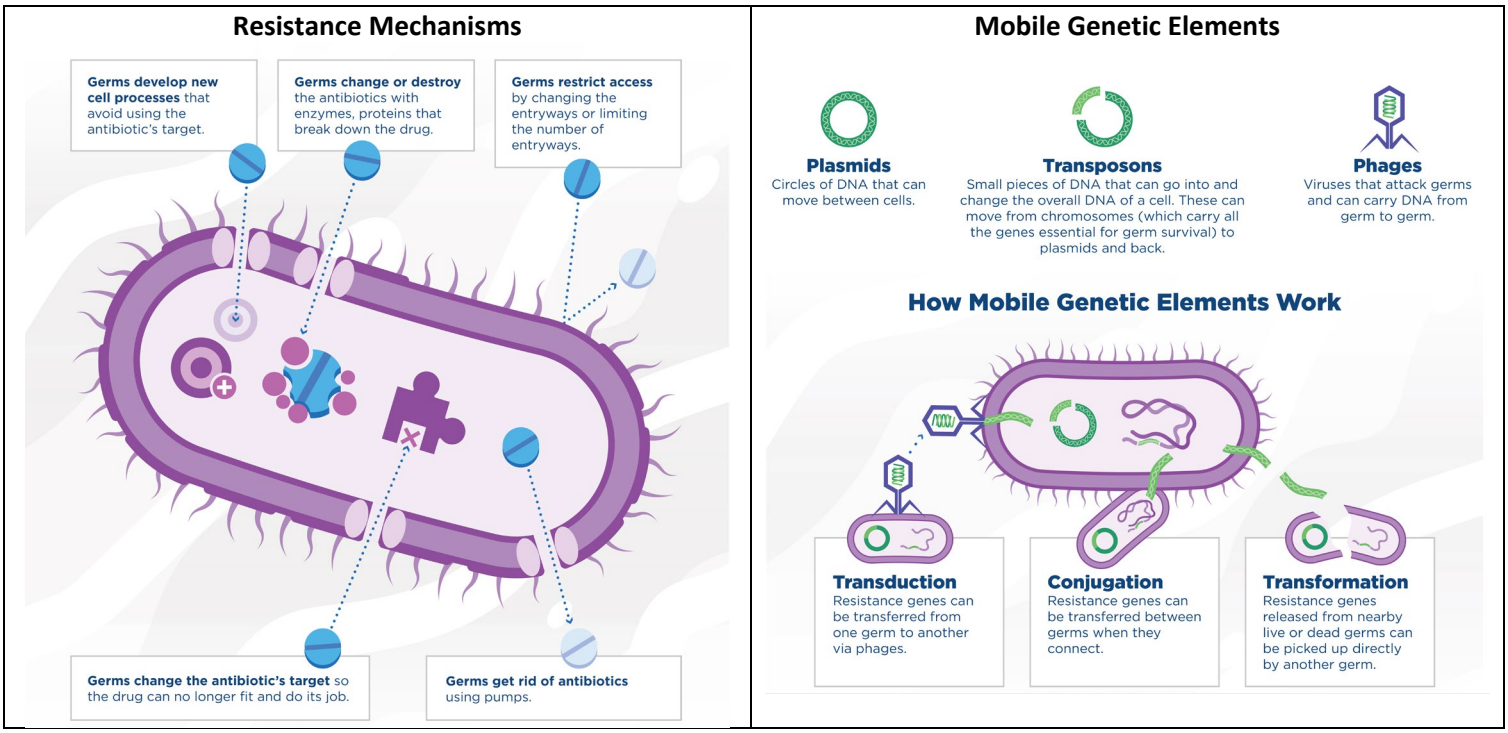
Report to the Boards of Health
Jennifer Morse, MD, MPH, FAAFP, Medical Director

Mid-Michigan District Health Department, Wednesday, March 22, 2023
Central Michigan District Health Department, Wednesday, March 22, 2023
District Health Department 10, Friday, March 31, 2023

