

MERS Transmission

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hi, I'm Sarah Gregory, and today I'm talking with Dr. Marie Killerby, an epidemiologist at CDC. We'll be discussing how Middle East Respiratory Syndrome, or MERS, can be transmitted from camels and between people.

Welcome, Dr. Killerby!

[Marie Killerby] Hi! Thanks very much for having me.

[Sarah Gregory] So, let's start off with what is MERS?

[Marie Killerby] So, MERS stands for Middle East Respiratory Syndrome, which is a viral respiratory illness in humans caused by MERS coronavirus. The illness MERS can be mild or severe and symptoms can include fever, cough, shortness of breath. And MERS was first reported in Saudi Arabia in 2012 and has since been reported in several other countries too.

[Sarah Gregory] Is it related to SARS-CoV-2?

[Marie Killerby] So, MERS coronavirus is related to SARS coronavirus 2 in that they're both Betacoronaviruses. There are four main groups of coronaviruses—there's Alpha, Beta, Gamma, and Delta. And there are many other Betacoronaviruses, including lots found in other animals, such as cattle, horses, pigs, and mice. And there are also two other Betacoronaviruses found in humans that cause symptoms similar to the common cold.

[Sarah Gregory] Okay, so it was first detected in 2012. How many people have had it and how many people have died from it?

[Marie Killerby] So, since it was first reported, there's been reports of over 2,400 people with MERS and over 800 of these people have died. Which means about 3 to 4 of every 10 people infected with MERS have...reported with MERS, sorry...have died.

[Sarah Gregory] So, are all these cases you mentioned sporadic? Or have there been actual outbreaks like this pandemic we're having now.

[Marie Killerby] So, some of the cases are sporadic, and we consider the cases sporadic when the virus is transmitted from a camel to a person, which has occurred multiple times. We also see outbreaks when the virus spreads among people in close contact. So these can occur, for example, in healthcare facilities. And one of the largest outbreaks of MERS occurred in South Korea in 2015 when one infected traveler from the Middle East caused a large outbreak of 186 cases.

[Sarah Gregory] What are the symptoms of MERS?

[Marie Killerby] So, the symptoms of MERS can range from very mild or almost no symptoms, or mild symptoms like the common cold, to severe respiratory illness with symptoms such as fever, cough, and shortness of breath. And people have also had diarrhea and vomiting, and then severe complications can occur such as pneumonia and kidney failure, and again can be severe, including death.

[Sarah Gregory] So, somewhat similar to what's going on with coronavirus COVID-19 right now.

[Marie Killerby] Somewhat similar, yes. We have seen a higher proportion of fatalities with MERS, but a much smaller number of people with MERS.

[Sarah Gregory] Okay, so do we know why MERS has not become as highly contagious as SARS-2 has?

[Marie Killerby] Well, there could be many reasons. While they are both coronaviruses, there are differences between the two and they do have different genetic codes. For example, the type of receptor MERS uses to bind on the cells and enter the human body is a different receptor than the one SARS coronavirus 2 uses. So, this and many other differences in the viruses' genetic code can add up to differences in how the two viruses spread among people. And then there's still a lot of research going on to understand just what makes SARS coronavirus 2—the virus causing COVID-19—so contagious.

[Sarah Gregory] How does a virus like this begin in camels, or in any other animal for that matter, and what happens to make it contagious to people?

[Marie Killerby] So, there are many, many viruses that exist out there, both in domestic and wild animals around the world. Some of these, like MERS, already exist in animals, like MERS exists in camels, where it causes little to no symptoms, and MERS can already transmit from animals to people. There are other viruses out there that may exist in animals that can't readily spread to people, but a change in the virus's genetic code, known as mutation, can then give the ability to spread from an animal to a person.

[Sarah Gregory] So, we know camels are the main host. Do any other animals carry it? And do those animals spread it to people?

