub.</b>	<b>Type of Article</b>	<b>Risk Level</b>	<b>Care Setting</b>	<b>Topics Presented</b>
Abrahamian, et al	2007	Review- cultures	0	2	1, 3, 10 ,11
Bach, et al	2007	Research study	0	2	1, 2, 3, 4
Bruce & Spencer	2008	Research study	0	2	4
Centers for Disease Control (CDC)	2004	MMWR report	1, 2	2, 3	1, 2
CDC	2007a	Fact sheet	0	1	4
Cohen	2007	Review - CA-MRSA	2, 3	1, 2, 3, 4	1, 3, 4, 8, 9, 10,11
Cosgrove, et al	2005	Cost study	1	3	2,7
Delit, et al	2004	Clinical guidelines	0	2	6
Dufresne, Wells, & Pfaff	2008	Research article	2	6	4
Ellis, et al	2007	Research study	2	6	1, 5, 9
Elston	2007	Review –CA-MRSA	0	1	1, 2, 4, 5, 6, 10, 10a, 11
Farley	2008	Review article	0	2	1, 4, 5, 10, 11
Fleming, et al	2006	Review article	0	2, 3	1, 2, 3, 8, 9, 10, 11
Fridkin, et al	2005	Research study	0	3, 5, 6,	1, 4, 5, 10, 11
Gorwitz, et al	2006	Experts summary clinical management of CA-MRSA	0	2	1, 2, 3, 4, 5, 6, 8, 9, 10, 11
Grundmann, et a	2006	Review article	0	1	1, 2, 3, 4, 5, 9, 11
Hawkes, et al	2007	Clinical guidelines	0	1	1, 4, 6
Hinckley & Allen	2008	Literature review	1	2	1, 3, 4, 5, 8, 9, 10, 11
Klevens	2007	Research study	0	2, 3	1, 2, 4, 5, 11
Kolar & Sanderson	2007	Research article	0	0	1, 3, 4, 5, 11
Kopp, et al	2004	Clinical/economic study	0	3	4, 7
Kowalski & Osmon	2005	Review article	0	0	4, 5, 6, 9, 10
Kundin	1989	Review article	0	1	12
Lee, et al	2004	Research study	1	2	5, 8, 10
Ligozzi, et al	2002	Research article	0	0	11
Magilner, Byerly, & Cline	2008	Research study	1	2	4
Malaviolle, et al	2008	Research study	0	0	11
McGowan	2001	Economic review	0	1	7
Moran, et al	2006	Research study	2	2	4, 11
Pallin, et al	2008	Research study	0	2	5
Public Health		Health department	0	1	4, 10

<b>Authors</b>	<b>Year of Pub.</b>	<b>Type of Article</b>	<b>Risk Level</b>	<b>Care Setting</b>	<b>Topics Presented</b>
Seattle& King county		Report			
Purcell & Fergie	2005	Research study	1	2, 3	4, 7, 10
Purcell & Fergie	2002	Research study	1	2 ,3	7
Rubin, et al	1999	Economic study	0	3	2, 4, 7
Schorr	2007	Review article	0	2, 3	1, 2, 3, 4, 5, 7, 9, 10
Scott, et al	2005	Cost/economic	0	2	7
Steven, et al	2005	Clinical guidelines	0	2, 3	6
Weber, Carol J.	2008	Review article	0	1	2, 3, 4, 9
Weber, J. Todd	2005	Review article	0	1	1, 4, 11

