

Investigation of First Identified *mcr-1* Gene in an Isolate from a U.S. Patient — Pennsylvania, 2016

Kelly E. Kline, MPH^{1,2}; Jordan Shover¹; Alexander J. Kallen, MD³; David R. Lonsway, MMSc³; Sharon Watkins, PhD¹; Jeffrey R. Miller, MD^{1,4}

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In 2015, scientists reported the emergence of the plasmid-encoded *mcr-1* gene conferring bacterial resistance to the antibiotic colistin (*I*), signaling potential emergence of a pandrug-resistant bacterium. In May 2016, *mcr-1*-positive *Escherichia coli* was first isolated from a specimen from a U.S. patient (2) when a Pennsylvania woman was evaluated for a urinary tract infection. The urine culture and subsequent testing identified the gene in an extended-spectrum beta-lactamase (ESBL)-producing *E. coli* with reduced susceptibility to colistin. The patient had no international travel for approximately 1 year, no livestock exposure, and a limited role in meal preparation with store-bought groceries; however, she had multiple and repeated admissions to four medical facilities during 2016.

In collaboration with CDC, the Pennsylvania Department of Health conducted an investigation to guide contact tracing and perirectal swab screening for bacteria with the *mcr-1* gene in the patient's household and in two facilities where she had frequent, extensive, and prolonged (≥ 7 days) interactions with health care personnel. Within these three high-risk locations, transmission risk was stratified into higher-risk and lower-risk categories based on the nature and duration of contact. Twenty persons at higher risk included the patient's medical facility roommate, household contacts, home health personnel, friends who assisted with activities of daily living such as cleaning, bathing, rotating, ambulating and toileting, and a patient who developed an *E. coli* infection after receiving direct care from a caregiver who also assisted the index patient. Persons at lower risk included 98 health care personnel from the two high-risk facilities who directly assisted with activities of daily living while generally adhering to contact precautions. All 20 higher-risk contacts completed screening; among the 98 lower-risk contacts, 78 agreed to testing.

To determine whether transmission was occurring between patients, the state health department offered to conduct point prevalence studies at the two high-risk facilities. One facility declined; the other offered testing to 18 patients residing in the same unit where the index patient had received care. Seven patients completed screening.

No bacteria with the *mcr-1* gene were detected among the 105 persons screened. In addition, no colistin-resistant organisms were detected among 51 ESBL-producing isolates prospectively collected over a 30-day period from the four facilities to which the index patient was admitted in 2016. These findings suggest that the risk for transmission from a colonized patient to otherwise healthy persons, including persons with substantial exposure to the patient, might be relatively low.

The index patient was screened monthly to monitor colonization status. Perirectal swabs collected on May 31 and June 26 were positive for bacteria with the *mcr-1* gene, but a swab collected on August 1 was negative. The patient received no antibiotics during this period, and there are no current recommendations to decolonize patients with Gram-negative bacteria in their gastrointestinal tracts.

It is not known how the patient became colonized, especially in the absence of an epidemiologic link to known persons or places with identified *mcr-1*. Nonetheless, as more surveillance systems with broader testing are established, it is anticipated that *mcr-1* will be identified with increasing frequency. In July, *mcr-1* in *E. coli* was identified from a patient specimen collected in New York in 2015 (3), and *mcr-2*, another colistin-resistance gene, was discovered in porcine and bovine *E. coli* isolates (4). The emergence of these novel resistance mechanisms highlights the urgency of a more global and comprehensive approach to antimicrobial stewardship and preventing transmission of antibiotic-resistant pathogens between persons and institutions. Health care personnel should immediately report colistin-resistant bacteria to their local health department. Health departments are encouraged to rapidly investigate reports of colistin-resistant bacteria to prevent transmission to other patients and thereby decrease the risk for transmitting plasmid-encoded genes to bacteria that might already contain other resistance genes. The Pennsylvania Department of Health's investigation suggests that focused screening of contacts at highest transmission risk can be recommended.

¹Pennsylvania Department of Health; ²CDC/CSTE Applied Epidemiology Fellowship Program; ³Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC; ⁴Career Epidemiology Field Officer Program, Division of State and Local Readiness, Office of Public Health Preparedness and Response, CDC.

Corresponding author: Kelly E. Kline, MPH, c-kekline@pa.gov, 717-787-3350.

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