Case Study: Methicillin-Resistant \textit{Staphylococcus aureus} (MRSA)

What is MRSA?

\textit{Staphylococcus aureus} (\textit{staph}) is a type of bacteria that is commonly found on the skin and in the noses of healthy people. In fact, about 1 out of every 3 people, have staph on their skin or in their nose. However, staph can be a problem if it manages to get into the body. Once there, it can cause an infection. \textit{Staph} is one of the most common causes of skin infections. Usually, these are minor and don’t need special treatment. Less often, staph can cause serious problems like infected wounds or pneumonia.

Some \textit{Staph} bacteria are easily treatable while others are not. \textit{Staph} bacteria that are resistant to the antibiotic methicillin are known as Methicillin-resistant \textit{Staphylococcus aureus} or MRSA. It’s now resistant to meticillin, amoxicillin, penicillin, oxacillin, and many other antibiotics.

Although most MRSA infections aren't serious, some can be life-threatening. Many health care professionals are worried by the spread of tough strains of MRSA. Since it's hard to treat, MRSA is sometimes called a "super bug."

How is MRSA spread?

MRSA relies on skin-to-skin contact. People who have MRSA bacteria on their skin or who are infected with MRSA may be able to spread the bacteria to other people. MRSA has been shown to spread easily in healthcare settings. MRSA can be passed on to bed linens, bed rails, bathroom fixtures, and medical equipment. One study to determine the survival of resistant \textit{staph} on common hospital surfaces looked at \textit{staph} survival on five hospital materials:  

- 100% smooth cotton (clothing)
- 100% cotton terry (towels and wash cloths)
- 60% cotton-40% polyester blend (scrub suits, lab coats and clothing)
- 100% polyester (privacy drapes, curtains and clothing)
- 100% polypropylene plastic (splash aprons).

Samples of fabric were injected with $10^4$ to $10^5$ colony-forming units (CFU) of the microorganism and examined daily. Results showed \textit{S. aureus} survived on the materials for the following number of days:

- Cotton: 4-21 days
• Terry: 2-14 days
• Polyester blend: 1-3 days
• Polyester: 1-40 days
• Polypropylene: 40-greater than 51.

MRSA is also showing up in healthy people who have not been living in hospital. This type of MRSA is called community-acquired MRSA, or CA-MRSA.

What are the symptoms of MRSA?

The symptoms of MRSA infection depend on where you've been infected. Staph skin infections, including MRSA, look like a bump or sore area of the skin that is often mistaken for an insect bite. Typically MRSA appears1:
   • Red
   • Swollen
   • Painful
   • Warm to the touch
   • Full of pus or other drainage
   • Accompanied by a fever

How is MRSA treated and diagnosed?

Infection with MRSA, including colonization, can be diagnosed by culture and identification of the organism. A sample or a swab from the infected area is taken and sent to a laboratory and allowed to grow. If the test results are positive, antibiotic susceptibility testing can identify methicillin resistant strains.

How can reduce the spread of MRSA?

In order to prevent these infections, good basic hygiene measures are extremely important. Keep your hands clean by washing thoroughly with soap and water or by using an alcohol-based hand sanitizer. Cuts and scrapes should be kept clean and covered until they have healed. It is also important that you avoid unprotected contact with other people's wounds or bandages. Finally, do not share personal items such as towels or razors.

Case Study Questions

Use the following information to answer the next question.

“A 60-year-old woman has a bump on her right knee that was swollen and warm to the touch for 2 days. Her occupation was a housecleaner and caregiver. The patient had been squeezing the bump for 2 days, and the discharge changed from clear to bloody fluid. An over-the-counter antibiotic and warm compress provided no relief. One week before symptoms, she was kneeling on a floor cleaning and noticed a rip in her pants at the right knee.”

1. Based on the scenario listed above. What would be your diagnosis? If you were a health care provider what course of action would you plan to be certain.

2. The three main shapes of bacteria are spherical, rod-shaped, and spiral. Examine the chart shown below. Shown in this chart are different groupings of bacterial cells. Next to the drawing of the bacterial cells are the names used to describe the groupings.

![Diagram of bacterial shapes]

- Cocci
  - Diplococci
  - Diplococci encapsulated
  - Staphylococci
  - Streptococci
  - Sarcina
  - Tetrad

- Bacilli
  - Coccobacillus
  - Bacillus
  - Diplobacillus
  - Palicados
  - Streptobacilli

- Budding and appendaged bacteria
  - Hypha
  - Stalk

- Others
  - Enlarged rod
  - Pseudo bacterium
  - Vibrio
  - Comma’s form
  - Bacteroides
  - Club Rod
  - Corynebacteria
  - Helical form
  - Helicobacter pylori
  - Corkscrew’s form
  - Borella burgdorferi
  - Filamentous
  - Spirochete
A. Bacteria are usually named for their shape and appearance. Below are listed several scientific names of bacteria. Next to each name, draw what you think the bacteria will look like.

- Staphylococcus aureus
- Diplococcus pneumonia
- Streptobacillus nicolau
- Spirillum minus (single cell)

B. Other bacteria are named for part of the body they infect or the disease they cause. Look at the scientific names given in the chart below. Determine what disease or body part each bacterium affects.

<table>
<thead>
<tr>
<th>Scientific name of bacterium</th>
<th>Disease or body part affected</th>
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</thead>
<tbody>
<tr>
<td><em>Diplococcus pneumonia</em></td>
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<tr>
<td><em>Neisseria meningitides</em></td>
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<tr>
<td><em>Clostridium tetani</em></td>
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<tr>
<td><em>Escherichia coli</em></td>
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<tr>
<td><em>Bordetella bronchiseptica</em></td>
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<tr>
<td><em>Staphylococcus epidermidis</em></td>
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<tr>
<td><em>Mycobacterium tuberculosis</em></td>
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</table>
3. Based on the ability of certain bacteria to survive on common hospital surfaces, what control mechanisms would you introduce to control the spread of bacteria?

4. Four isolates of *Staphylococcus aureus* are being tested below with an antibiotic oxacillin. From the lab results what can you conclude?

5. Using appropriate sources, research how scientists and health care providers are discovering new treatments for MRSA and other resistant bacteria.