[Marie Killerby] So, there's some data out there to show, for example, that alpacas, who are close relatives of camels, are infected with it in areas where MERS is also existing in camels. And there's even also been limited evidence to show that MERS coronavirus can infect a few other animals. For example, it's been found in a very small number of sheep, goats, and donkeys, and they found it in one cow. However, other studies have looked for MERS coronavirus in these animals and haven't shown any evidence of it. But it's thought to be very limited if it does infect other animals, and it's not thought that any other animals, apart from the dromedary camel—or the one-humped camel—have a major role in the spread of MERS coronavirus to people.

[Sarah Gregory] Okay, help me understand this a little more. It's not very contagious and it's pretty limited in the animals that it's found in, so how is it spreading?

[Marie Killerby] So, it is widespread in the dromedary camel. That means it's found quite often in these camels, and at least up to over 90% of camels in most places have antibodies which show they've previously been infected with MERS. So, it's thought to be relatively widespread in the dromedary camel in these areas, and people who then come into close contact with these camels, it's thought that the virus can then spread from camels to people who are in close contact.

[Sarah Gregory] But, it was already in camels and just not detected until 2012? Or somehow that was when it first got into camels?

[Marie Killerby] So, there's actually....there's been some evidence where people have gone back and looked at a lot of camels from a long time ago, even back in the 1980s, and looked for

antibodies for this virus back then. So, it's thought that this MERS coronavirus has existed in camels for much longer than we have seen it in people. We first saw evidence of this virus in humans in 2012. It's not sure if any other sporadic infections could have happened before then that we just may not have known about.

[Sarah Gregory] In person to person transmission, are healthcare workers more vulnerable, as they are in the current SARS-CoV-2 pandemic?

[Marie Killerby] So, certainly healthcare workers can be more vulnerable to MERS coronavirus infection as the people that are more likely to come in contact with a sick person with MERS when they come into a hospital, or even another outpatient setting. So, the most important way to prevent healthcare workers from getting infected with MERS coronavirus is to make sure these MERS cases are recognized early on as soon as they come into either a hospital or another healthcare setting, and to make sure healthcare workers act appropriately by using recommended infection control, particularly such as isolating the patient and wearing proper personal protective equipment.

[Sarah Gregory] So, right now we're in the middle of this COVID pandemic. Will people even be looking for MERS? I'm just wondering as it will kind of get ignored or misdiagnosed at this point.

[Marie Killerby] So, certainly the concern with MERS is very limited from this camel to human transmission in these particular folks in the Middle East, and people should ask about exposure to camels when they do seek care in the healthcare setting. And they should be looking for the symptoms, which are similar to the symptoms of SARS coronavirus 2 in some circumstances, but certainly people should be aware. If anything, they should be hyperaware of anybody coming in with these respiratory symptoms. So, if you are making sure people are isolated and wearing proper personal protective equipment for anyone with respiratory illness, as you would be expected to be at this time, I think the few MERS cases that crop up should also be covered by people taking precautions with anyone with respiratory illness at this time.

[Sarah Gregory] Is it seasonal like the flu? I mean, I know the flu does always stay around a little bit everywhere, but it's perceived as seasonal because it expands in certain seasons. Is that true for MERS or is it just kind of there?

[Marie Killerby] So, MERS is a little different from flu in that it often jumps from camels to people, still, rather than consistently spreading amongst people, but there is some limited evidence that MERS infections could occur more in camels during certain times of the year. So, different investigations have shown more camels infected with the virus during potentially spring or summer, and this could be because camel calves are typically born in winter and then it's thought they first become infected around six months old in the spring or summer. That said, we do find camels infected with the virus all year round in different investigations, but it's thought that people could become infected from camels at any point in the year. So, there's still more investigation needed to be done into the seasonal nature of MERS.

[Sarah Gregory] Are there geographic locations of MERS in camels and in people if they're not the same?

