DIAGNOSTIC AND THERAPEUTIC EVALUATION OF COMMUNITY-ACQUIRED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) SKIN AND SOFT TISSUE INFECTIONS IN THE EMERGENCY DEPARTMENT

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Abstract—Background: Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) infections commonly present as skin and soft-tissue infections (SSTIs). Treatment often includes incision and drainage with or without adjunctive antibiotics. Emergency department (ED) pharmacists wished to provide specific data to emergency physicians to better inform antibiotic choices for patients with SSTIs. Study Objectives: The objectives of this study were to describe local susceptibility trends of CA-MRSA isolates obtained from patients with SSTIs and describe diagnostic and empiric therapeutic management of CA-MRSA SSTIs among ED health care providers at University of Utah Hospitals and Clinics. Methods: Susceptibility of all unique CA-MRSA SSTI isolates for 2008 were identified and compiled into an antibiogram. ED providers evaluated their diagnostic and treatment habits using a self-assessment questionnaire, which was verified against charted information documented in the electronic medical records for patients presenting to the ED with a CA-MRSA SSTI. Results: The ED antibiogram indicated that 57/58 (98%) CA-MRSA SSTI isolates were susceptible to sulfa-methoxazole/trimethoprim (SMX/TMP); 50/58 (86%) isolates were susceptible to tetracycline, and 47/58 (81%) isolates were susceptible to clindamycin. Incision and drainage were performed in 23/25 (92%) patient cases, which was consistent with providers’ perceived habits (100%). SMX/TMP monotherapy was preferred among 23/35 (66%) providers, however, SMX/TMP combined with cephalaxin was the antibiotic regimen prescribed in 9/22 (41%) patient cases. Conclusions: Cephalexin was often added to cover for potential cellulitis due to Streptococcus spp., however, the surrounding erythema may simply be an extension of the CA-MRSA infection. Department-specific antibiograms are useful in guiding empiric antibiotic selection and may help providers judiciously prescribe antibiotics only when necessary. © 2012 Elsevier Inc.

Keywords—emergency department; community-acquired MRSA; skin and soft tissue infections; diagnosis; treatment

INTRODUCTION

Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) infections are a common cause of skin and soft-tissue infections (SSTIs) such as abscesses, pustules, “spider bites,” or cellulitis (1,2). Over the past 25 years, a type of methicillin-resistant Staphylococcus aureus (MRSA) has emerged from the community with unique microbiological characteristics that differ from hospital-acquired MRSA (HA-MRSA) strains in terms of risk factors, phenotype, and antibiotic susceptibility patterns (3–5). The Centers for Disease Control and Prevention (CDC) defines a likely CA-MRSA infection as one in which the patient lacks exposure to the typical health care risk factors, including
recent hospitalization, central venous catheters, skilled nursing facilities, or surgery. Millar et al. expanded the CDC definition to include genotypic confirmation of SCC\textit{mec} (staphylococcal cassette chromosome \textit{mec}) types IV or V, a clinical presentation predominantly of SSTIs, and antibiotic susceptibility to sulfamethoxazole/trimethoprim (SMX/TMP), gentamicin, tetracyclines, and clindamycin (3). Epidemiological studies have identified populations at risk as being younger, healthy patients, those living in close quarters, and those having direct contact with an infected person (1,6,7). Table 1 compares the different characteristics between CA-MRSA infections and HA-MRSA infections (8,9).

Diagnosis of CA-MRSA infections relies on a thorough medical history with emphasis on risk factors for CA-MRSA exposure. Treatment of SSTIs includes incision and drainage (I&D) alone, with antibiotics in cases of abscess larger than 5 cm or if patients fail to respond to I&D, but are unnecessary in most cases (10–12). The selection of antibiotics should be guided by local susceptibility patterns. At the University of Utah Hospitals and Clinics in Salt Lake City, an increasing number of patients were presenting to the Emergency Department (ED) with skin abscesses. Pharmacists in the ED noticed an increased use of antibiotics despite I&D for treatment of SSTIs, which formed the basis of this investigation. The objectives of this study were to collect microbiological data of CA-MRSA isolates for the ED to describe antimicrobial susceptibility trends and describe diagnostic and therapeutic management trends among emergency medicine providers at the University of Utah Hospitals and Clinics in Salt Lake City.

