Antibiotics and Resistance

Could antibiotic resistant bacteria make you sick?

Antibiotic resistance is a growing human health problem. Antibiotic resistance is when bacteria that cause disease don't respond to medical treatment with antibiotics, causing infections that can be difficult to treat. When this happens, an infected person can get very sick and may need to spend days in a hospital, needing expensive treatment. Severe cases of infection with resistant bacteria can result in death.

Data from the U.S. Centers for Disease Control (CDC) show that almost 3 million people every year in the U.S. get an infection from a germ that is resistant to antimicrobials. More than 35,000 of those people die because of infections with antimicrobial resistant germs.

Every 15 minutes someone dies because of an antibiotic resistant infection.

What is a bacteria?

Bacteria are tiny, invisible germs that are found everywhere. They live inside and outside of all living creatures.

Most of the bacteria in our body are good bacteria. Many are found in our digestive system, helping us digest food or to fight off bad bacteria.

The bad bacteria, called pathogenic bacteria, can cause a fever and other symptoms that make us sick. These bad bacteria can enter our body through an open wound, our eyes, nose, or mouth. Bacterial infections are often treated with antibiotics.

What is a virus?

Viruses can cause diseases like the common cold, the flu, COVID-19, and other infections. Viruses cannot be seen by the naked eye. Viruses are not living cells. They need host cells from a human or animal to multiply and cause an infection. Viral infections are not treated with antibiotics. Usually, viruses are treated in other ways like drinking plenty of fluids and rest. Sometimes other medications are given to make you feel less sick.

Bacterial infections can be treated with antibiotics. Viral infections can not.

Bacteria points of entrance into the body

Mouth | Eyes | Skin (open wounds) | Nose

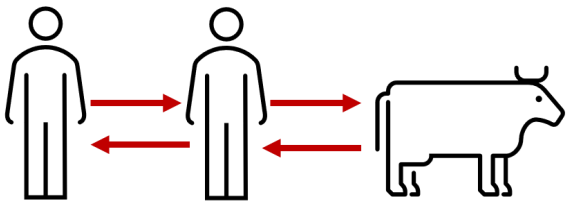
WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

Antibiotics and Resistance

Bacteria and viruses

Bacteria and viruses can both cause infections, and often spread in the same way, causing similar symptoms. But bacteria and viruses are very different from each other. Therefore, "bacterial" and "viral" infections must be treated differently. Infections from bacteria often are treated with antibiotics. But viral infections are not.



Bacteria	Both	Virus
Smaller	Can cause disease, some are deadly	Larger
Living organisms	Can spread through the air by coughing, sneezing, or touching a contaminated object, surface, animal, or person	Not living organisms
Made of only one cell		Do not have cells
Can reproduce on their own		Cannot reproduce on their own
Can reproduce inside and outside a living body		Need a living host to reproduce
Can be treated with antibiotics		not killed by antibiotics
Ex. Strep throat		Ex. Common cold, flu, covid-19

Both bacteria and viruses can cause infections. Many spread from person to person or from animals to people.

What are antibiotics?

And why we should see a doctor before taking antibiotics

Antibiotics are a type of medicine used to fight infections caused by bacteria. There are different types of antibiotics and certain types of antibiotics work better on some types of bacteria than others. This is one reason why we should go to a healthcare professional when we are sick, before we take an antibiotic.

Antibiotics have become less effective at destroying bad bacteria because people don't follow the doctor's instructions, causing the antibiotic to not kill all of the bacteria that are making us sick. Or sometimes a person has a viral infection and tries taking antibiotics. But, then they don't get better. Antibiotics will not work on viruses. Usually, a virus is treated in other ways like drinking plenty of fluids, rest, and sometimes other medications are given.

Always see a healthcare professional when you are sick, before taking an antibiotic.

When treating patients, a health care professional will often perform tests to determine whether you need an antibiotic at all.

A common example is when you have your throat swabbed because of a bad sore throat to see if you have a type of bacteria in your throat called "strep" which can be usually be treated with antibiotics.

Antibiotics and Resistance

How bacteria become resistant to antibiotics?

