

# NATIONAL SUMMARY DATA

Estimated minimum number of illnesses and deaths caused by antibiotic resistance\*:

At least  **2,049,442** illnesses,  
 **23,000** deaths

*\*bacteria and fungus included in this report*

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Estimated minimum number of illnesses and death due to *Clostridium difficile* (*C. difficile*), a unique bacterial infection that, although not significantly resistant to the drugs used to treat it, is directly related to antibiotic use and resistance:

At least  **250,000** illnesses,  
 **14,000** deaths

## WHERE DO INFECTIONS HAPPEN?

Antibiotic-resistant infections can happen anywhere. Data show that most happen in the general community; however, most deaths related to antibiotic resistance happen in healthcare settings, such as hospitals and nursing homes.



U.S. Department of  
Health and Human Services  
Centers for Disease  
Control and Prevention

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# **MRSA**

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## **METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS**

### **FREQUENTLY ASKED QUESTIONS**

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#### **What is Staphylococcus aureus?**

*Staphylococcus aureus*, otherwise known as “Staph.,” is a very common type of bacteria (or germ). Up to half of all people carry Staph on their skin and in other areas of the body. In most of these people, Staph lives harmlessly on the body. But Staph sometimes does cause actual infections. Most of these Staph infections are minor skin infections. Less commonly, Staph may go inside the body and cause more serious infections.

#### **What are MRSA, community-associated MRSA, and healthcare-associated MRSA?**

In the 1960s some Staph gained resistance to an antibiotic — a type of medicine used to treat infections — called methicillin. “Resistance” means that an antibiotic no longer works against the bacteria. Resistant Staph are now called methicillin-resistant staphylococcus aureus, or “MRSA” (pronounced MER-SAH). As with ordinary Staph, some people carry MRSA on their skin without developing infections. Also, MRSA may also cause the same kinds of infection as ordinary Staph does. The main difference is that MRSA should be treated with different kinds of antibiotics than ordinary Staph. Until the late 1990’s, MRSA infections were mostly seen in people who had been in hospitals and other healthcare settings. That type of MRSA is called healthcare or hospital-associated-MRSA, or HA-MRSA. HA-MRSA is still an important problem. It is difficult to treat, often affects people who are ill with other diseases, and usually causes more serious infections.

Recently there have been more MRSA infections outside of hospitals or other healthcare settings. The type of MRSA that causes those infections is called community-associated MRSA, or CA-MRSA. CA-MRSA usually causes minor skin infections. But it can cause severe infections, even in healthy people. Plus, it must be treated with different antibiotics than ordinary Staph.

#### **What’s new about MRSA recently?**

Following a recently published study in a medical journal, the media have been focusing a lot on MRSA, particularly CA-MRSA. That study article reported about CA-MRSA in San Francisco. It found that MRSA infections were more common in gay men and other men who have sex with men in San Francisco. For this and other reasons, the article suggested that MRSA might be a sexually transmitted disease (STD). However, the study was not designed to answer the question of whether MRSA is in fact an STD.

#### **How is MRSA spread?**

Staph, including CA-MRSA, is primarily spread when someone’s skin comes in contact with the skin of someone who has Staph. That sort of skin-to-skin contact can happen when someone is playing sports, having sex, or doing other things.

#### **Is MRSA a sexually transmitted disease (STD)?**

Data do not exist to determine whether sex itself — anal, oral, or vaginal intercourse — spreads MRSA. But we do know that skin-to-skin contact, which occurs during sex, can spread MRSA.

#### **Who is at risk of getting MRSA?**

Everyone is at risk of getting MRSA. In general, the factors that make people more susceptible to MRSA infections are the 5 “Cs”:

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- Frequent skin-to-skin **contact**
  - **Compromised** skin (i.e., cuts or abrasions)
  - **Contaminated** items and surfaces
  - **Crowding**
  - Lack of **cleanliness**.

### **Are gay men or other men who have sex with men at higher risk of getting MRSA?**

There is some evidence that gay men or other men who have sex with men are at higher risk of getting MRSA infections. The specific reason for this is not clearly understood. Data do not exist to answer the question of whether MRSA is transmitted through oral or anal sex. But we do know that skin-to-skin contact during sex, including oral or anal sex, can spread MRSA.

### **Are HIV-infected people at greater risk of getting MRSA?**

There is some evidence that people with weakened immune systems, including those with HIV infection, might be at higher risk of getting MRSA. Plus, when people with weakened immune systems do get MRSA infections, the infections tend to be more serious.

### **What are the symptoms of a *S. aureus* or MRSA skin infection?**

Signs of a skin infection include redness, warmth, swelling, and tenderness of the skin. Some people with MRSA might think they have a “spider bite.” People may develop boils, blisters, pustules or abscesses but for most people it does not cause serious problems. The infection can cause a fever and/or chills. People with fever and/or chills should see their health-care provider.

### **What should I do if I think I have an active MRSA infection?**

If you notice any of the symptoms of a Staph infection, you should contact your health-care provider. You may need antibiotics or other treatment. Your healthcare provider will discuss treatment with you. Do not try to treat yourself. Whenever antibiotics are prescribed, take all of the medication even if you think the infection has gone away. This will help prevent the Staph germ from becoming more resistant to antibiotics.

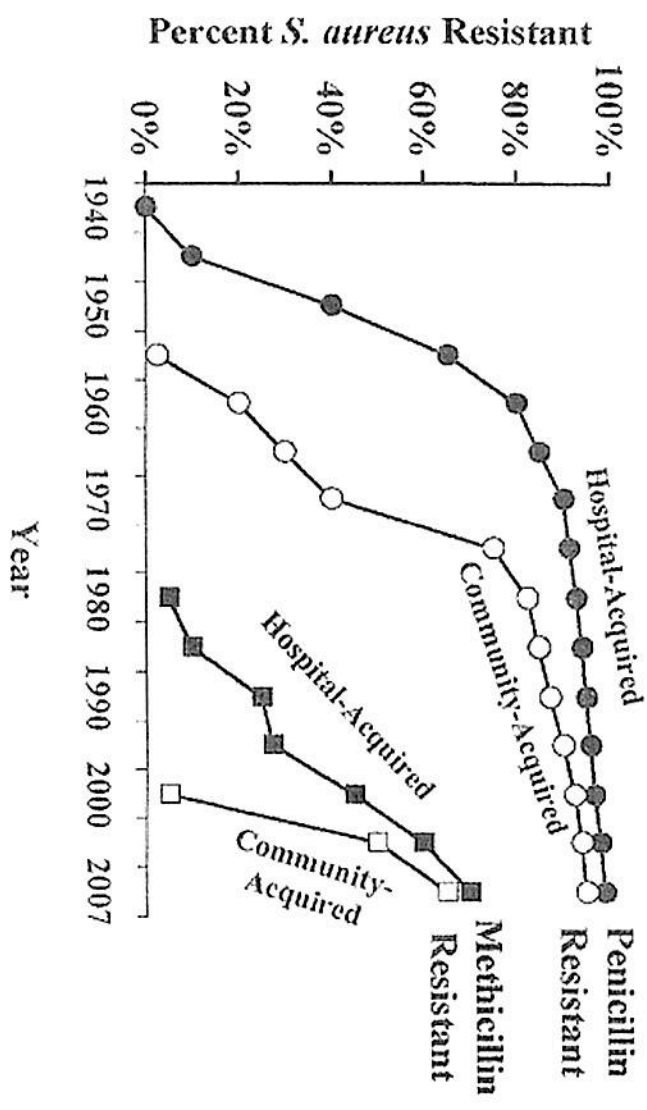
### **How do I protect myself from getting and spreading MRSA?**

- Practice good hygiene.
- Wash your hands frequently with soap and water. If soap is not available, use hand sanitizer instead.
- Keep wounds covered with clean, dry bandages.
- Do not share personal items such as towels, clothes, or anything else that makes contact with skin.
- Clean and disinfect items that are shared before and after every use (athletic/workout equipment) with disinfectant or detergent. A list of products approved by the Environmental Protection Agency that are effective against MRSA is available at [http://epa.gov/oppad001/list\\_h\\_mrsa\\_vre.pdf](http://epa.gov/oppad001/list_h_mrsa_vre.pdf). These products should be used only as directed.
- Use lotion to keep skin moist; damaged skin can provide an opening for infection.

### **Other useful websites and information:**

- SFDPH Communicable Disease Control and Prevention Website:  
<http://www.sfdcp.org/index.cfm?id=100>
- SF City Clinic website: <http://dphwww.sfdph.org/sfcityclinic/providers/>
- Centers for Disease Control web site: [www.cdc.gov/ncidod/dhqp/ar\\_mrsa\\_ca.html](http://www.cdc.gov/ncidod/dhqp/ar_mrsa_ca.html)

Updated January 18, 2008







Leading research to understand, treat, and prevent infectious, immunologic, and allergic diseases

## Overview, Methicillin-Resistant *Staphylococcus aureus*

### Overview

During the past four decades, a type of bacteria has evolved from a controllable nuisance into a serious public health concern. This bacterium is known as methicillin-resistant *Staphylococcus aureus*, or MRSA. About one-third of people in the world have *S. aureus* bacteria on their bodies at any given time, primarily in the nose and on the skin. The bacteria can be present without causing an active infection. Of the people with *S. aureus* present, about 1 percent has MRSA, according to the Centers for Disease Control and Prevention (CDC).

MRSA can be categorized according to where the infection was acquired: hospital-acquired MRSA (HA-MRSA) or community-associated MRSA (CA-MRSA).

### Hospital-acquired MRSA (HA-MRSA)

HA-MRSA is acquired in the hospital setting and is one of many hospital-acquired infections exhibiting increased antimicrobial resistance. HA-MRSA has increased during the past decade due to a number of factors including an increased number of immunocompromised and elderly patients; an increase in the number of invasive procedures, e.g., advanced surgical operations and life support treatments; and failures in infection control measures such as hand washing prior to patient contact and removal of non-essential catheters.

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### Community-associated MRSA (CA-MRSA)

CA-MRSA is caused by newly emerging strains unlike those responsible for HA-MRSA and can cause infections in otherwise healthy persons with no links to healthcare systems. CA-MRSA infections typically occur as skin or soft tissue infections, but can develop into more invasive, life-threatening infections. CA-MRSA is occurring with increasing frequency in the United States and around the world and tends to occur in conditions where people are in close physical contact, such as athletes involved in football and wrestling, soldiers kept in close quarters, inmates, childcare workers, and residents of long-term care facilities.

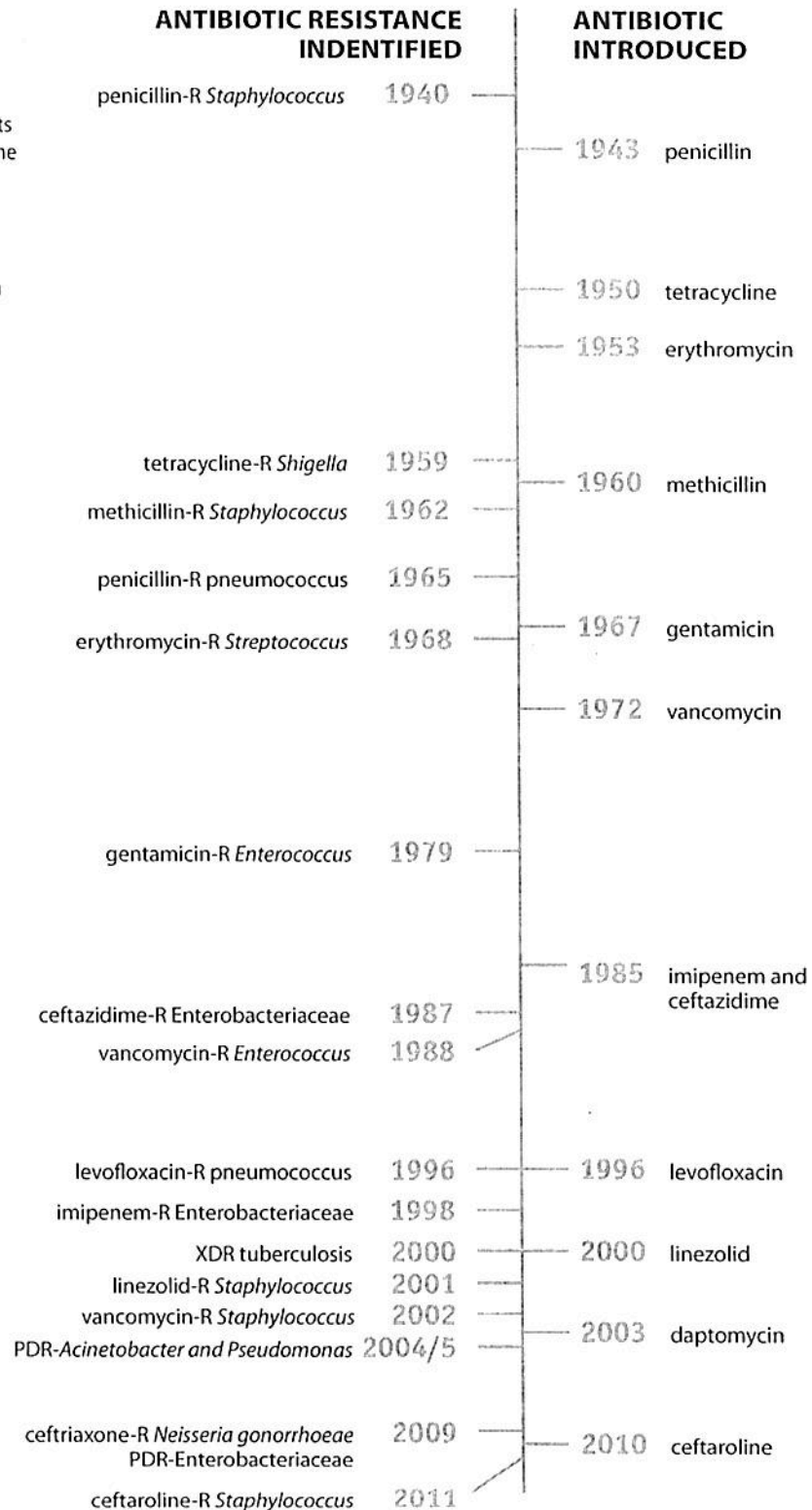
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MRSA has attracted the attention of the medical research community, illustrating the urgent need to develop better ways to diagnose and treat bacterial infections.

# Developing Resistance

## Timeline of Key Antibiotic Resistance Events

Dates are based upon early reports of resistance in the literature. In the case of pan drug-resistant (PDR)-*Acinetobacter* and *Pseudomonas*, the date is based upon reports of healthcare transmission or outbreaks. Note: penicillin was in limited use prior to widespread population usage in 1943.



## Lesson 2 - Reading (abstract from): A diversity of Antibiotic-resistant *Staphylococcus* spp. in a Public Transportation System

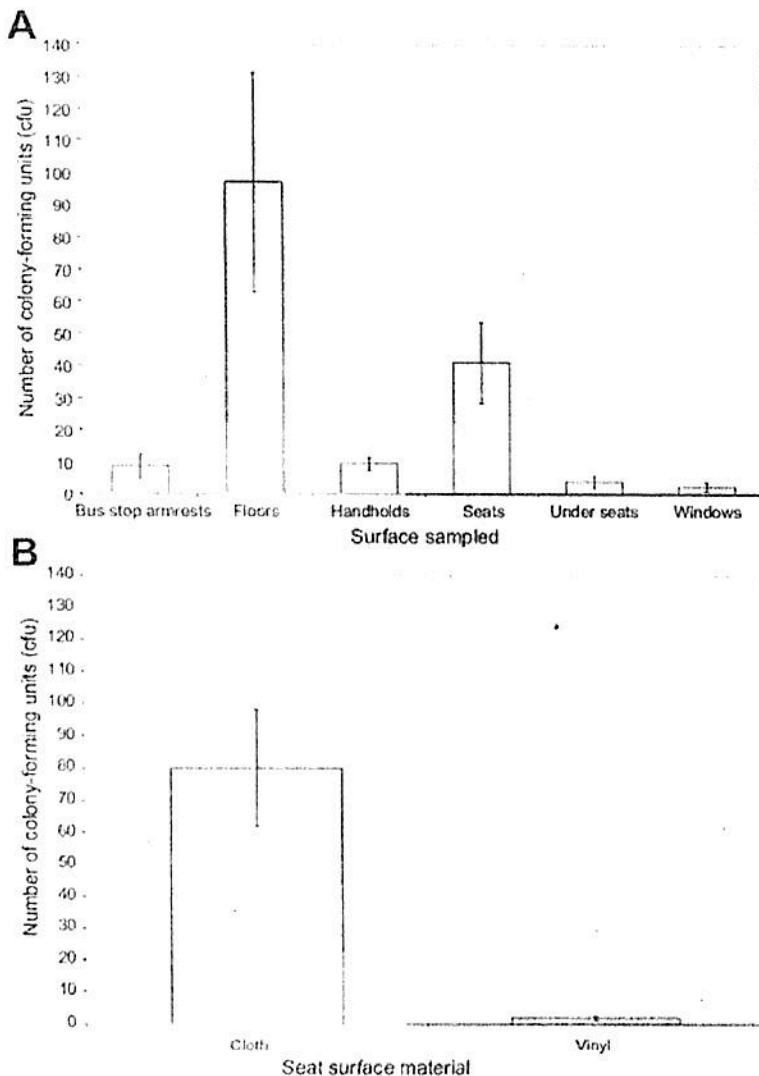
Abstract (from <http://www.sciencedirect.com/science/article/pii/S2210909911000968>)

### Objectives

Our goal was to determine the diversity and abundance of *Staphylococcus* bacteria on different components of a public transportation system in a mid-sized US city (Portland, Oregon) and to examine the level of drug resistance in these bacteria.

