Methicillin-Resistant *Staphylococcus aureus*

**By: Carolyn Marie Brubaker**  
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Recently, there has been a great deal of discussion throughout the media regarding Methicillin-resistant *Staphylococcus aureus* (MRSA) infections in the United States. MRSA reports have shown up in the newspaper, on the television, and in many publications, both professional and recreational. National statistics show increasing numbers of both hospital-acquired and community-acquired MRSA infections. Increasing public awareness of this issue has created massive fear and absolute confusion. The increasing number of MRSA cases has been referred to by many as an “epidemic”.(5) MRSA itself has been labeled as the “super bug” of the century.(5) Is there a possible healthcare danger that lies ahead? The public is concerned for their safety and several questions have arisen about MRSA infections.

This paper is intended to clear up some of the uncertainty about methicillin-resistant *staphylococcus aureus* and how it is affecting today’s society. This paper will answer some of the most commonly asked question about MRSA in order to shed some light on this topic. It is necessary to take a glimpse of both the past and the present use of antibiotics in order to understand how organisms grow resistant to our drug therapy. As a result of this knowledge, stronger drugs can be developed and help continue to save lives.

The primary objective will be to educate readers about the proper use of antibiotic therapy for treating infections and also to inform readers about what options are available to prevent further resistance. This paper will also address the ethical dilemmas concerning the exposure of statistical and confidential information of MRSA infected patients. Furthermore, the social and professional responsibilities that are required from healthcare providers in this specific situation will be described. The role pharmacists can have in educating patients about antibiotic
therapy is priceless. Due to pharmacist accessibility, they can also play a crucial part in reassuring the public during this MRSA crisis.

What is methicillin-resistant Staphylococcus aureus and is it really an epidemic at this time? MRSA is a form of Staphylococcus aureus that has grown resistant to methicillin and other antibiotics. MRSA is not a new discovery, nor should it be referred to as an epidemic at this time. MRSA was first seen back in 1961, a few years after the antibiotic methicillin was developed. The reason why the media has recently flooded the public with a wave of MRSA news is because there has been a large increase in the number of cases seen in both the hospital and the community setting. In 2005, there were 94,000 MRSA infections, 19,000 of these infections lead to death, but this number is on the rise. More recent data suggests that “as many as 1.2 million U.S. hospital patients may be infected each year with a virulent staph infection that's resistant to antibiotics -- a rate almost 10 times greater than previous estimates…. and as many as 119,000 hospital patients each year may die from the tough-to-treat strain of bacterium, called methicillin-resistant Staphylococcus aureus.” The good news is, despite this growing number of MRSA cases, we still have a select few antibiotics, like vancomycin and linezolid, which can fight against most MRSA strains. The real concern lies in the future of bacterial resistance; how far can it expand and how quickly can we keep up with these bugs?

How exactly does antibiotic resistance develop? We will now look into the mechanism of resistance and how we can overcome this battle. There are a number of factors that can affect the future of antibiotics and microbial resistance. “These determinants can be grouped into 4 categories. The first group is related to the molecular characteristics of pathogens, such as virulence, transmissibility, and survival fitness, which are issues beyond the scope of this article. Moreover, progress in microbiologic detection and identification of infectious pathogens is likely
to influence diagnostic uncertainty and prescribing patterns of antimicrobial drugs.”(9) Through the same ways that humans have evolved over the years, bacteria can develop into resistant bugs due to a natural selection process. This process is actually a defense mechanism for the bacteria to prevent its extinction. When an antibiotic is administered and is either not taken long enough or is not sufficiently strong enough, it does not kill all of the bacteria. Ultimately, a single bacterium that has an abnormal mutation in its genome can be left behind. This organism can then multiply, passing on the mutated gene to its daughter cells, which are now resistant to the original antibiotic too.(3) Somewhat related to the first determinant, “the second group of determinants is linked to prescribers of antimicrobial drugs, physicians, who may change their prescription patterns. Recent data from different parts of the world show promise in this area.”(9) Providers need to be more thoroughly educated about both the mechanism and the seriousness of antibiotic resistance. By altering prescribing patterns, we might have a chance to fight against these highly intelligent bacteria. “The third group is related to characteristics of patient populations and host-related factors. Not only does this include infection rates and case-mix characteristics, but also consumer attitudes and global migration patterns.”(9) The spread of infection within a community and across the globe is crucial to consider. By monitoring infection rates more closely and by publicly promoting preventative measures, we may have an impact. “A fourth group of determinants is linked to macro-level factors related to the healthcare environment. These factors include regulatory policies that may influence use of antimicrobial drugs, infection control practices, technologic development, and drug discovery.”(9) Healthcare policies and protocols such as preventative hygiene, microbial testing and monitoring, protective barriers, correct antibiotic regimens, and restrictive prescribing could help to put an end to resistance.
In summary, antibiotics can grow resistant to our current treatment regimens for a number of reasons. A few “factors contributing towards resistance include incorrect diagnosis, unnecessary prescriptions, improper use of antibiotics by patients, and the use of antibiotics as livestock food additives for growth promotion.”(3) The use of broad spectrum antibiotics and inappropriate antibiotic use in general has also significantly lead to the development of resistance. As more strains of MRSA develop resistance to our antibiotics, the less fighting power we will have against them. This is where the concern lies. The more resistance develops to antibiotics, the faster we need researchers to develop newer, stronger drugs in order to keep up with the pace of these mutating bugs. Antibiotic resistance can significantly affect the healthcare field and how we treat our patients. If we do not continue to evolve with these Staph infections, this problem of resistant bacteria could turn in to an epidemic.

Who is at the greatest risk for MRSA and how do you know if you have it? There are two ways you can contract MRSA; first, by being in direct contract with a person who is infected and second, by touching infected objects. There are also two different forms of MRSA: healthcare-acquired which accounts for 86% of all MRSA infections and community-acquired which accounts for 14% of all MRSA infections.(1) The hospital associated form of MRSA is unfortunately more common and is often more virulent. Patients who are at increased risk for healthcare associated MRSA are those who have been in the hospital setting recently and have a surgical incision, catheter, or IV line in place. Healthcare providers are at significantly high risk due to daily direct contact with infected patients.(2) Other populations with increased risk are those who have impaired immune systems, such as burn victims, the elderly, the very young, the HIV infected, and the organ transplant patients. Diabetics can also be at significantly higher risk
due to the fact that these patients often have open wounds that are slow to heal. This results in a breeding ground for infection, especially MRSA.

On the other hand, community associated MRSA can infect any individual, sick or healthy. Most patients in the community who acquire MRSA are those who are in close contact, such as sports players or other athletes. Community infections most commonly manifest as skin and soft tissue infections, such as furuncles, boils, spider bites, and cellulitis. Although, MRSA infections can be hard to pick out from a normal infection since they often look very similar. Prompt referral and quick antibiotic treatment can be crucial in these settings. Both healthcare and community acquired MRSA can be breeding grounds for serious and possibly fatal infections if they are not managed correctly.

Prevention may be the most important factor concerning MRSA at this time. If we as a society can prevent the spread of infection, we can also prevent death from these simple staph aureus infections. Since staph infections are primarily spread by contact with an infected person or an infected object, prevention can be relatively simple at the community level. The first form of prevention is to practice good hygiene. Always wash your hands thoroughly with soap and hot water. Also included in good hygiene procedures is washing and then covering cuts and open wounds. The second way to avoid infection is by not sharing any personal items with other people and avoiding close contact with infected individuals. Examples of objects that can carry this type of infection would be razors, linens, or equipment. Fighting back against MRSA at a community level is important and these simple “common-sense precautions can reduce your risk” of infection.

Now we will look at the ethical problems that involve antibiotic resistance; more specifically MRSA infections. Initially, we will look at different healthcare providers and their
roles in antibiotic usage in order to determine which one should be in charge. Should a physician have the right to order antibiotics whenever he chooses or should restrictions be attached to antibiotic prescribing? Should pharmacists be involved with antibiotic administration to ensure proper utilization and prevent resistance? Next, we will look at a case involving an elderly patient who contracted MRSA in the hospital setting and see what legal ramifications could result. Specifically, who is to blame for the spread of MRSA, could the infection have been prevented, and also does the family have a legal right to sue the institution for this crisis. Finally, we will discuss what confidential information should be made available to the public. Particularly, should information about young children such as name, location, and school have to be disclosed to their community? Both ethical and legal issues can play a significant role in the healthcare field. These issues can have a major effect on the form of treatment patients receive.