Bacteria are tiny living organisms that multiply quickly. As bacteria divide, the new cells can changes in tiny ways. These changes are called mutations. Sometimes these mutations make bacteria more difficult to be killed by antibiotics.

This is antibiotic resistance.

When a person gets infected with an antibiotic resistant bacteria, that bacteria cannot be killed with an antibiotic. It make the infection hard or impossible to treat. This can lead to extended hospital stays or multiple doctor's visits. Or you can die. Resistance bacteria can be spread from person to person or animal to person, making it more difficult to control.

You can you help fight the spread of antibiotic resistant bacteria

Only take antibiotics that have been prescribed by a health care professional

Do not share antibiotics with anyone, even with others in your family

Take the recommended dose of antibiotics that the health care professional prescribes for the full number of days

Only take antibiotics for infections that are caused by bacteria.

Antibiotic resistance is a threat we need to take seriously.

We all play a role in fighting antibiotic resistance.

Together, let's take actions to protect ourselves, our families and our communities.

What is that?

Bacteria– *Tiny living organisms found inside and outside our body.*

Pathogenic bacteria– *Harmful types of bacteria that make us sick.*

Fungi– *Tiny living organisms that can make us sick or cause skin to become red or itchy*

Antibiotic resistance– *Changes to bacteria that make treating them with antibiotics difficult or impossible.*

Centers for Disease Control (CDC)- *A U.S. agency that studies public health issues like antibiotic resistance.*

Germ– *A general word for small things that sometimes make us sick. Includes bacteria, viruses, and fungi.*

Virus– *A tiny infectious particle that requires a host to replicate and cause sickness.*

Mutation– *Tiny changes to bacteria that are passed along to new bacteria as they divide.*

Host– *A person (or animal) who gets sick from a virus or bacteria.*

Infection– *Getting sick from a harmful virus or bacteria.*

Exposure to Disease-Causing Bacteria

Antibiotic resistance has happened and can happen to you

According to the CDC, in a single outbreak, 56 people were infected with a resistant bacteria called *Salmonella* Heidelberg from contact with dairy calves over two years. Thirty five percent (35%) of people in this outbreak were children younger than five years. Seventeen (17) people were hospitalized.

People who were sick reported that they became sick after the calves they were handling became sick or died.

Source: https://www.cdc.gov/salmonella/heidelberg-11-16/index.html

Cattle can sometimes carry resistant forms of *Salmonella* or other bacteria, but may not appear to be sick. However, in this outbreak, some people did notice illness in their cattle.

Farm workers should watch for animals that appear sick and ask your supervisor for the best practices to handle the animal in a safe way to help the animals and to prevent yourself from getting sick.

How can you be exposed?

Exposure occur working in areas and doing jobs where animals are present such as

- Milking
- Moving cows
- Doing herd health
- Working with sick or fresh cows
- Working with sick calves
- Cleaning pens/removing bedding
- Handling placentas
- Moving and disposing dead animals

Exposure can happen through contact with

Manure, urine, saliva, mucus, blood and body tissues from animals.

Raw milk or milk that is not pasteurized.

Contaminated food and water

Objects that are contaminated with manure, urine, saliva, mucus, blood and body tissues from animals (clothing, light switches, dirty gloves, etc.)

Cattle can sometimes carry bacteria, but not appear to be sick. But they can still transmit diseases and can cause serious illness in humans.

Common exposure scenario: When a worker has manure on their hands after working with cattle, and they eat a snack without washing their hands first it is likely bacteria will enter the worker's mouth. This increases the chance the worker will get sick

What is that?

Raw milk– *Milk that comes straight from a cow is called raw milk. It has not been "pasteurized." Milk that is pasteurized means that it has been processed in a way that kills all of the harmful germs that make people sick.*

Dairy workers can help stop the spread

Fighting antibiotic resistance one cow, one worker at a time

- Follow veterinarian recommendations for treatment, length and doses needed.
- All animal treatment changes must be evaluated and approved by the veterinarian.
- Assess each animal's need for antibiotic use, including culturing or testing to see what bacteria are present, and consider condition and history of the animal.
- Keep records of antibiotic use for all animals at the farm that include animal identification, the date(s) of treatment, reasons for using the antibiotic, amount given with each dose, duration of treatment, route of administration, withholding time, and name of person administering the treatment.
- Keep antibiotics and other medicines in secure and designated storage areas
- Only authorized and trained employees may handle antibiotics.