**APPENDIX F: CODE TABLE OF REVIEWED ARTICLES**

<b>Code</b>	<b>Patient Risk Level</b>
0	General; not specified
1	Pediatric
2	Adults
<b>Code</b>	<b>Care Setting</b>
1	General; not specified
2	Community/outpatient centers/E.D.
3	Hospital
4	Long Term Care
5	Laboratory Centers
6	Centers for Disease Control/Government Agency
<b>Code</b>	<b>Topics Presented</b>
1	CA-MRSA
2	HA-MRSA
3	Skin & Soft Tissue Infection (SSTI)
4	Epidemiology (Prevalence, Incidence, Risk Factors, Co-morbidity, etc.)
5	Antibiotics/Antibiotic Resistance
6	Clinical Guidelines
7	Cost/Economics
8	Diagnosis
9	Prevention/Control
10	Management/Treatment/Algorithm
10a	Algorithm
11	Wound Culture/Microbiology
12	Wound healing



## **APPENDIX G: LOG FORM**



**APPENDIX H: PATIENT EDUCATION PAMPHLET**

## **Have you been diagnosed with a *Staphylococcus aureus* or MRSA infection?**

Below are answers to some common question...

### **What is *Staphylococcus aureus* or Staph?**

Staph is a type of bacteria. It may cause skin infections that look like pimples or boils. Skin infections caused by Staph may be red, swollen, painful, or have pus or other drainage. Some Staph (known as Methicillin-Resistant *Staphylococcus aureus* or MRSA) is resistant to certain antibiotics, making it harder to treat. The information on this page applies to both Staph and MRSA.

### **Who gets Staph infections?**

Anyone can get Staph infections. People are more likely to get a Staph infection if they have:

- Skin-to-skin contact with someone who has a Staph infection
- Contact with items and surfaces that have Staph on them
- Openings in their skin such as cuts or scrapes
- Crowded living conditions
- Poor hygiene

### **How serious are Staph infections?**

Most Staph skin infections are minor and may be easily treated. Staph also may cause more serious infections, such as infections of the bloodstream, surgical sites, or pneumonia. Sometimes, a Staph infection that starts as a skin infection may worsen. It is important to contact your doctor if your infection does not get better.

### **How are Staph infections treated?**

Treatment for a Staph skin infection may include taking an antibiotic or having a doctor drain the infection. If you are given an antibiotic, be sure to take all of the doses, even if the infection is getting better, unless your doctor tells you to stop taking it. Do not share antibiotics with other people or save them to use later.

### **How do I keep Staph infections from spreading?**

- Wash your hands often or use an alcohol-based hand sanitizer
- Keep your cuts and scrapes clean and cover them with bandages
- Do not touch other people's cuts or bandages
- Do not share personal items like towels, razors, or toothbrushes
- Do not work out at public gyms. School children should avoid contact sports
- Avoid personal care services such as haircut, manicure, or massages

If you have any questions about your conditions, please ask your doctor. For more information, please visit:  
[http://www.cdc.gov/ncidod/dhqp/ar\\_mrsa.html](http://www.cdc.gov/ncidod/dhqp/ar_mrsa.html).



Centers for Disease  
Control and Prevention

## **APPENDIX I: IRB APPROVAL**



University of Central Florida Institutional Review Board  
 Office of Research & Commercialization  
 12201 Research Parkway, Suite 501  
 Orlando, Florida 32826-3246  
 Telephone: 407-823-2901 or 407-882-2276  
 www.research.ucf.edu/compliance/irb.html

**Approval of Exempt Human Research**

**From:** UCF Institutional Review Board #1  
 FWA00000351, IRB00001138  
**To:** Ivonne E. Johnson  
**Date:** April 05, 2010

Dear Researcher:

On 4/5/2010, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Initial Review  
 Project Title: THE INCIDENCE AND EPIDEMIOLOGIC FACTORS OF  
 COMMUNITY-ACQUIRED METHICILLIN-RESISTANT  
 STAPHYLOCOCCUS AUREUS SKIN AND SOFT TISSUE  
 INFECTIONS IN A SUBURBAN FAMILY PRACTICE IN  
 FLORIDA  
 Investigator: Ivonne E Johnson  
 IRB Number: SBE-10-06782  
 Funding Agency: None

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Beshitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 04/05/2010 03:36:30 PM EDT

IRB Coordinator

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