**METHODS**

**Approval of Study Design**

This was a descriptive study consisting of three portions: 1) compilation of an ED antibiogram from microbiological data of patients with CA-MRSA SSTIs; 2) a retrospective chart review of patients with CA-MRSA SSTIs who presented to the ED; and 3) a survey of emergency medicine providers regarding their diagnosis and treatment habits for patients with suspected CA-MRSA SSTIs. The institutional review board for human research at the University of Utah Hospitals and Clinics approved this study.

**CA-MRSA Criteria**

The CDC defined criteria to distinguish between HA-MRSA and CA-MRSA infections (9). Patients suspected of having a CA-MRSA infection include those with clinical signs and symptoms of a skin infection, such as redness, swelling, pain/tenderness, or complaint of a "spider bite." In addition, patients must meet the following criteria: diagnosis of MRSA made in the outpatient setting or by a culture positive for MRSA made within 48 h after admission to the hospital and no medical history of MRSA infection or colonization. Patients are excluded from having a CA-MRSA infection if they have a medical history within the past year of: hospitalization; admission to a nursing home, skilled nursing facility, or hospice; dialysis; or surgery (a medical procedure requiring hospital stay). Patients with permanent indwelling catheters or medical devices that pass through the skin into the body are also excluded.

**Collection of Microbiological Data**

Microbiological data were identified from an infection surveillance database report limited to skin and soft-tissue culture results between January and December 2008. Cases were included if cultures were obtained from adults 18 years of age and older who presented to the ED with an SSTI that met the CDC criteria for a CA-MRSA infection. In addition to the exclusion criteria listed above, patients were excluded if cultures were obtained from non-SSTI sources (e.g., blood or urine), internal surfaces (e.g., eyes, oropharynx, nares, vagina, or urethra), or was the product of a human or animal bite wound. A retrospective chart review of patients with CA-MRSA SSTIs who presented to the ED was performed over a 6-month time frame to capture emergency

| Table 1. Characteristics of CA-MRSA and HA-MRSA Infections (8,9) |
|-----------------------------|-----------------------------|
| **Characteristic** | **CA-MRSA** | **HA-MRSA** |
| Risk factors | Children, athletes, incarcerated patients, military personnel, intravenous drug users, ethnic minorities, men who have sex with men, HIV/AIDS | Long-term care facility residents, prolonged hospitalizations, ICU stay, indwelling catheters |
| Genetic resistance | | |
| SCC\textit{mec} type | IV (sometimes V) | I, II, and III |
| PVL toxin | Common | Rare |
| Antibiotic resistance | \(-\)lactam resistance | Multi-drug resistance |

CA-MRSA = community-acquired methicillin resistant \textit{Staphylococcus aureus}; HA-MRSA = hospital-acquired MRSA; ICU = intensive care unit; SCC\textit{mec} = staphylococcal cassette chromosome \textit{mec}; PVL = Panton-Valentine leukocidin.
Diagnostic and Therapeutic Management Evaluation

Diagnostic and therapeutic tendencies were evaluated using an electronic survey of emergency medicine providers, including attendings, mid-level providers, fellows, and residents. All emergency medicine attendings have completed training in an emergency medicine residency program and are either board certified or are board eligible in emergency medicine. Emergency medicine fellows function as attendings and have also completed an emergency medicine residency program. Emergency medicine providers did not receive any special training on how to differentiate CA- vs. HA-MRSA, and the ED does not have an SSTI treatment policy. Two follow-up reminders were electronically sent 2 weeks apart. Providers were asked to evaluate the percent of time they record a patient’s risk factors for CA-MRSA in the ED’s electronic admission note and what process they use to differentiate CA-MRSA from HA-MRSA. If a patient had an abscess, providers were asked if they record the size of the abscess and what size abscess they treat with I&D. If providers prescribe antibiotics in addition to I&D, they were asked to indicate their preferred antibiotic, regardless of patient allergies. Providers who prescribe more than one antibiotic were asked to indicate their reason for such practice. Information from the provider survey was verified using retrospective chart reviews of patients who presented to the ED with CA-MRSA SSTIs during the 6 months before distribution of the provider’s survey to determine whether practice patterns were similar to the provider’s perceived practices. Electronic admission notes from the ED were retrospectively reviewed for information on patient age, gender, ethnicity, drug allergies, specific CA-MRSA risk factors, CA-MRSA skin and soft tissue presentation, CA-MRSA susceptibility profile, and empiric management of the infection, including I&D and the use of antibiotics.