The same actions that lead to the spread of antibiotic resistant bacteria when we use antibiotics in humans are similar to those that contribute to antibiotic resistance on the farm.

- Clearly identify any treated animal and keep them in a designated area.
- Animals treated with antibiotics must be milked separately from the rest. Milk must be diverted and handled so that it NEVER enters the bulk tank.
- Use residue screening tests before any antibiotic treated animal is sent to market. Never send to market if there is a doubt about residue or if you do not have proof from tests that an animal is safe to go to market.

Safe practices to avoid exposure to bacteria

- Wash your hands and arms ALWAYS before eating
- Store food in a clean location designated for food only.
- Eat in designated eating areas. Do not eat snacks or meals when working with animals or in areas where animals are kept, milked, or handled.
- Wear the correct personal protective equipment (PPE).
- Wear dedicated work clothing and boots that stay on the farm and are washed and dried daily.
- Do not wear work clothes in personal vehicles or at home.
- Keep scratches and wounds clean and covered.
- Do not touch your face while you are working.

Photo source: UW-Madison. Pioneer Farms-Chancellor 22

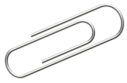
Wash your hands!

Are you washing your hands correctly?

Did you know that hand washing with soap and water for 15-20 seconds can reduce hand bacteria by 90% and when you wash for an additional 15 seconds it can reduce bacteria by 99.9%?

When should you wash your hands?

- After working with animals
- After being in areas where animals, manure, or used bedding are kept
- After working in areas where other people who work with animals are present
- When moving from one work area to another
- Before eating
- Before and especially after going to bathroom



Did you know that 1 gram of human feces, which is about the weight of a clip, can contain one trillion germs?

Imagine how many germs you are touching when you flush the toilet. **That's over one trillion reasons to wash your hands!**

How to wash hands?

1. Remove gloves by pinching glove cuff and pull toward finger tips.
2. Using partially gloved hand gab the cuff of the opposite glove.
3. Pull away with both hands, turning them inside out as you pull.
4. Discard the gloves in garbage container.
5. Turn on water and thoroughly wet hands, remove any jewelry.
6. Apply soap and rub hands together for 20-30 seconds, cleaning between fingers, under nails and arms up to the elbow.
7. Rinse thoroughly under running water. Keep hands pointed downward to allow contaminated water into the sink, not up your arms.
8. Dry with a clean paper towel.
9. Disinfect hands with hand sanitizer.

Personal protective equipment (PPE)

Protects us from exposure to hazards at the farm

Personal protective equipment (PPE) help us avoid exposure to germs while working at the farm.

Personal protective equipment works when:

- It's the correct equipment for the job
- It's clean
- It's in good working condition.
- It's worn

If your personal protective equipment is no longer working or if you do not have the personal protective equipment you need for your job, talk to your supervisor. Note that the use of masks and other types of respirators requires that workers be okayed by a doctor, fit-tested, and trained.

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

Zoonotic Diseases

Diseases that can spread from animals to people

The same actions that can help prevent exposure to germs that cause diseases will also help to prevent exposure to zoonotic diseases. **Zoonotic diseases are diseases that can spread from animals to people.**

Farm workers, have a high risk of getting sick from a zoonotic disease or spreading zoonotic diseases because they are working with and have direct contact with animals as a part of their job for many hours each day.

Some of these diseases are a threat to public health and some can be especially harmful to children, older people, and pregnant women. If a farm worker thinks they are sick with a zoonotic disease they should make an appointment to be seen by a health care provider.

"According to the World Health Organization, more than half of all human pathogens are zoonotic and have represented nearly all of the emerging pathogens during the past decade"

Don't drink raw milk!

The pasteurization process destroys disease-causing organisms in milk by rapidly heating and then cooling the milk.