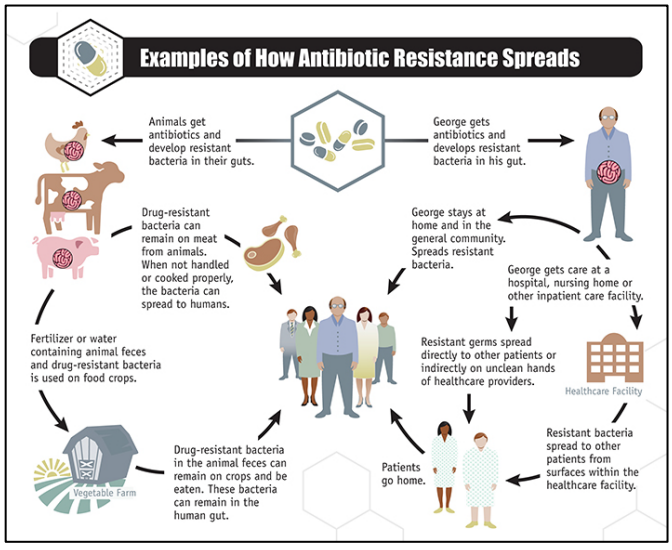
Antimicrobial Resistant Organisms

In 2019, at least 1.27 million people died worldwide due to antimicrobial resistant (AMR) bacteria and nearly 5 million more deaths were associated to infections with AMR bacteria. In the U.S., it is estimated that more than 2.8 million infections and more than 35,000 deaths occur each year to due AMR infections. These infections and deaths can happen to anyone and can be debilitating, as these patient stories reflect. Antimicrobial resistance is considered an urgent global public health threat.

Antimicrobial resistance happens when germs, like bacteria or fungi, develop ways to keep medicines from working against them. Germs use different resistance mechanisms to do this. These mechanisms can be passed to the next generation of the same germ, and they can also pass to other germs by ways called mobile genetic elements. The resistance mechanisms and mobile genetic elements are illustrated below.



All germs, including AMR germs, can spread between people, between people and animals, and from people and animals to the environment. The environment includes water, soil, food, hospitals and other buildings, medical equipment, cars, airplanes, and so on. This is how antimicrobial resistance in one person or one animal can spread to many others and eventually spread around the world.



There has recently been news about an increase in XDR (extensively drug resistant) *Shigella. Shigella* is a very contagious bacteria that causes shigellosis, an inflammatory type of diarrhea. It is spread from the stool or soiled fingers of one person to the mouth of another person, and is known to cause outbreaks in day cares, through food preparation,

and during sexual encounters. This germ had been gaining resistance to the most common antibiotics used against it. More recently, increasing number of *Shigella* germs have been found that are resistant to all the commonly used and alternative antibiotics available including ampicillin, azithromycin, ciprofloxacin, trimethoprim-sulfamethoxazole, and ceftriaxone, making it XDR. Last year 5% of all *Shigella* cases in the U.S. were XDR, compared to 0% in 2015.

Shigella is only one of the AMR organisms causing high levels of concern. The CDC reported 16 antibiotic resistance organisms that were of urgent or serious public health threat in 2019, which are listed below. The COVID-19 pandemic did cause setbacks in efforts against antibiotic resistance. Due to interruptions in and shifting of healthcare resources, it is likely many infections were not diagnosed and reporting of antimicrobial resistant infections slowed. There was also an increased use of antibiotics during the pandemic due to confusion of COVID-19 symptoms with bacterial infections. The stress to the healthcare system during the pandemic also caused slips in some infection prevention and control practices in healthcare facilities.

Bacteria and Fungi Listed in the 2019 AR Threats Report

(% increase from 2019 to 2020 or if data is delayed due to pandemic)

Urgent Threats

1. Carbapenem-resistant *Acinetobacter* (+78%)
2. Antifungal-resistant *Candida auris* *(+60%)*
3. *Clostridioides difficile* (delay)
4. Carbapenem-resistant Enterobacterales (+35%)
5. Drug-resistant *Neisseria gonorrhoeae* (delay)

Serious Threats

1. Drug-resistant *Campylobacter* (delay)
2. Drug-resistant *Candida* (+26%)
3. Extended-spectrum β-lactamase (ESBL)-producing Enterobacterales (+32%)
4. Vancomycin-resistant *Enterococci* (VRE) (+14%)
5. Multidrug-resistant *Pseudomonas aeruginosa* (+32%)
6. Drug-resistant nontyphoidal *Salmonella* (delay)
7. Drug-resistant *Salmonella* serotype Typhi (delay)
8. Drug-resistant *Shigella* (delay)
9. Methicillin-resistant *Staphylococcus aureus* (MRSA) (+13%)
10. Drug-resistant *Streptococcus pneumoniae* (delay)
11. Drug-resistant Tuberculosis

Concerning Threats

1. Erythromycin-Resistant Group A *Streptococcus* (delay)
2. Clindamycin-resistant Group B *Streptococcus* (delay)

Watch List

1. Azole-resistant *Aspergillus fumigatus*
2. Drug-resistant *Mycoplasma genitalium*
3. Drug-resistant *Bordetella pertussis*

There is action taking place to fight against antibiotic resistance and things we can all do to help.

