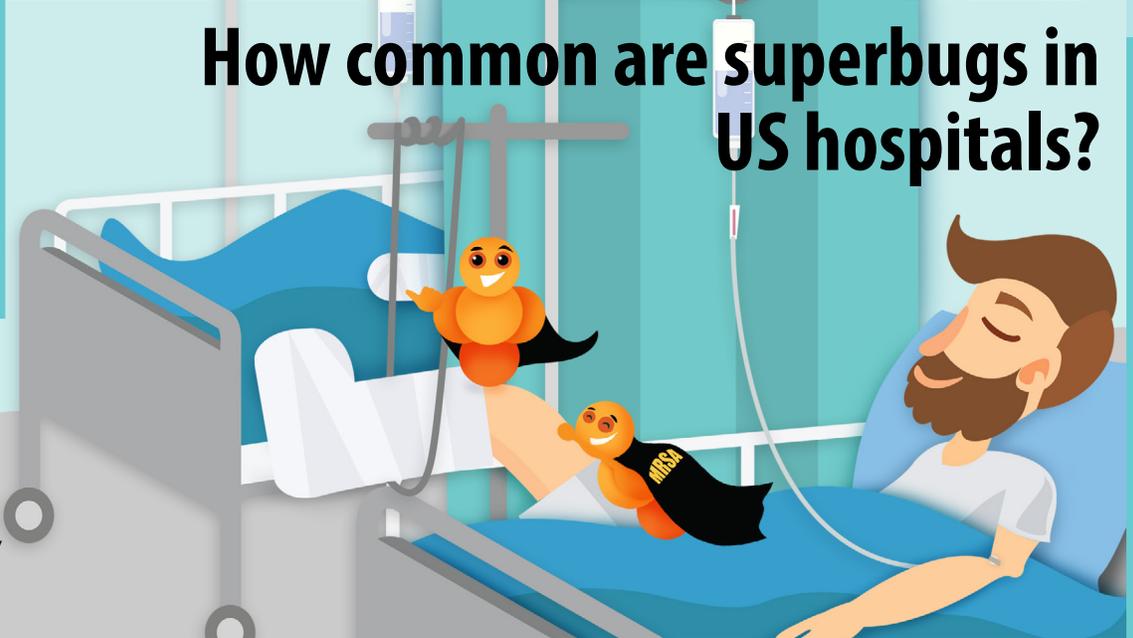


How common are superbugs in US hospitals?



Authors:

Eili Y. Klein, Nestor Mojica,
Wendi Jiang, Sara E. Cosgrove,
Edward Septimus, Daniel J. Morgan,
Ramanan Laxminarayan

Associate Editors:

Elitsa Panayotova, Rachel Watson

Abstract

Do your parents and teachers bug you about washing your hands? They probably have, and it's good advice because cleaning your hands is a great way to prevent infection with bacteria and viruses. One of the bacteria that can live on the skin, called *Staphylococcus aureus*, can cause infections in healthy people. When this bacteria becomes resistant to common antibiotics, it is called *methicillin-resistant S. aureus* (MRSA). MRSA can cause minor skin infections but also more

severe infections that can kill. In fact, MRSA is the leading cause of death due to antibiotic-resistant infections in the US. We wanted to see how the number of hospitalizations due to this superbug changed over time. We analyzed records of patients in the hospital with this infection in the US from 2010 to 2014, and found out that hospitalization rates decreased for mild infections caused by MRSA, while rates for more severe MRSA infections remained constant.

Introduction

We peacefully coexist with trillions of bacteria that live in or on our bodies. The vast majority of these bacteria are actually beneficial to us: some help us digest food, and others protect us against bad microbes. Sometimes, though, some of our normal bacteria become *pathogens* (causing infection) – mostly when our immune system is weak, or when the microbes get into our lungs or our bloodstream.

S. aureus is a part of the normal *flora*, or microorganisms, of the body. It is found on the skin, in the nose and in the gut. It's not usually pathogenic but sometimes it causes skin infections such as *abscesses*, respiratory infections (such as *pneumonia*) and sometimes it can get into the blood and cause *sepsis*. These infections are usually treatable with antibiotics, but some *strains* of *S. aureus* have developed antibiotic resistance. Methicillin-resistant *S. aureus* (MRSA) is a type of *S. aureus* that is resistant to many widely used antibiotics, which makes it harder to treat than *methicillin-susceptible S. aureus* (MSSA) infections. That means doctors have to use stronger antibiotics that can have more side effects, plus it makes it more likely that a person could die from their infection. In the US, MRSA is in fact the leading cause of death due to antibiotic-resistant infections.