Common zoonotic diseases

Ringworm is a fungus that spreads by direct skin contact with an infected animal. It can also be transmitted from person to person or from contaminated objects to a person. Ringworm is an itchy rash that can appear anywhere on the body. It is easily treated, but needs medical attention.

E. coli diarrheal infection is caused by a bacteria that spreads through manure. There are different types of E. coli, but all can enter the body through the mouth by contaminated hands, food, and water.

Salmonella infection is also can be spread through manure from infected animals. The many types of Salmonella bacteria enter the body through the mouth. Symptoms include diarrhea, fever, and abdominal cramps.

Bovine tuberculosis in Wisconsin

In September 2018, a dairy farm in Wisconsin had 12 milking cows that tested positive for Bovine tuberculosis (*Mycobacterium bovis).* The infected animals had to be euthanized. Fortunately, no people on the farm were infected in this outbreak, but infection of workers and other have occurred from this bacteria in the past.

If a person is infected with this bacteria, it causes a disease that will affect the lungs, lymph nodes, and other parts of the body. **People are most commonly infected with Bovine tuberculosis by eating or drinking unpasteurized dairy products.** An infected person can then transmit the disease to another person.

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

Did you wash your hands well?

Let's prove it!

Hand Washing Activity

This activity allows participants to evaluate the effectiveness of their hand washing technique and adopt appropriate hand washing technique.

Materials

- 1 bottle of Glo Germ™ gel
- 1 UV light
- Access to a sink, soap, and paper towels
- Access to a dark room

Instructions

1. Apply a pea size drop of Glo Germ™ gel to the hands of 3/4 of the participants.
2. Ask participants that did not get Glo Germ™ gel to shake hands with participants with Glo Germ™ gel on their hands and have them pass objects between themselves.
3. Send participants to wash their hands as they usually do.
4. Examine students' hands with UV light in a dark evaluate their handwashing.
5. Discuss how bacteria and viruses can spread from person to person and by touching a contaminated object or surface.
6. Watch handwashing video and highlight steps.
7. Practice handwashing steps in the room.
8. Send participants to wash their hands again and evaluate using UV light.

Discussion questions

- In what areas did you still find "germs" still after washing your hands?
- How clean were your hands after following the hand washing procedure?
- Did you contaminate other people's hands, objects or surfaces?
- What areas are important to wash while washing hands?
- What can you do to avoid spreading germs or getting exposed to germs?
- When working at the farm, when will you wash your hands using the handwashing techniques learned?
- When will you wash your hands at home or in other areas outside of work?

Photo: Hands exposed to UV light after inefficient hand washing, showing areas where potential germs can be present.

One trillion reasons to Wash your hands

Did you know that 1 gram of human feces, which is about the weight of a clip, can contain one trillion germs?

Imagine how many germs you are touching when you flush the toilet.

That's over one trillion reasons to wash your hands!

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

Would you leave your face half shaved?

So why would you stop taking your antibiotics half way?

Even when you feel better

Take the full dose for the full length of the treatment.

Help stop the spread of antibiotic resistant bacteria.

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

Help stop the spread of disease causing germs at the farm

Safety & Health Management Checklist

- ✓ Hand washing station close to eating area with warm water, soap, clean paper towels and hand sanitizer
- ✓ Person in-charge to monitor and restock hand wash station supplies
- ✓ Designated eating area with cleaning supplies (spray and paper towel) to clean tables
- ✓ Refrigerator designated to only store food (no medications, samples, etc.)
- ✓ Laundry area to wash work clothes with laundry instructions
- ✓ Designated storage area for work clothes and shoes
- ✓ Available personal protective equipment
- ✓ Yearly training and for new employees on exposure to disease causing germs; prevention of zoonotic diseases; and ways to reducer antibiotic resistance risk

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.

