Chapter 2
Data Mining to Examine the Treatment of Osteomyelitis

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ABSTRACT
The purpose of this study is to use data mining methods to investigate the physician decisions specifically in the treatment of osteomyelitis. Two primary data sets have been used in this study: the National Inpatient Sample (NIS) and the Thomson MedStat MarketScan data. We used online sources to obtain background information about the disease and its treatment in the literature. An innovative method was used to capture the information from the web and to cluster or filter that information to find the most relevant information, using SAS Text Miner. Other important innovations in investigating the data include finding the switches of medication and comparing the date of the switch with the date of procedures. We could study these medications switched at deeper levels, but this is not necessary in our study, especially with limited access to data. We also create a model to forecast the cost of hospitalization for patients with osteomyelitis.

BACKGROUND
Preprocessing is an essential aspect of outcomes research. Dealing with multiple data sources is essential. We demonstrate the needed preprocessing. Our data contain multiple observations for each patient. We convert this dataset from a one-to-many to a one-to-one observation for each patient; we developed the necessary SAS coding required to perform the preprocessing steps. In other words, we need to have a one-to-many relationship between patients and their procedures (instead of many-to-many). We also show how disparate datasets such as inpatients, outpatients and RX datasets can be merged to examine the relationship of antibiotics to disease treatment. (Cerrito, 2010)

Using MedStat MarketScan data, we show that physicians do not use proper antibiotics if antibiotics are used at all, resulting in unnecessary amputations and amputations performed sequentially on patients.
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with osteomyelitis. Other conclusions discovered include the result that physicians assume amputation is the primary treatment for Osteomyelitis. Injection of antibiotics was performed on only a small portion of patients with Osteomyelitis. In many cases, infection has recurred and amputation was performed more than once.

**MRSA**

*Methicillin-Resistant Staphylococcus Aureus* (MRSA) is a type of bacteria that is resistant to most antibiotics known as beta-lactams that include Methicillin, Amoxicillin, and Penicillin. *Staphylococcus Aureus* (Steph) bacteria commonly live on the skin. They can cause infection when they enter inside the body from a cut, or through a catheter or breathing tube. This infection occurs in people with weak immune systems, the patients with long stays in hospitals or care facilities, and people receiving certain, invasive treatments such as dialysis. People with diabetes are at a great risk of infection since they usually have a weaker immune system compared to others, and they also have a greater chance to be exposed to the bacteria. In some cases, MRSA infection has occurred in people not considered at high risk; these infections are known as community-associated MRSA (CA-MRSA). They occur in healthy people who have no history of hospitalization in the past. Many such infections have occurred among athletes who share equipment or personal items, and children in daycare facilities. (MedlinePlus, n.d.) More recently, infections have occurred as a result of tattoos. (MRSA, n.d.) Another study showed homosexuals are at greater risk of infection than others. (Binan Dep, et.al., 2008)

One of the main ways of transmission to other patients is through human hands, especially worker’s hand. Hands may be contaminated with MRSA by infected contact or colonized patients. If healthcare providers do not wash hands after contact with a patient, the bacteria can be spread when that provider touches other patients.

**Osteomyelitis**

*Osteomyelitis* is an acute or chronic bone infection, usually caused by bacteria. The infection that causes osteomyelitis often is in another part of the body and spreads to the bone via the blood. Affected bone may have been predisposed to infection because of recent trauma. The objective of treatment is to eliminate the infection and prevent it from getting worse. Antibiotics are given to destroy the bacteria that cause the infection.

If left untreated, the infection can become chronic and cause a loss of blood supply to the affected bone. When this happens, it can lead to the eventual death of the bone tissue.

For infections that are not eradicated, surgery may be needed to remove dead bone tissue (Amputation). Antibiotic choice and duration can help reduce the chance of amputation.

Osteomyelitis can affect both adults and children. The bacteria or fungus that can cause osteomyelitis, however, differ among age groups. In adults, osteomyelitis often affects the vertebrae and the pelvis. In children, osteomyelitis usually affects the adjacent ends of long bones. Long bones are large, dense bones that provide strength, structure, and mobility. They include the femur and tibia in the legs, and the humerus and radius in the arms.

Osteomyelitis does not occur more commonly in a particular race or gender. However, some people are more at risk for developing the disease, including: (Cleveland Clinic, n.d.)

- People with diabetes
- Patients receiving hemodialysis
- People with weakened immune systems
- People with sickle cell disease
- Intravenous drug abusers
- The elderly

The symptoms of osteomyelitis can include: