Antibiotics, Bacterial Resistance, and Antibacterial Products: Public vs. Individual Responsibility

The following article deals with the dangers of bacterial resistance to antibiotics and the possible hazards caused by the overuse of germ-killing products at home. The main characters and events in the article are fictitious, but the facts are real. Read the article and think about the questions at the end. Be prepared to discuss both.

Patrick's Story

When 15-year-old Patrick C. developed a pimple on his cheek in the spring of 2006, he assumed it was just acne. But when the whole side of his face became swollen and abscessed the next day, he knew it was more than a typical teenage blemish. A similar abscess soon appeared on his forehead, along with a painful, softball-sized boil on his thigh. His alarmed parents took him to the doctor who said Patrick had a common staph infection.

"Staph" is shorthand for *Staphylococcus aureus,* a type of bacteria that many healthy people carry on their skin or in their nostrils without causing illness. Around 25% to 30% of the population is a carrier of staph and when an infection does occur, as a result of a break in the skin for instance, it usually produces only minor skin conditions such as boils or rashes that are easily treated with antibiotics.

For Patrick's doctor the treatment was routine. She cleaned, drained, and bandaged the abscesses and sent him home with a prescription for an antibiotic. Patrick and his family thought that would be the end of it.

When antibiotics appeared in the 1940s, the public hailed their discovery as miraculous. Infections that were once deadly or crippling could be cured in days, if not hours. Penicillin, the first mass-produced antibiotic, saved the lives of many thousands of American G.I.s during World War II. Soon, dreaded afflictions such as infected wounds, septicemia (blood poisoning), pneumonia, scarlet fever, and tuberculosis were no longer death sentences for millions.

As expected, Patrick's abscesses responded well to his prescribed course of antibiotics, but within a week, he was complaining of tiredness and shortness of breath. "I knew something was wrong when he came home early from baseball practice," said Patrick's father Joseph C. "Patrick is very athletic and baseball is his passion; he never misses a practice."

That night, Patrick ran a fever of 104° and went to bed early wondering if he'd come down with the flu. The next morning Patrick lay in bed and looked "ghastly," according to his mother Elaine. "There were dark circles around his eyes, and he was wheezing with every breath. He rolled his head toward me and moaned that he couldn't get up." Over Patrick's objections, Elaine called 911 for an ambulance.

At the hospital, tests showed that Patrick had a bacterial infection known as methicillin-resistant *Staphylococcus aureus (*MRSA). The infection had entered his bloodstream and lungs, causing severe pneumonia. Patrick was placed on a respirator in the intensive care unit and given vancomycin, a powerful antibiotic, intravenously. Doctors told Patrick's distraught parents that he might die.

A Bigger Problem than You'd Think

MRSA (pronounced by the initials M.R.S.A. or as the word "*mur-sah*") is a virulent strain of staph that is resistant to the most commonly used antibiotics—what doctors call beta-lactam antibiotics. These include penicillin, oxacillin, and amoxicillin.

Bacterial resistance to antibiotics is nothing new. Almost as soon as penicillin was introduced, strains of bacteria appeared that were resistant to it. Early resistant strains of staph and *streptococcus* (another common infectious bacterium) occurred most frequently in hospitals and other healthcare facilities, where they were responsible for many deaths.

"It may surprise a lot of people," says Dr. Judy Munster, infectious disease specialist at New York's Gotham Hospital, "but hospitals are veritable incubators of harmful bacteria. We have a lot of sick people in here, many of them with weakened immune systems, who are loaded with a spectrum of germs. Hospital staff moves from patient to patient, sometimes carrying germs inadvertently. Also, with the quantities of antiseptics and other anti-microbial agents used, there's strong selection pressure for bacteria to evolve resistance. We're like the Army Ranger boot camp of germs," says Dr. Munster. "Germs get put through the wringer and only the toughest survive."

Until recently, nearly all MRSA cases were limited to the healthcare settings described by Dr. Munster. However, since the 1990s, physicians have reported an alarming number of cases among the general population. "It seems to be infecting healthy people everywhere," says Dr. Keith Laramide of the Centers for Disease Control and Prevention (CDC).

Known as community-associated methicillin-resistant staph or CA-MRSA, to distinguish it from its hospital-acquired cousin, it is now the most frequent cause of skin and soft tissue infections appearing in emergency rooms across the United States. "The CDC does not track nationwide incidences of CA-MRSA," admits Dr. Laramide, "but we do know that infection rates doubled between 2002 and 2006 in cities like Atlanta and Baltimore where we conduct disease surveillance."

CA-MRSA was responsible for the deaths of four children in Minnesota and North Dakota in 1997 and made more headlines in 2005 when Miami Dolphins Junior Seau and Charles Rodgers contracted limb-threatening MRSA skin infections.

Even more insidious and frightening are the invasive forms of MRSA. When staph gets into the bloodstream, it invades other tissue and organs. In 2005, college football player Ricky Lannetti died of MRSA pneumonia after exhibiting flu-like symptoms. The CDC estimates that the number of invasive MRSA infections in 2005 was around 94,400. About 85% of invasive MRSA cases were hospital or healthcare related, but a mysterious 14% of all infections occurred in people like Patrick C. who had no previous hospital exposure.

All of this information was news to Patrick C.'s parents as they waited at his bedside day after day, hoping that the cocktail of drugs dripping through the tangle of IV tubes in Patrick's arm would work its magic. Surgeons had risked operating on Patrick's lungs, which had become riddled with holes from the toxins produced by the staph bacteria. The operation was successful, but doctors now had Patrick on a variety of antibiotics and strong sedatives to induce a coma that would hopefully allow his body time to heal.

To the public, CA-MRSA and other hardy germs, such as the much publicized "flesh-eating" bacteria, are often known as "superbugs." According to the CDC, drug-resistant microbes kill 70,000 Americans annually—more than automobile accidents and homicides together.

“Nearly every significant bacterial infection in the world is becoming resistant to front-line (most commonly used) antibiotics,” says Dr. Laramide. “By one estimate, the number of resistant strains has increased tenfold in the last 10 years. Many of us fear that the day will come when even the most potent antibiotics will be useless against most infections.”

But Why?

“A lot of this problem comes from the overuse of antibiotics in the last 50 years,” says Dr. Munster. “Early antibiotics were so successful that the public saw them as wonder drugs. Physicians began prescribing them for a wide variety of ailments, including those caused by viruses.”

“Antibiotics are ineffective against a viral infection, but doctors often prescribed them anyway,” Dr. Muster elaborates. “They did this to please the patient, who usually demanded an antibiotic, and because they couldn’t always be certain what kind of microbe was causing the patient’s illness. It wasn’t long before tens of millions of Americans were unnecessarily taking antibiotics every year.”

Drug-resistant bacteria are a textbook example of Darwin’s natural selection in action. In the presence of antibiotics, any bacterium that has even the tiniest resistance has a slightly better chance of surviving than ones that don’t. As the antibiotic kills off the weakest bacteria, the more resistant ones have more room to multiply in a patient’s body, passing this resistance along to their offspring. If the same antibiotic is later given to this patient, then the most resistant of these already resistant bacteria multiply even more. Eventually, a population of bacteria evolves that is completely unaffected by the antibiotic.

“From a public health perspective,” continues Dr. Munster, “one of the worst things a patient on antibiotics can do is to stop taking the drug before finishing all of the pills in the prescription bottle. Many people stop taking the medication as soon as they feel better—which is a big mistake; you’ve killed off the least resistant bacteria, but left behind a population of the hardier types. You’ve just made your body a superbug training camp.”

As Patrick lay comatose and close to death, his parents asked themselves that inevitable question: “What could we have done differently?” Doctors assured them that they had done everything right; they had gotten Patrick to the hospital in time, when a delay of one or two days would have meant Patrick’s certain death. Still, Patrick’s parents worried and wondered. “We’ve always kept our house spotless,” said Patrick’s mother, Elaine C. “Patrick has excellent hygiene. I don’t understand how he could have gotten such a nasty infection.”

Even Bigger Worries to Come?

With increasing public awareness of the perils of microbial resistance, one might suppose people would be more careful about how they use antibiotics and anti-microbial products. Paradoxically, this awareness of bacterial danger may be producing the opposite effect.

“Americans seem to be on an anti-germ craze,” explains Tony Patina of John Hoskins School of Public Health. “Journalists love to sensationalize. We hear frightening stories of flesh-eating bacteria and deadly *E. coli* outbreaks and think we need a lot of extra protection against germs.”

To allay their fears, Americans are snapping up antibacterial soaps and other germ-killing products at a ferocious rate. Since the mid 1990s, more than 700 new household and personal-care products labeled “antibacterial” or “disinfectant” have appeared on the market.

Antibacterial products are a $400 million industry. By some estimates two-thirds of all liquid soaps and about one-third of all bar soaps sold in the U.S. contain antibacterial additives. Some researchers muse about a time when it may be nearly impossible to buy soap that is not antibacterial.

Americans may be well on their way to repeating the same mistakes they made with antibiotics—only this time with the slew of anti-bacterial products crowding supermarket shelves.

A common ingredient in household antibacterial products is triclosan, a chemical agent that kills many kinds of bacteria and fungi. Found in nearly half of all commercial antibacterial soaps, triclosan is now appearing in products as diverse as acne medication, toothpaste, toothbrushes, cutting boards, sponges, and dish towels. In some areas of the country you can find triclosan in mattresses, pillows, sheets, towels, and slippers!

"If overuse and misuse of antibiotics in the last 50 years caused a superbug problem," asks Patina, "isn't it reasonable to wonder whether antibacterial products will cause new, perhaps even more frightening, superbug problems in the next 50 years?"

So far, the jury's still out on that question. The biochemical effects of triclosan resistance in bacteria have been observed in the laboratory but not in the home or real-world environments. A recent one-year study of antibacterial soap use in 224 households found no evidence of bacteria developing resistance to triclosan.

However, many health researchers conclude that, given the laboratory evidence, it's better to be safe than sorry. Currently, the American Medical Association (AMA) is urging against the extensive domestic use of "antibacterial soaps, lotions, and other household products." The AMA is also asking the Food and Drug Administration to speed up regulation of any antibacterial products shown to produce resistance in bacteria.

At the hospital, Patrick came out of his coma and began a slow recovery. "I still have some health problems but am very happy to be alive," says Patrick. "When you're young and fairly athletic like me, you don't expect to be up and running one day then nearly dead from infection the next. But if it could happen to me, I guess it could happen to anyone."

Questions to Consider

1) The first series of questions about this story concerns who is to blame, or who is at fault. Before you answer or discuss the questions, think about what blame means:

   Usually what we mean by blame is that someone or something is causally responsible. For example, when we say that most cases of lung cancer can be blamed on cigarette smoking, we mean that had these people not smoked, they would not have developed cancer. But that reasoning doesn't always seem to be right. Suppose you're outside walking when you notice that someone accidentally threw a baseball in your direction. You duck and the ball misses you but hits someone else. If you hadn't ducked, the ball would not have hit the other person, so you seem to be causally responsible. Are you to blame?

   In certain cases, most of us think that people should not be blamed even when they are causally responsible. Mentally challenged individuals, for example, probably should not be blamed for behaving in certain ways when they are incapable of understanding the consequences. What about simple mistakes? Can you blame someone for not being perfect? In other words, if humans by definition will make mistakes no matter how hard they try not to, can you blame someone who makes a mistake despite his or her best efforts not to?

a) Should Patrick's family doctor bear some blame for not recognizing the severity of Patrick's illness? Why or why not? What could be done to ensure such misdiagnoses happen less often? Discuss.

b) The article points out that hospitals are often breeding grounds for deadly bacteria. Can you list a couple of reasons why this is true? What factor(s) can the hospital most easily control? What should be done if a hospital does not take adequate measures to prevent the spread of harmful bacteria?

c) Much of the problem of bacterial resistance to drugs can be traced to doctors overprescribing antibiotics. Who's more to blame, the drug companies, the doctors, or the patients? Why? What can each of these groups do to avoid further contributing to the problem?

d) Who is most responsible for the huge market for antibacterial products: big business, the media, or the consumer? Why? Does it make sense to blame a group of people? For example, can you blame the companies that make antibacterial products? If so, does that mean that you can or cannot blame the individual employees of these companies?

2) Who (if anyone) do you think should make the decision to withhold some antibiotics from the general public so they might be used especially for drug-resistant bacterial infections?

3) Who do you think should pay for the development of new antibiotics to treat resistant bacteria? Drug companies, the government, or the consumer? Why? If all of them are responsible, in what proportion should they pay? If it's the government's responsibility, then who *really* pays? Is this fair to everybody? Why or why not?

4) Many health experts think that the use of antibacterial products in the home should be more strictly controlled because it's better to be safe than sorry. This reasoning is one example of what's often called the Precautionary Principle, which advocates that any new chemical, drug, or technology be proven absolutely safe before it's implemented into society. Do you agree with this principle? What are the benefits and possible drawbacks in strictly applying this principle?

5) Based on the article, do you think that oral or topical antibiotics should be used as part of a general regime to clear up teenage acne? Why or why not?

6) In the article, a health worker criticizes the media for sensationalizing the germ problem. Why?

a) Is there a dilemma here for the media? For example, does the magazine article, which tries to point out the problem of superbugs, contribute to the problem? How?

b) Would you read something on your own that wasn't at least a little bit exciting or interesting? Why or why not?

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