This document was developed by University of Wisconsin-Madison:

Dr. John Shutske, Elsie Gonzalez-Leach, Danielle Veeser, Olivia Chao, and Emily Diaz Vallejo

References & Additional Resources

AgriSafe Network. (2022). Zoonotic disease in agriculture. Retrieved April 16, 2023, from https://www.agrisafe.org/resource/zoonotic-disease-in-agriculture/

Ayim-Akonor, M., Krumkamp, R., May, J., & Mertens, E. (2020). Understanding attitude, practices and knowledge of zoonotic infectious disease risks among poultry farmers in Ghana. Veterinary medicine and science, 6(3), 631-638. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7397889/

Centers for Disease Control and Prevention. (2021). National infection & death estimates for antimicrobial resistance. Retrieved May 9, 2023, from https://www.cdc.gov/drugresistance/national-estimates.html

Centers for Disease Control and Prevention. (2021). Show me the science – how to wash your hands. Retrieved May 10, 2023, from https://www.cdc.gov/handwashing/show-me-the-science-handwashing.html

Centers for Disease Control and Prevention. (2018). Multistate outbreak of multidrug-resistant salmonella heidelberg infections linked to contact with dairy calves (final update). Retrieved April 19, 2023, from https://www.cdc.gov/salmonella/heidelberg-11-16/index.html

Centers for Disease Control and Prevention. (2022). About antimicrobial resistance. Retrieved May 10, 2023, from https://www.cdc.gov/drugresistance/about.html

Centers for Disease Control and Prevention. (2021). Five things to know. Retrieved May 9, 2023, from https://www.cdc.gov/drugresistance/about/5-things-to-know.html

Centers for Disease Control and Prevention. (2013). 1,000,000,000,000 germs can live in one gram of poop (That's the weight of a paper clip!). Retrieved May 10, 2023, from https://www.cdc.gov/handwashing/pdf/one-trillion-germs_508_8x11.pdf

Kates, A.E., Knobloch, M.J., Konkel, A., Young, A., Steinberger, A., Shutske, J., Ruegg, P.L., Sethi, A.K., Goldberg, T., Leite de Campos, J. and Suen, G. (2021). Wisconsin dairy farm worker perceptions and practices related to antibiotic use, resistance, and infection prevention using a systems engineering framework. Plos one, 16(12), p.e0258290.

Konkel, A., Kates, A., Knobloch, M.J., Safdar, N., Byrs, N., Steinberger, A., Young, A., Shutske, J., Ruegg, P., Sethi, A. and Goldberg, T. (2020). One health: farmworker perceptions of antibiotic resistance and personal protective practices on Wisconsin dairy farms. Infection control & hospital epidemiology, 41(S1), pp.s448-s449.

Pittet, D., Allegranzi, B., Boyce, J. (2009). The World Health Organization guidelines on hand hygiene in health care and their consensus recommendations. Infection Control & Hospital Epidemiology, 30(7), 611-622.

Quadri, N. S., Brihn, A., Shah, J. A., & Kirsch, J. D. (2021). Bovine tuberculosis: A re-emerging zoonotic infection. Journal of agromedicine, 26(3), 334-339.

Richardson, L. A. (2017). Understanding and overcoming antibiotic resistance. PLoS biology, 15(8), e2003775.

Ruegg, P. L. (2003). Practical food safety interventions for dairy production. Journal of dairy science, 86, E1-E9.

U.S. Food and Drug Administration. (2016). Battle of the Bugs: Fighting Antibiotic Resistance. Retrieved May 10, 2023, from https://www.fda.gov/drugs/information-consumers-and-patients-drugs/battle-bugs-fighting-antibiotic-resistance

Wisconsin Department of Health Services. (2018). Biosafety recommendations for individuals handling carcasses from animals known or suspected to have tuberculosis. Retrieved May 10, 2023, from https://www.dhs.wisconsin.gov/publications/p02295.pdf

University of Wisconsin–Madison. For more information, contact shutske@wisc.edu or https://topmilk.msu.edu/Antibiotic-Stewardship-Program
Materials developed with funding from USDA-NIFA Food Safety Challenge Grant 2017-68003-26500. An EEO/Affirmative Action employer, University of Wisconsin-Madison provides equal opportunities in employment and programming, including Title IX and ADA requirements. This document can be provided in an alternative format or language upon request. Created April 2023.