Statistical Analysis

Microbiological data were compiled into an antibiogram representing the percent of isolates susceptible to a particular antibiotic among the total isolates tested. Results of the provider survey and chart reviews were compared using descriptive statistics.

RESULTS

Collection of Microbiological Data

Between January and December of 2008, 123 MRSA-positive cultures were identified from patients who presented to the ED. Of these, 37 isolates were excluded because they were obtained from non-SSTI sources. An additional 27 patients were excluded because they did not meet the CDC criteria for a CA-MRSA infection and one isolate was excluded because it was obtained from a patient <18 years of age. The remaining 58 isolates were included in the development of the ED CA-MRSA SSTI antibiogram, presented in Table 2. Of the 54 (93.1%) isolates reported as susceptible to clindamycin, only 47 were screened for inducible clindamycin resistance using a disk diffusion test (D-test), of which 81% of the isolates were susceptible. The hospital’s microbiology laboratory did not routinely use the D-test to verify clindamycin-susceptible MRSA isolates until midyear. Therefore, only those isolates with D-test confirmation were included in the development of the antibiogram. High rates of antibiotic susceptibilities were observed with gentamicin (58/58, 100%), tetracycline (50/58, 86%), and SMX/TMP (57/58, 98%). Resistance to vancomycin was not observed among any of the isolates. Similarly, no resistance was found among the few isolates that were tested against linezolid and daptomycin.

Diagnostic and Therapeutic Management Evaluation

Provider survey results. Thirty-seven ED providers responded to the electronic survey, for a response rate of 65%. Of those who responded, 14/37 (38%) were attendings, 8/37 (22%) were mid-level providers, and 15/37 (41%) were ED medical residents and fellows. According to providers’ perceptions, 13/37 (35%) providers rarely chart risk factors, arbitrarily defined as <25% of the time, and 23/37 (62%) providers chart CA-MRSA risk factors.

Table 2. Antibiotic Susceptibility of CA-MRSA SSTI Isolates for 2008 in the ED

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Susceptible (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clindamycin (D-test negative)</td>
<td>47/58 (81)</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>3/58 (5)</td>
</tr>
<tr>
<td>Daptomycin</td>
<td>42/42 (100)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>58/58 (100)</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>12/58 (21)</td>
</tr>
<tr>
<td>Linezolid</td>
<td>58/58 (100)</td>
</tr>
<tr>
<td>Quinupristin/dalfopristin</td>
<td>58/58 (100)</td>
</tr>
<tr>
<td>Rifampin</td>
<td>58/58 (100)</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>50/58 (86)</td>
</tr>
<tr>
<td>Sulfamethoxazole/trimethoprim</td>
<td>57/58 (98)</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>58/58 (100)</td>
</tr>
</tbody>
</table>

CA-MRSA = community-acquired methicillin resistant Staphylococcus aureus; SSTI = skin and soft-tissue infection.
factors frequently, defined as 25–75% of the time. Only 1/37 (3%) providers reported charting patient risk factors a majority (defined as more than 75%) of the time. When differentiating between a diagnosis of CA-MRSA and HA-MRSA infection, 23/37 (62%) providers indicate using patient risk factors alone, whereas 13/37 (35%) providers use both patient risk factors and culture susceptibilities, if available at the time of treatment. None of the providers reported using culture susceptibilities alone to differentiate between a CA-MRSA and HA-MRSA infection.

In patients who present with an abscess, all providers indicated that they document the size of the abscess. I&D was the treatment of choice among all providers for CA-MRSA SSTI abscesses, regardless of the size. After I&D, 16/37 (43%) providers would not prescribe any antibiotics, 13/37 (35%) providers would prescribe a single antibiotic, and 8/37 (22%) providers would prescribe two or more antibiotics. SMX/TMP monotherapy was the preferred antibiotic of choice among 23/37 (66%) providers. None of the providers indicated using cephalaxin alone, and 7/37 (20%) providers prescribed both SMX/TMP and cephalaxin. Of the remaining providers, 3/35 (9%) prefer using clindamycin, dicloxacillin, or doxycycline as their antibiotic of choice for adjunctive treatment of CA-MRSA SSTIs. None of the emergency medicine providers reported using intravenous antibiotics in addition to oral antibiotics.