### Methods

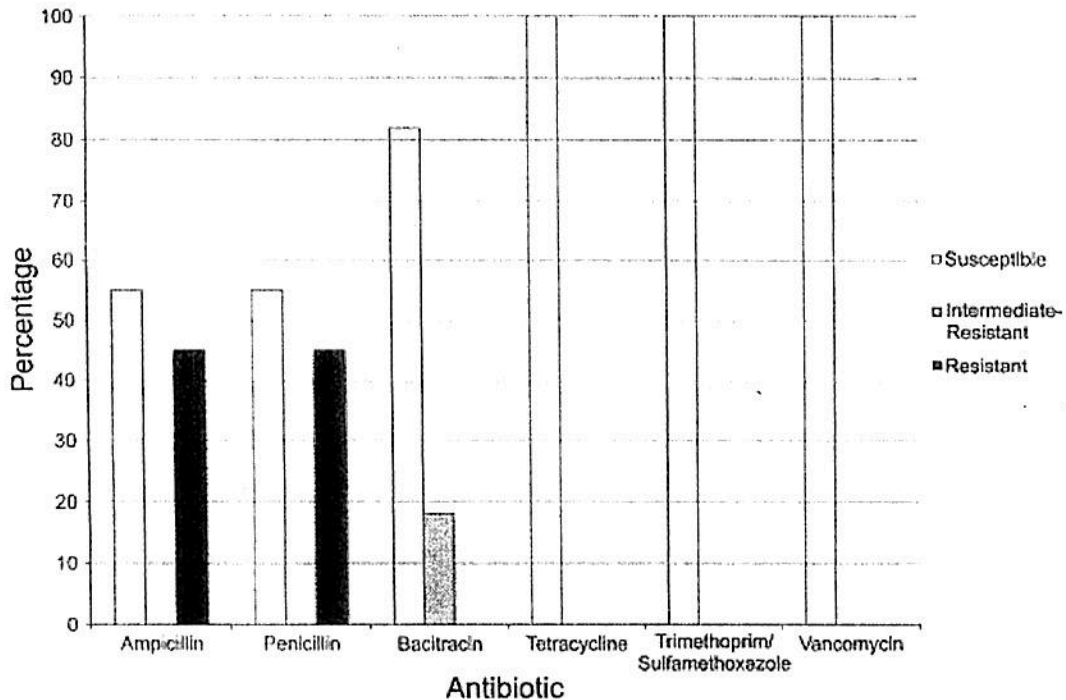
We collected 70 samples from 2 cm × 4 cm sections from seven different areas on buses and trains in Portland, USA, taking 10 samples from each area. We isolated a subset of 14 suspected *Staphylococcus* spp. colonies based on phenotype, and constructed a phylogeny from 16S rRNA sequences to assist in identification. We used the Kirby–Bauer disk diffusion method to determine resistance levels to six common antibiotics.



### Results

We found a range of pathogenic *Staphylococcus* species. The mean bacterial colony counts were 97.1 on bus and train floors, 80.1 in cloth seats, 9.5 on handrails, 8.6 on seats and armrests at bus stops, 3.8 on the underside of seats, 2.2 on windows, and 1.8 on vinyl seats per 8 cm<sup>2</sup> sample area. These differences were significant ( $p < 0.001$ ). Of the 14 isolates sequenced, 11 were staphylococci, and of these, five were resistant to penicillin and ampicillin, while only two displayed intermediate resistance to bacitracin. All 11 isolates were sensitive to trimethoprim-sulfamethoxazole, vancomycin, and tetracycline.

**Figure 001:** Comparison of the number of colony-forming units (cfu) found in 8 cm<sup>2</sup> locations within the Portland public transit system. There were significant mean differences in the number of cfu between these types of surface. (A) Number of cfu shown for various surface types within TriMet buses and trains, and for bus stops (mean ± standard error). (B) Number of cfu for all seats broken down into surface type: cloth seats found on buses, and vinyl seats found on trains (mean ± standard error).



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Figure 3. Resistance to antibiotics among confirmed *Staphylococcus* isolates. Among the 14 isolates sequenced, 16S sequences indicated that 11 were staphylococci. The resistance of these strains to several antibiotics, as determined by a disk diffusion method, is shown on the graph in percentages. The percentages of isolates that were susceptible are shown as white bars, isolates with intermediate resistance are shown as hatched bars, and resistant isolates are shown as black bars. There is a diversity of resistance levels among strains and antibiotics.

## Conclusions

We found six different strains of *Staphylococcus*, and while there were varying levels of drug resistance, we did not find extensive levels of multidrug-resistant bacteria, and no *S. aureus* was found. We found floors and cloth seats to be areas on buses and trains that showed particularly high levels of bacteria.