1. Prevent infections from happening.
    - Take proper care of cuts and scrapes, and care for your health conditions that may increase your risk for infections.
    - Wash your hands properly.
    - Get vaccinated.
    - Only use antibiotics and antifungals when they are truly needed and use them properly.
    - Use safe habits around pets and animals.
    - Follow safe food preparation recommendations.
    - Take care when traveling by checking travel health alerts, having safe food and drinks, and having plans in case you do get ill.
    - Take steps to prevent STIs.
    - Livestock and poultry producers should implement biosecurity practices to prevent the introduction and spread of disease to their animals.
2. Improve antibiotic and antifungal use.

- Healthcare providers, dentists, and veterinarians should follow clinical and treatment guidelines for diagnosis and treatment of infections.
- Livestock and poultry producers should communicate with their veterinarian regarding antibiotic and antifungal use.
- Healthcare providers should know the resistance patterns for common infections in their community.

3. Stop the spread of resistance when it does occur.
   - Follow infection prevention and control guidelines for your setting.
     - https://infectionpreventionandyou.org/infection-prevention-basics/
     - https://www.cdc.gov/infectioncontrol/index.html
     - https://www.cdc.gov/infectioncontrol/projectfirstline/index.html

Antimicrobial resistance tends to develop quickly after a new class of drug is developed. Due to the difficulty finding effective drugs, the short course an antimicrobial is prescribed, the lower price typically charged for an antimicrobial, and recommendations to only use antimicrobials sparingly, there is little motivation for pharmaceutical companies to invest in research and development of new antimicrobials. Over the past decade, there has been much more support of the research and development of antimicrobials worldwide by several government and non-government organizations. An excellent review of these developments can be found here. Research is also exploring non-antimicrobial options to treat and prevent infections. Improvements have also been made in testing available to differentiate viral from bacterial infections and quickly identify antimicrobial resistance in organisms.

Additional Resources

- The Michigan Antibiotic Resistance Reduction Coalition (MARR) https://www.mi-marr.org/
- Guide to Wise Use of Antibiotics https://dobugsneeddrugs.org/guide-to-wise-use-of-antibiotics/
- Patient Stories: The Faces of Antimicrobial Resistance https://www.idsociety.org/public-health/patient-stories/patient-stories/
- Be Antibiotics Aware https://www.cdc.gov/antibiotic-use/index.html
- CIDRAP-ASP Communication Toolkit https://drive.google.com/drive/folders/1-MvEgQXY38iLVr10J0LmIpue0TvYIsCV?usp=sharing
- Infection Prevention and You https://infectionpreventionandyou.org/

Recommendations:

1. Take steps to prevent infections in yourself and those around you.
2. Before taking an antibiotic, ask if it is really necessary and the most appropriate one for your infection. If it is, take all of it as prescribed.
3. Support efforts to combat antimicrobial resistance.

Sources

- Murray, Christopher JL, et al. "Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis." The Lancet 399.10325 (2022): 629-655. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02724-0/fulltext#seccestitle190
- CDC. 2021. Antimicrobial Resistance. National Infection & Death Estimates for Antimicrobial Resistance. https://www.cdc.gov/drugresistance/national-estimates.html
- CDC. 2023. Increase in Extensively Drug-Resistant Shigellosis in the United States. https://emergency.cdc.gov/han/2023/han00486.asp
- CDC. 2022. COVID-19 and Antimicrobial Resistance. https://www.cdc.gov/drugresistance/covid19.html#anchor_1656421934582
- Biomerieux. A lack of new antibiotics. https://amr.biomerieux.com/en/challenges/a-lack-of-antibiotics/
- Wasan, Himika, et al. "Landscape of Push Funding in Antibiotic Research: Current Status and Way Forward." Biology 12.1 (2023): 101. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9855914/