Providers were also asked to provide their rationale for using more than one antibiotic after I&D was performed. Although only 8/37 (22%) providers indicated the routine use of more than one antibiotic, 18 providers supplied responses to the question. Table 3 summarizes the providers’ rationale for using two or more antibiotics. According to providers’ perceptions, more than one antibiotic is commonly prescribed to cover skin flora, specifically *Streptococcus* spp. More than one antibiotic is also used by 6/18 (33%) providers to cover surrounding cellulitis; 1/18 (6%) providers prefer to double-cover MRSA infections, and 1/18 (6%) providers indicated co-morbidities, such as diabetes or another immune-compromised state, as the reason.

Retrospective chart review findings. During the 6-month patient chart-review period, a total of 60 MRSA-positive cultures were identified from the ED. Thirty-seven of these were obtained from skin and soft tissue sources, with 25 cases (68%) matching the criteria for a CA-MRSA infection. Of the CA-MRSA SSTI cases, 17/25 (68%) patients were male, with a mean age of 38 ± 3 years, as seen in Figure 1. Abscesses were the most common skin and soft tissue presentation in 21/25 (84%) cases, with 15/25 (60%) also having cellulitis, or redness around the abscess. Prior antibiotic use, defined as any antibiotic use within 7 days before presentation to the ED, was documented in 8/25 (32%) patient charts, with 6 of the 8 patients being prescribed antibiotics for initial treatment of their SSTI. Patients later presented to the ED for worsening or non-resolving signs of infection. Homelessness and illicit drug use were each documented in 6/25 (24%) patient charts.

Abscess size was documented in 10/23 (43.5%) cases. Of the 10 cases with a documented abscess size, only 5 were ≥ 5 cm in diameter, yet all 10 cases were treated with I&D as well as antibiotics. In 21/25 (84%) patient cases, MRSA was the only pathogen identified from the wound culture. In two cases, the culture yielded MRSA and *Streptococcus*, with one isolate identified as viridans *Streptococcus* and the other identified as Group B β-hemolytic *Streptococci*. Two other cultures grew MRSA and coagulase-negative *Staphylococci*. I&D was performed in 23/25 (92%) cases, with the other two cases being classified as cellulitis without the presence of an abscess. Only one case was managed with I&D without adjunctive antibiotics. Of the patients managed with I&D, 9/23 (39%) cases were also treated with intravenous antibiotics. Six of these patients were given a single dose of vancomycin; however, 3 patients were treated with two intravenous antibiotics: one patient received vancomycin plus ceftriaxone, another patient received vancomycin plus cefazolin, and the other patient received ceftriaxone plus clindamycin. After I&D, oral antibiotics were prescribed for 20/23 (87%) patients, with 7/23

![Figure 1. Patient ages (in years) from the retrospective chart review.](image-url)
negative alone for a culture growing both MRSA and coagulase-
 negative, when susceptibilities indicated resistance to SMX/TMP. Another patient was prescribed dicloxacillin empirically in the ED, for each of the cases above (61%) received two or more antibiotics after I&D, including intravenous or oral administration. It is unclear from the patient’s medical record whether an initial dose of antibiotic was given in the ED in addition to a prescription for the antibiotic(s). Table 4 compares the providers’ perceived treatment strategies to what was actually observed in patient charts. Antibiotic and culture data mismatches were identified in 11/25 cases (44%); 9/25 (36%) cases were related to the use of cephalexin in addition to SMX/TMP for cultures growing MRSA alone. In another case, SMX/TMP mono-theory was prescribed less frequently in 6/22 (27%) cases, with cephalexin monotherapy prescribed in 2/22 (9%) cases. Other outpatient antibiotic therapies included one case each of doxycycline, dicloxacillin, and clindamycin, and in 2/22 cases patients were treated with vancomycin followed by SMX/TMP. A total of 14/23 patients (61%) received two or more antibiotics after I&D, including intravenous or oral administration. It is unclear from the patient’s medical record whether an initial dose of antibiotic was given in the ED in addition to a prescription for the antibiotic(s). Table 4 compares the providers’ perceived treatment strategies to what was actually observed in patient charts. Antibiotic and culture data mismatches were identified in 11/25 cases (44%); 9/25 (36%) cases were related to the use of cephalexin in addition to SMX/TMP for cultures growing MRSA alone. In another case, SMX/TMP was prescribed, when susceptibilities indicated resistance to SMX/TMP. Another patient was prescribed dicloxacillin for a culture growing both MRSA and coagulase-negative Staphylococci. Although antibiotics were prescribed empirically in the ED, for each of the cases above there was no documentation in the patient chart regarding whether the patient had been contacted or whether antibiotics were changed based on culture susceptibilities.