[Marie Killerby] Yes. Unsurprisingly, given the name, we see most infections in the Middle East in humans and camels. The most human MERS cases have been seen in Saudi Arabia, and cases

have also been found in other countries in the Middle East, including United Arab Emirates, Jordan, and Qatar. And again, additionally this large number of cases was seen in the outbreak in South Korea in 2015. And it's important to note that all the human cases outside of the Middle East have actually had links back to people exposed in the Middle East originally. MERS coronavirus in camels is a little different, because we do detect it in camels also in Africa as well as in camels in the Middle East. And, this is quite interesting. We don't know for sure why we don't see so many humans with MERS in Africa and these places where MERS is circulating in camels. And it could be due to differences in the virus, it could be due to differences in the human population or the camel population, or even how humans interact with camels in these two different regions. So, there's still a lot to be learned in this area.

[Sarah Gregory] For now, anyway, they're saying we can't get SARS-CoV-2 from food...from eating food. What about MERS? Say, camel milk or meat—are there any recommendations? Or can we get it from those things?

[Marie Killerby] So, with MERS, there's no direct evidence to say that the virus is definitively spread from people via camel milk or camel meat. And it seems that the virus is much more likely to be spread from direct physical contact with camels. However, we're not 100 percent certain that the virus can't spread from milk and meat. And because there's certainly many other illnesses that can be transmitted from raw milk or raw camel meat, the CDC does recommend avoiding raw camel meat and raw or unpasteurized camel milk.

[Sarah Gregory] Has, has anyone ever gotten MERS from those camel rides at fairs?

[Marie Killerby] Certainly not in the U.S., and there's no evidence that any camels, for example, in the U.S. have MERS and we have very strict limits on where camels can be imported from. And as I mentioned, we have...we've only ever had two cases of MERS in the United States and both of these are in return travelers from the Middle East.

[Sarah Gregory] Okay. Apparently, about 14 percent of cases in people are from unknown sources. Are there any thoughts as to what might be the causes of these cases?

[Marie Killerby] Yes, and certainly with this 14 percent of people it just means people have had no direct exposure to camels or camel products or somebody they knew that had MERS. So, this...these are known causes. It could just be that these people did have contact with another person who had MERS, but they just didn't know about it. And if you think how many people you might interact with every day, it's certainly possible to come into contact with someone who is sick without you actually realizing. So, an alternative theory is they could have come into contact with the virus on the surface, for example, from a sick person's secretions or secretions from a camel. This is, however, considered less likely and there really isn't any strong evidence yet for this type of transmission.

[Sarah Gregory] You work at CDC, how are you involved in studying MERS, and tell us about your job?

[Marie Killerby] So, I first became in studying MERS as an Epidemic Intelligence Service officer, or "disease detective," working with the viral respiratory group. And I was involved in studying how MERS spreads from camels to humans and looking at some hospital outbreaks of MERS, and it was a fantastically interesting experience. I now still work at the CDC as an

epidemiologist with the Global Rapid Response Team, and I'm currently deployed for the COVID-19 response.

[Sarah Gregory] Have you traveled to the Middle East to investigate any of these MERS cases?

[Marie Killerby] I've traveled to the Middle East, I guess, two times to investigate MERS in a couple of different ways. And I traveled to the United Arab Emirates to study how MERS spreads from camels to humans in markets and slaughter houses. And I also got to travel to Saudi Arabia to investigate two different hospital outbreaks of MERS coronavirus that occurred at the same time.

[Sarah Gregory] So, this is a question that's on everybody's mind with each other, I think, right now. What are you doing to stay normal during these "stay-at-home" times?

[Marie Killerby] This is a tough one, and I think it's really important to recognize just how abnormal these times are for everybody right now. For me, I'm still incredibly busy with work, and, but that's...that's obviously a huge occupier of my time. But I also find time to connect with family and friends over text and video chat, and I'm a big fan of doing at-home yoga. And, I do like to acknowledge the few small advantages of this. One is that my dog is much happier now I'm working from home and I get to see her more.

[Sarah Gregory] I have two dogs sitting here with me as we talk, yes indeed.

Okay, well thank you so much for taking the time to talk with me today in the middle of your very busy world.

[Marie Killerby] Thank you!

[Sarah Gregory] And thanks for joining me out there. You can read the February 2020 article, Middle East Respiratory Syndrome Coronavirus Transmission, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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