pennsylvania
DEPARTMENT OF HEALTH

FREQUENTLY ASKED QUESTIONS: MCR-1

What is *mcr-1*?

In November 2015, scientists in China detected bacteria resistant to the antibiotic colistin. Typically saved as a drug of last resort, colistin is used to treat bacteria that is already resistant to other antibiotics.

The scientists' findings are especially important for two reasons. First, they found these resistant bacteria in multiple samples including pigs, pork and humans in China. Second, they found that the resistance gene, called *mcr-1*, was coded on an extra loop of DNA, called a plasmid.

Sometimes we talk about bacteria "carrying" genes. In this case, it's not just a turn of phrase because these bacteria quite literally carry these plasmids and resistance genes as transferable elements next to the bacteria's core DNA. Since one bacterium can share resistance genes coded on plasmids with another bacterium, the concern is that we may soon be facing a super bug that contains a dangerous combination of genes – a combination that allows it to become immune to all currently approved antibiotics.

Following the revelation in China, scientists across the globe began searching for other bacteria containing the MCR-1 gene. The bacteria were subsequently discovered in samples from Europe and Canada and, most recently, the United States.

Has *mcr-1* been found in the United States?

Yes. Since it was first reported in China, scientists have implemented special screening programs to actively look for *mcr-1*. On May 26, 2016, it was announced that two different groups of scientists detected the first cases of *Escherichia coli* (*E. coli*) bacteria containing the *mcr-1* gene in the United States.

The National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS) is a highly successful 20-year partnership between the Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture, as well as state and local departments of health, to detect and track antimicrobial resistance in foodborne and other enteric bacteria in humans, retail meat and food animals.

NARMS scientists have, to date, tested tens of thousands of animal, meat and human specimens. Last week, NARMS scientists announced finding the first colistin-resistant *mcr-1 E. coli* in a food animal in the United States.

Also last week, the U.S. Department of Defense (DOD) notified stakeholders that its Multidrug-resistant Organism Repository and Surveillance Network (MRSN) at the Walter Reed Institute of Research had identified the first colistin-resistant *mcr-1 E. coli* in a person in the United States.

There is no known connection between these two occurrences. The DOD testing identified the *mcr-1* gene in bacteria cultured from a Pennsylvania resident. Scientists from USDA's Agricultural Research Service found the *mcr-1* gene in the intestines of a pig slaughtered in another state.

Can you provide information on the Pennsylvanian with *mcr-1*?

No, the department cannot discuss specific details of individual investigations because of Pennsylvania's Disease Prevention and Control Law. Under this law, the department is charged with protecting a patient's privacy. As such, the department cannot divulge specific information related to the individual.

While it's understandable to want to focus on the individual, the key development here is the discovery of a dangerous gene (*mcr-1*) that can transfer to other bacteria and make them resistant as well.

What is the relationship between antibiotic resistant bacteria and health care-associated infections?

Health care-associated infections (HAIs) and antibiotic resistant organisms are intertwined issues. Resistant bacteria can be spread in health care settings, when patients are most vulnerable. Three critical efforts to prevent an HAI are:

1) Prevent infections related to surgery or placement of a catheter;
2) Prevent spread of bacteria between patients;, and
3) Improve antibiotic use.

Infection control in health care must be perfect for every patient every time. Antibiotics are a precious commodity and we need to be sure that doctors are using the right drug for the right bug for the right amount of time. This will slow the evolutionary march of antibiotic resistance and hopefully give our scientists time to develop new antibiotics.

Is *mcr-1* contagious?

Unfortunately, the health care community already has a lot of experience working with, and preventing transmission of, antibiotic resistant organisms. Although the discovery of the *mcr-1* gene is concerning, fundamental infection control principles still apply. This means health care providers and family members can do simple things when caring for patients with any resistant organism – like washing hands and using alcohol-based hand gels. Care providers should wear medical gloves if they will be coming into contact with blood or body fluids. A good rule of thumb is if it's wet and not yours, don't touch it with your bare hands. These tried and true principles of infection control work.

After finding *mcr-1* in a pig, is it safe to eat meat?

First and foremost, it is important to know that cooking meat to the proper internal temperature kills bacteria whether or not they are carrying the *mcr-1* gene. Handling, preparing and storing food correctly are essential in preventing any type of foodborne illness.

The findings so far indicate that the colistin *resistant mcr-1* gene is rare in the U.S. Scientists found the *mcr-1* gene in one pig sample among 949 samples tested from food animals and more than 50,000 samples tested from retail meats and ill people. There is also no direct connection between the discovery in pigs and humans.

Currently, it's not possible to determine how colistin resistance developed in the pig. Resistance can develop naturally without an organism ever coming into contact with an antibiotic, and it can also develop through overuse of an antibiotic. Resistant bacteria can also be transferred from one source to another (for example, soil, water, feed, wildlife and insects).

What is the Pennsylvania Department of Health doing in response to the confirmed case of *mcr-1* in the commonwealth?

The department is working very closely with the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Defense on a coordinated investigation into this *mcr-1* case.

The department is not permitted to discuss specific details of individual investigations because of Pennsylvania's Disease Prevention and Control Law. Generally, when the department conducts an investigation, we may do the following:

- Verify the diagnosis;
- Conduct active case finding, or surveillance – this typically involves interviews, medical record review and collection of specimens for laboratory testing;
- Trace leads to and from the index patient to better understand how the infection is spreading so that we can implement prevention and control measures; and
- Work with local, federal and other state agencies to assess, prevent and control the spread of disease.

Why is MCR-1 considered a serious public health issue?

Although very concerning, the discovery of the MCR-1 gene is not entirely unexpected. The eventual identification of an organism with this resistance mechanism in a U.S. patient has been expected since they were first described in 2015. It is also likely that more will be identified over time. If provided the opportunity to spread further, these organisms can limit the available options for treating infections caused by highly-resistant bacteria.

The MCR-1 gene exists on a plasmid, a small piece of DNA that is not a part of a bacterium's chromosome. Plasmids are capable of moving from one bacterium to another, spreading antibiotic resistance between bacterial species.

The two detections of the MCR-1 gene in the U.S. provide a new clue into the antibiotic resistance landscape, and also highlights how much we still do not understand. Colistin is rarely used in human medicine compared to other antibiotics. It is often used to treat multi-drug resistant infections and its use is increasing. It is not used in animals in this country. As such, the new detection underscores the urgent need for more research in this area.

Where can I get more information?

Proactive Efforts by U.S. Federal Agencies Enable Early Detection of New Antibiotic Resistance: http://www.hhs.gov/blog/2016/05/26/early-detection-new-antibiotic-resistance.html

The National Antimicrobial Resistance Monitoring System (NARMS): www.cdc.gov/narms/

The United States Department of Agriculture (USDA) - food safety information:
http://www.fsis.usda.gov/wps/wcm/connect/625d9435-4f14-46fe-b207-5d6688cb4db5/Safe_Miminum_Internal_Temperature_Chart.pdf?MOD=AJPERES
CDC Antibiotic Resistance website: www.cdc.gov/drugresistance

CDC's Antibiotic Resistance and Food Safety website:
http://www.cdc.gov/foodsafety/challenges/antibiotic-resistance.html

CDC's Antibiotic Resistance Threats Report and Foodborne Germs website:
http://www.cdc.gov/narms/resources/threats.html