**DISCUSSION**

In this study, 58/86 (67%) MRSA SSTIs fit the CDC criteria for a CA-MRSA infection, which is similar to CA-MRSA SSTI rates observed in other studies (1,11,13). Based on our data used to compile the CA-MRSA antibiogram, the isolates demonstrate a similar susceptibility pattern to that described in the literature, with a high level of susceptibility to gentamicin, tetracyclines, and SMX/TMP (14,15). As expected, there was no observed resistance to vancomycin, linezolid, or daptomycin, which are antibiotics often reserved for more severe MRSA infections. The antibiogram susceptibility to clindamycin may be lower than the actual rate, because the antibiogram reports only those isolates with susceptibilities verified by D-test. Although few oral options are available for outpatient treatment of CA-MRSA, clindamycin should be avoided as initial empiric treatment unless the susceptibility has been confirmed by a negative D-test.

In an ED, providers must rely on history of illness and culture susceptibilities to make a diagnosis of CA-MRSA. In this study, providers commonly used patient risk factors to differentiate between HA-MRSA and CA-MRSA infections. However, upon review of patient charts, providers did not frequently document these risk factors. Unfortunately, it is unknown whether this information was neglected during the charting process or no CA-MRSA risk factor could be identified. Recent data suggest that patient risk factors alone or in combination with antibacterial susceptibilities may not be sufficient to differentiate between CA-MRSA and HA-MRSA. Some MRSA strains may develop overlapping susceptibility patterns in time, blurring the definition between HA-MRSA and CA-MRSA. Genetic typing of the bacteria may be more useful in distinguishing CA-MRSA and HA-MRSA; however, results from these tests take longer and may not be clinically relevant at the point of care for diagnosis and treatment (13).

It is clear from this study that the providers’ perceived treatment practices did not match up with their actual practice. I&D was the most common form of treatment in cases where an abscess was present, however, providers charted the size of the abscess in only 10/23 (43%) cases, much less than their perceived 100% of the time. Similarly, providers perceived their usage of antibiotics to be less than what was actually prescribed. As mentioned previously, 16/37 (43%) providers would treat CA-MRSA SSTIs with I&D alone; yet only 1/25 (4%) cases was managed without antibiotics. Another prevalent trend observed in the chart reviews was the use of cephalexin. In a study by Rajendran et al., the addition of cephalexin to patients with CA-MRSA skin and soft-tissue abscesses managed with I&D did not affect cure rates compared to patients managed with I&D alone (16). In our study, cephalexin was added to SMX/TMP in 9/22 (41%) cases, whereas only 7/35 (20%) providers perceived this to be their normal practice. Furthermore, intravenous antibiotics were used in 9/23 (39%) patients who...
were also treated with I&D. Of these 9 patients, 5 (56%) were admitted to the hospital for further care. Intravenous antibiotics are often reserved for systemic CA-MRSA infections or for those patients requiring hospitalization (8). Unfortunately, this study did not assess the provider’s perspective on the use of intravenous antibiotics, particularly for patients not admitted to the hospital.

Antibiotics seemed to be liberally prescribed even though I&D had already been performed. With proper drainage, use of antibiotics may not be necessary for uncomplicated SSTIs (8,13,16). Similarly, providers had a propensity for adding cephalaxin after I&D to cover cellulitis thought to be caused by Streptococcus spp. However, upon retrospective review of the microbiological cultures obtained during I&D, the erythema surrounding an abscess was simply an extension of the inflammation caused by the CA-MRSA infection and not necessarily a secondary infection caused by another pathogen. After I&D, patients were given written instructions to return to the ED the following day for wound changes. This would be an appropriate time to assess the continued need for antibiotics or de-escalate the empiric antibiotic selection based on culture susceptibilities, which may be available at that time.