Figure 1:
Staphylococcus aureus culture

Source:
Janice Haney
Carr, PHIL
#11157



MRSA is a common pathogen in hospitals and in the community. Patients in the hospital are at risk of getting infected with MRSA because a lot of them have open *wounds*, *intravenous lines* (IVs), and weak immune systems. People can also become infected in their communities, typically through contamination of cuts and scrapes, and some of these infections will require them to go to the hospital. Between 1999 and 2005, hospitalizations for people in the US who got an MRSA infection in their community

increased sharply. Since then, there have been a lot of efforts to try to reduce the number of people infected with this and other antibiotic-resistant pathogens. We have regularly tracked the number of hospitalizations due to MRSA since 1999, and here

we examined how efforts to control MRSA have affected trends in people who had this pathogen while in the hospital, because there had been no reports since 2009.

Methods

We used the National Inpatient Sample database to analyze records of hospitalized patients with MRSA from 2010 to 2014. This database includes more than 7 million records and we analyzed everyone who had a documented *S. aureus* infection, splitting the results up into those with MRSA and those with

MSSA infections. Statistical software helped us calculate the rate of hospitalization due to MSSA and MRSA (the number of hospitalizations due to MSSA or MRSA divided by the total number of hospitalizations).

Results

During this period:

- ① Hospitalizations (no matter what caused them) decreased by 5% (from 37.4 to 35.4 million).
- ② Hospitalizations due to all *S. aureus* infections decreased by 7% (from 661 to 613 thousand), but the overall rate of these hospitalizations did not change much.
- ③ In 2014 there were an estimated 350,000 hospitalizations with MRSA.
- ④ Hospitalizations due to MRSA decreased by 16% and the overall rate of these hospitalizations decreased as well. However, MSSA infections increased, which is why the overall rate of *S. aureus* infections did not greatly change.
- ⑤ The decrease in MRSA rates was due largely to reductions in skin infections, though in recent years there was also a small decline in MRSA-related pneumonia infections.
- ⑥ The rate of patients with sepsis caused by MRSA slightly increased over this time.
- ⑦ Rates of hospitalization differ across geographic regions in the US. While there were declines in all regions, rates of hospitalization related to MRSA remain highest in the southern region of the US.