Several healthcare providers are involved in managing a patient’s overall health. Physicians obviously play a significant role in diagnosing disease states. Alternatively, pharmacists have the responsibility of medication management and are referred to as the drug experts. Finally, nurses are the administrators of medications and often monitor for side effects. Determining which provider should be in charge of antibiotic control is a hard issue to tackle. Studies have shown that “both nurse practitioners (NPs) and physicians (MDs) are prescribing inappropriate antibiotics to patients with viral upper-respiratory tract infections, a practice that may lead to increased rates of antimicrobial resistance. Researchers also found that highly marketed broad-spectrum antibiotics are being prescribed excessively, by both NPs and MDs, to patients with diagnoses of viral illnesses. It is well accepted that antibiotics have no clinical effect in the treatment of these illness.”(8) Since physicians have the tendency to over prescribe and under test patients for bacterial causes of infection, should another practitioner step up and
take control of this situation in order to prevent future resistance to antibiotics? Many people believe pharmacists should take on the responsibility of managing and monitoring antibiotic use.

Pharmacists managing and monitoring antibiotics may have significant potential advantages. Currently “it is recognized that a substantial proportion of antibiotic prescribing is sub-optimal. Common errors include: use of an agent with an inappropriate spectrum, administration of an antibiotic when there is little evidence of bacterial infection, unnecessarily prolonged courses and overuse of intravenous agents. The result is an increase in avoidable side effects for the patient, expense for the funding body and resistance to antibiotics for the community as a whole.”(12) Today, pharmacists may participate in antibiotic use but often times only play a minor role. Pharmacists are commonly called on to assess lab values and monitor peaks and troughs of select antibiotics. This new proposal would get pharmacists more actively involved in disease treatment and would encourage them to participate at a deeper level. Pharmacists would use “tools from information technology and progress in microbiology [to] reduce diagnostic uncertainty and improve antimicrobial dosing, selection, and treatment duration. Use of antimicrobial agents will, therefore, continue to decrease, not only in the outpatient setting, but also in the inpatient setting.”(9)

Pharmacists who take on this role would require specialized training beyond the PharmD level. This advanced position would not only “include education of medical, pharmaceutical and nursing staff, audit of local practices, monitoring of antibiotic consumption, participation in infection control, formulary development and appraisal of new antimicrobials” (12) but would also embrace the idea of assisting physicians in the correct antibiotic selection, dosing and duration assessments, appropriate culturing of specimens, and IV to oral interchange. Pharmacists obviously would be taking on a huge role with this new specialized position.
Despite this tremendous work load, pharmacists could make a significant difference in the world of infectious disease and possibly improve patient care. With pharmacist involvement we could not only decrease the amount of antibiotic resistance in the community but we could also contribute to higher patient satisfaction by shrinking hospital stays, lowering infection and antibiotic costs, and by reducing mortality rates. (12)

Next, we will discuss other possible consequences involving MRSA infections. The following scenario is based on a true story and will be used to examine the possible ramifications of MRSA contraction in today’s society.

“An elderly patient dies from septic shock in the intensive care unit. This is perhaps not an unusual scenario, but in this case the sepsis happens to have been due to methicillin-resistant *Staphylococcus aureus*, possibly related to a catheter, and possibly transmitted from a patient in a neighbouring room by less than adequate compliance with infection control procedures. The family decides to sue.” (7) What should the outcomes be?

The case that was mentioned above is one account which presents issues that occur frequently in the hospital setting. Nosocomial infections and infection control are important aspects of daily patient care. With so many different types of people with varying illnesses in a hospital, there is obviously a high risk for infection to any patient. Nevertheless, we need to find a way to keep our patients safe while being treated effectively in these environments. It is important to educate healthcare providers about the ease of transmission of bacteria, reminding them that they themselves are a common cause of bacterial spread.