**Limitations**

Although CA-MRSA infections have been reported to be the cause of invasive infections, this study was limited to patients with SSTIs who presented to the ED. By limiting the search criteria to MRSA infections alone, the total number of SSTIs is unknown and further, the percent of total SSTIs that can be attributed to CA-MRSA. Therefore, these results do not reflect the true prevalence of CA-MRSA infections or CA-MRSA SSTIs that may present to an outpatient clinic rather than the ED. Furthermore, the criteria for a likely CA-MRSA infection relies on an accurate medical and procedural history dating back at least 1 year, which would not be available in a retrospective chart review if the patient sought treatment at an outside facility.

The survey used to assess the provider’s approach to diagnosis and management of SSTIs was not a validated questionnaire. It was designed specifically to corroborate observed practices for comparison with the retrospective chart review. The response rate to the provider survey was higher than the average response rate for similar electronic-based surveys (17,18). This response rate may have been hindered by lack of Internet or computer access, scheduling, or the busy nature of the ED itself. Because the survey was anonymous, we were unable to directly correlate each emergency medicine provider’s survey response to their observed practices from the chart review. In addition, the survey was limited to emergency medicine providers and was designed to be a brief snapshot of their perceived practice habits in general. As a result, it did not inquire about providers’ specific knowledge regarding CA-MRSA SSTI, such as notable risk factors or guidelines for treatment of SSTIs.

The patient chart review process was retrospectively performed; therefore, data collection was limited to information that was charted. Because EDs can become chaotic, documentation of patient encounters may take place at a later time and may be less descriptive and subject to recall bias.

**CONCLUSIONS**

The antibiotic susceptibility patterns for CA-MRSA SSTIs in this study demonstrated a high level of susceptibility to SMX/TMP, tetracyclines, and gentamicin, as expected. These results did not significantly differ from the hospital’s antibiogram data for Staphylococcus aureus isolates, which includes both methicillin-susceptible and methicillin-resistant S. aureus isolates. The perceived treatment practices of emergency medicine providers did not correlate with their own practices as observed from patient charts. Providers were unaware of their over-use of antibiotics during and after treatment of abscesses with I&D. This study was able to provide them with feedback on their current practices so they could reevaluate and adjust their treatment habits for consistency and moderation.

In the ED, providers often prescribe antibiotics empirically and may choose to err on the side of caution, especially if patients are at high risk for being lost to further follow-up. Department-specific antibiograms are useful in capturing susceptibility trends that may differ from the hospital’s antibiogram and serve as an important guide to providers who must empirically select antibiotics for patients being discharged back to the community. We hope the data in this study will better inform emergency physicians of appropriate antibiotic choices for patients with abscess and suspected MRSA.

**REFERENCES**


ARTICLE SUMMARY

1. Why is this topic important?
Community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA) skin and soft-tissue infections (SSTIs) are becoming an increasing cause of emergency department visits, in which treatment is often empiric. This study examines methods to improve the empiric treatment of CA-MRSA SSTIs by matching physician practices with their perceived practices.

2. What does this study attempt to show?
This study attempts to show that CA-MRSA SSTIs are being inappropriately treated with excessive antibiotics. A retrospective review of microbiological data indicates that most infections are due to a single pathogen, implying that empiric antibiotic coverage is too broad in most cases.

3. What are the key findings?
   a) CA-MRSA SSTIs are being treated with excessive use of antibiotics.
   b) Providers are unaware of their excessive use of antibiotics to treat CA-MRSA SSTIs.
   c) Department-specific, disease-specific antibiograms can be developed to better guide empiric therapy, especially for emergency medicine providers.

4. How is patient care impacted?
   a) Patients are often exposed to multiple antibiotics after getting incision and drainage of the abscess, which increases their risk of an adverse event.
   b) Appropriate antibiotic prescribing will decrease medical costs and hopefully decrease antibiotic resistance in the community.