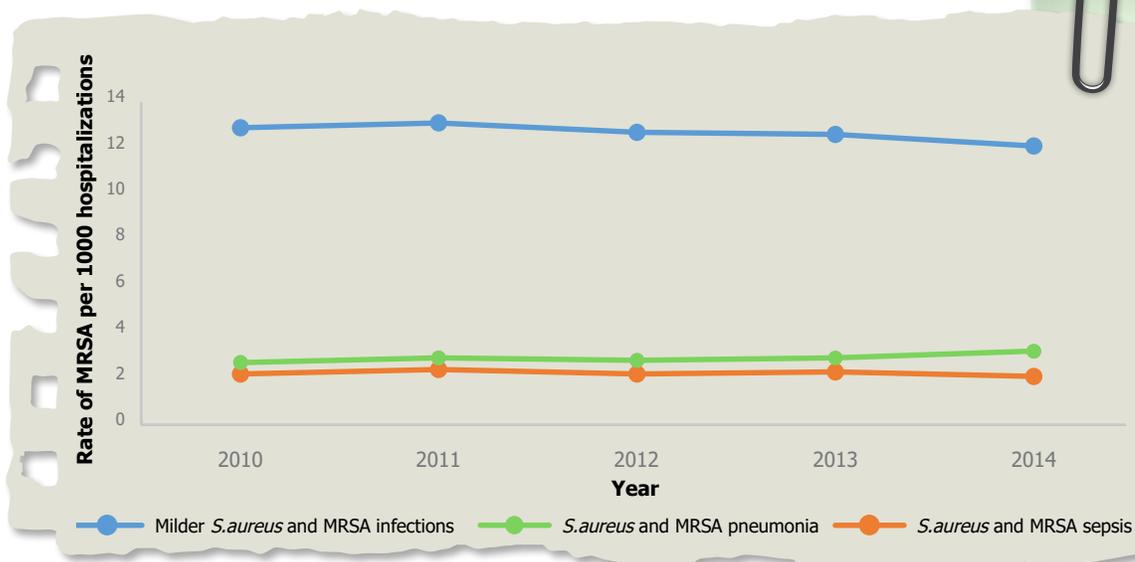


Figure 2: Rates of *Staphylococcus aureus*- and Methicillin-Resistant *Staphylococcus aureus*-related hospitalizations (we show the results per 1000 hospitalizations) in the USA during 2010-2014

Which infections show decreasing rates?

Discussion

Between 2010 and 2014, the hospitalization rate for MRSA decreased largely due to a reduction in skin infections (which are generally milder infections). Unfortunately, despite efforts to control the problem, hospitalization rates for more severe MRSA infections (such as sepsis) largely remained constant. These results contrast with other reports that suggested that hospitalizations related to MRSA had been going down. There might be several reasons for these differences: for example, the other reports didn't include hospitalizations due to MRSA acquired in the community, but only the ones related to care in the hospital.

Our study showed that rates of MRSA were higher in the southern regions, which confirms previous reports. Perhaps this is due to the warmer climate there, which makes it easier for bacteria to grow and spread, especially in the community. Antibiotic use is higher in the southern regions of the US as well, which may also contribute to the spread of MRSA there.

Even though there is an overall decrease in the number of hospitalizations related to *S. aureus*, the rates of MRSA remain higher in the US than in other developed countries, especially for sepsis and pneumonia infections. Increasing efforts to prevent infections in the hospital can help reduce this rate.

Conclusion

Antibiotic-resistant infections are a major public health concern. Part of the problem is unnecessary use of antibiotics. Antibiotics do **not** work for all infections. For most coughs and colds, antibiotics do **not** make you better, and taking antibiotics when they are not needed can hurt you (sometimes causing serious side effects such as really bad diarrhea or an allergic reaction). Help prevent the spread of resistant infections by following some simple rules:

- Wash your hands often, and clean your body regularly, especially after exercise.
- Cover and clean your wounds.
- Don't share personal items, such as razors and towels.
- Listen to your doctor. If they say you have a virus, you don't need antibiotics.
- Take medications fully. Even if you feel better, don't stop taking the drug until your doctor says to stop.

Glossary of Key Terms

Abscess - a swollen area in the tissue of the body that is filled with pus.

Antibiotic resistance - the ability of bacteria to resist the effects of an antibiotic to which they were once sensitive.

Flora/microflora - collective bacteria and other microorganisms in the body (or an ecosystem).

Intravenous lines - often called IVs, these are plastic tubes that deliver liquid medicine directly into a vein.

Methicillin-resistant *Staphylococcus aureus* (MRSA) - strains of *S. aureus* that are resistant to many antibiotics, and thus not easily treated.

Methicillin-susceptible *Staphylococcus aureus* (MSSA) - strains of *S. aureus* that can be treated with many antibiotics.

Pathogen - a microorganism that can cause infection.

Pneumonia - an infection that causes the air sacs of the lungs to fill up with fluid. This makes it hard for you to get enough oxygen into your bloodstream.

Sepsis - the body's overwhelming and life-threatening response to infection that can lead to tissue damage, organ failure, and death.

Staphylococcus aureus - bacterium that is found on the skin and in the nasal passages of about a quarter of humans. It can cause mild skin infections to life-threatening pneumonia and sepsis infections.

Strain - a genetic variant or subtype of a microorganism (a virus or bacterium or fungus).

Wound - an injury in which the skin is cut or broken.

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WHO: Use antibiotics wisely to combat rising drug resistance.

<http://www.who.int/campaigns/world-antibiotic-awareness-week/2017/launch-event/en/>

CDC: MRSA information for patients.

<https://www.cdc.gov/mrsa/healthcare/patient/index.html>

Check your understanding

1 Should you take antibiotics when you get a really bad flu?

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2 Why are patients in hospitals susceptible to MRSA infections?

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3 What is the problem with antibiotic-resistant infections?

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4 People become infected with MRSA mainly in the hospital. What other way might you become infected? Can you think of an example?

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