Most institutions do have a wide range of infection control procedures set in place, but exactly how often are they followed? Hand washing is a common mechanism and is often a required protocol to prevent infection transmittal. But “in 34 published studies the average
adherence of healthcare workers to hand washing was 40%.” Could not adhering to protocols like this one be considered negligence? In a case like the one above, there are several unanswered questions in which it is hard to pinpoint an exact answer.

If the children from the case above decide to sue the hospital for responsibility of their loved one’s death, several factors must first be proven. Primarily, it must be demonstrated that the MRSA infection that the patient had was in fact a hospital acquired strain. This could be determined by culturing and testing a specimen, then comparing the strains of bacteria. It is possible that there was transmission of MRSA from one patient to another but the strains must prove to be identical. In addition, the infection must be proven not to have been present on the patient before admittance to the institution. So often patients come into the hospital carrying community acquired MRSA on their skin and show no overt symptoms of infection. Next, one must establish a connection between the MRSA infection and the primary cause of death of the patient. It is hard to prove that the MRSA infection was the sole cause of death. Other factors could have lead to this fatality such as the patient’s previous health conditions or a decreased immune system from hospital stress. Finally, one must confirm that the hospital personnel was negligent, did not follow protocol, and this is how the patient acquired the bacteria. In order to answer this question, one might look at the documentation of proper disease control conduct. Also, an investigation concerning intensive care unit infection protocol could prove useful. There are a number of circumstance that all must point in the same direction of hospital liability before this accusation could be conclusive. Most commonly, a case like this one had several contributing factors to infection leading to the unfortunate ending. Furthermore, patients and family members must be willing to accept both the possible benefits and the potential risks when they enter a hospital setting for treatment.
Often it is thought that the ICU is the cleanest place in the hospital where patients receive the most intimate care; unfortunately, recent data has proved otherwise. “The proportion of healthcare-associated staphylococcal infections that are due to MRSA has been increasing: 2% of *S. aureus* infections in U.S. intensive-care units were MRSA in 1974, 22% in 1995, and 64% in 2004.”(1) Although infection is commonly linked to other underlying disease or a decreased immune system, there needs to be a more stringent means of infection control in hospitals to prevent statistics like these. Documentation of cleaning tasks, continual reminders of hand washing, and constant supply of sanitizers are a few minor guidelines. In healthcare institutions, when a patient contracts a serious MRSA infection by any means, certain major precautions should be taken in order to prevent the spread of disease. These preventative measures include isolation of the patient, the use of barrier equipment, and to inform all surrounding providers of the delicate situation. If on a continual basis infectious protocol like these are not followed and it results in a patient injury or death, the patient or the family should be compensated. MRSA can contribute to a more costly hospital stay; patients with MRSA can spend at least three times the amount a patient without MRSA would spend.(11) An MRSA infection can also increase the hospital visit by up to eight days.(11) It is important to control infections in the hospital in order to prevent unnecessary hospital stays, excessive costs, and undue mortality. Reducing these hospital associated infections and related consequences could also contribute to an increase in patient trust in the healthcare field. Patients count on the healthcare system to provide them with the most accurate and safe care.

When family members must make the important choice of which institution would be best for a loved one, they should have all the essential information accessible at their finger tips. This issue raises the question: what health information should be available to the public? Should
hospitals and other healthcare institutions be required by law to provide documentation of
disease control and statistical infection rates to the public? Currently, there are nineteen states
that require institutions to publicly report overall infections rates and hopefully more states will
jump on board.(5) In fact, in Michigan, on January 30, 2007, there was a new bill presented to
the House of Representatives that would make institutions do just that. This bill, No. 4518,
outlined regulations for public reporting of hospital-acquired infections. The bill is currently
under consideration for approval. If this bill becomes law, hospitals would be required to report
nosocomial infections rates for the previous year by February 2nd.(10) The report would break
down infection contraction by unit or department in order to focus on the causative site. If this
proposal does in fact become a law, infection rates could be more easily tracked. Tracking the
most contagious hospitals or possibly the most affected area of a specific hospital may lead to a
greater awareness and higher infection control. It is important that people can make an honest
and informed decision about their own healthcare and to do this they need have the proper
resources. Before long, more states will not only require hospitals to publish general infection
rates but will also force them to specifically test and report rates of MRSA infections as well.

Due to the recent talk of MRSA in the media and the new laws buzzing around, hospitals
are using infection rates and antimicrobial control as a marketing strategy. Striving to achieve
low infection rates is a way to drive business up while simultaneously protecting patients.(5)
“Some states are also beginning to mandate broader testing specifically for MRSA, since patients
can carry the bug and spread it without showing signs of infection. Pennsylvania will soon
require hospitals to test high-risk patients, including those admitted from nursing homes. In
August, New Jersey and Illinois adopted legislation requiring hospitals to identify patients
carrying MRSA and isolate them, among other provisions.”(5) This type of reporting should be
required nationally. By making monitoring for MRSA mandatory, hospitals will be held responsible for their actions. Keeping patients safe and free from infection should be the hospital’s number one priority. This reporting of infection rates could benefit not only prospective patients and their quality of healthcare but could also be profitable for institutions as well. The more we begin to focus on the actual rates of MRSA that occur in our community, the greater the likelihood people will take action towards proper prevention and treatment.

Despite the advocacy of proper prevention and appropriate hygiene, people in today’s society do contract methicillin-resistant *Staph aureus* in the community setting. Recently, students from local area schools have been diagnosed with MRSA. Two of these cases turned up in Michigan cities, Lake Orion and Troy. When such a contamination occurs should the people be notified directly? How much information should the community be provided with? Should patient specific data be made available to the public? If any type of contagious, infectious disease presents itself in a community, the people of that area have a right to know about it. People deserve to be informed if these easily transmitted diseases are in their area so that they may be able to take additional precautions towards prevention. However, there should be certain restrictions placed on the presentation of this information. For example, some parents want to know the name of the infected child so that they can protect their own child by restricting contact or play time at school, but this information exposure would be a breech of patient privacy. The name and the address of the infected individual should remain confidential in order to protect his/her rights. More importantly, a community outbreak of MRSA should lead to area wide healthcare campaigns. Reinforcing appropriate hygiene and offering accurate infection information can help to calm troubled parents. We need to give the public necessary information to keep families safe and free from infection, but we also need to monitor the quality of
information provided. We are trying to clarify the MRSA situation, not make people more frightened.

It is a fact that MRSA is increasing in prevalence across the United States. The media has had a large impact on the way society views this situation. At the present time, the society regards the rise in MRSA cases to be an “epidemic.” We need to educate the public so that they may know the truth about resistant bacteria. The truth of the matter is that there are an increasing number of MRSA cases showing up around the country but the situation is by no means an epidemic at this time. However, if the community does not take simple measures now to prevent resistance, then the current situation of resistant bugs could develop into something more serious.

"In the early years of the 21st century, we are seeing the value of antibiotics decline as more and more germs become resistant to them,’ said Dr. David Katz, the director of the Prevention Research Center at Yale University School of Medicine. ‘Methicillin resistant Staph aureus is one important example of this trend.’"(6) Antibiotics need to be used properly in order to prevent further resistance beyond just staph aureus. Antibiotics can be very useful tools to protect the public when used appropriately. Right now we still have antibiotics that can fight most of the bacteria, such as vancomycin and linezolid; the real problem lies in the future of these smart microbes which are adapting to the current agents. Researchers need to develop new antimicrobial agents that can fight these mutating “super bugs” and stay ahead of the game.

All healthcare providers could play a significant role by offering to educate the public with accurate information involving methicillin-resistant Staph aureus. Pharmacists can be key players in the area of education since they are regarded as the most accessible and the most trusted provider by the public. In order avoid further resistance, there also needs to be a change
in protocol of antibiotic prescribing and use. Physicians can help to reduce the spread of resistance by prescribing antibiotics only when medically necessary, by performing the necessary cultures to determine the exact agent a patient needs, and by reducing the use of empiric antibiotics. Additionally, all providers can make collaboratively an impact to help reduce antibiotic resistance by simply counseling and educating patients about how to prevent the spread of infection by practicing appropriate hygiene such as hand washing.
References


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