U.S. Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

Weekly / Vol. 75 / No. 2

January 15, 2026

Notes from the Field

Retrospective Analysis of Wild-Type Measles Virus in Wastewater During a Measles Outbreak — Oregon, March 24–September 22, 2024

Rebecca Falender, DVM[1,*]; Melissa Sutton, MD[2,*]; Paul Cieslak, MD[2]; Juventila Liko, MD[2]; David Mickle[1]; Christine Kelly, PhD[1]; Tyler Radniecki, PhD[1]

In 2024, Oregon reported 31 measles cases in residents of three counties, the highest case count in Oregon since 1991. Thirty of these cases were associated with an outbreak in Clackamas and Marion counties, which included a close-knit community that did not readily seek health care; all cases occurred in unvaccinated persons. Illness onset for the person with the first confirmed case occurred on June 11, 2024, and the outbreak was declared over approximately 15 weeks later on September 26, a total of 42 days after illness onset in the last person with measles. Wastewater surveillance is a useful tool in the surveillance of emerging pathogens, including avian influenza A(H5) (*1*); however, wastewater surveillance for measles virus has not been well described in the context of clinical data. This retrospective study describes the detection of wild-type measles virus in wastewater samples collected during the 2024 measles outbreak.

Investigation and Outcomes

Data Collection

Oregon began wastewater surveillance for SARS-CoV-2 (the virus that causes COVID-19) in 2020. Routine wastewater surveillance now includes SARS-CoV-2, influenza, respiratory syncytial virus, influenza A(H5), and, since October 2025, wild-type measles virus. Unlike vaccine-derived measles virus, wild-type measles virus is transmitted from person to person and can cause outbreaks. Wastewater surveillance activities include collecting and archiving 24-hour composite samples from up to 40 wastewater treatment facility influents statewide once or twice weekly (*1*). To ascertain the presence of wild-type measles virus in wastewater in the outbreak-affected area, archived specimens collected during March 19–September 26, 2024, were retrospectively tested during July and August 2025 from four communities in the two counties with outbreak cases. The study period initially ranged from April 30 through September 26, which was two incubation periods (42 days) before illness onset for the first case through two incubation periods after onset for the last case. When wild-type measles virus was detected in samples from the first week of the study period (on May 5, 2024), the beginning of the study period was extended to include four incubation periods before illness onset for the first case (i.e., March 19–September 26) (*2*).

Processing of Samples

Filtered, preserved 24-hour composite wastewater influent samples were homogenized using bead-beating with 0.7-mm garnet beads to lyse the cells. Nucleic acids were extracted from 200–400 μl of the homogenate and analyzed for a wild-type–specific measles virus target using reverse transcription–digital polymerase chain reaction (RT-dPCR) (*1*,*3*). Detections were defined as samples with a viral concentration above the assay limit of detection, which was calculated based on the assay

* These authors contributed equally to this report.

INSIDE

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

limit of blank.[†] Data were analyzed in RStudio (version 4.3.1; RStudio, Inc.). This activity was reviewed by the Oregon Health Authority, deemed not research, and was conducted consistent with federal law.[§]

Detections of Wild-Type Measles Virus in Wastewater

Among 94 analyzed samples collected during March 19–September 26, 2024, a total of 20 (21.3%) tested positive for wild-type measles virus (Figure). The first detection of measles virus in wastewater was in a sample collected on April 3. Wastewater detections preceded reported cases by approximately 10 weeks. After scattered detections of measles virus at low concentrations (i.e., above the limit of detection but fewer than three positive dPCR partitions) in both counties, a period during which measles virus was detected at higher concentrations (i.e., above the limit of detection and three or more positive dPCR partitions) occurred during June 12–July 23, corresponding with the first reported clinical cases. The last sample in which measles virus was detected was collected on July 24. Overall, 11 (55%) of the 20 measles virus detections were in samples collected during the outbreak period. No virus was detected in wastewater during the last 9 weeks of the outbreak. After the last detection of wild-type measles virus in a wastewater sample, an additional eight cases were reported.

[†] A total of 40 no template control (NTC) samples were used to calculate the assay limit of blank (LOB). Assay LOB = (Average gene copies per μl of reaction of NTCs) + 1.654 × (Standard deviation of gene copies per μl of reaction of NTCs). Assay limit of detection (LOD) = Assay LOB × 3 × (Standard deviation of gene copies per μl of reaction of NTCs). Process LOD accounts for volume of wastewater filtered. Process LOD = Assay LOD × (μl of reaction/μl of template) × (μl of elution buffer eluted/μl of lysate used for extraction) × (μl of Zymo DNA/RNA Shield used to stabilize and lyse the sample/mL of wastewater filtered) × (1,000 mL of wastewater/1 L of wastewater).

[§] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

Preliminary Conclusions and Actions

Wastewater surveillance can provide an early warning signal for emerging pathogens, including measles, independent of health care–seeking behavior and access to testing (*1*). In this retrospective study, wastewater detection of wild-type measles virus preceded the first reported case by 10 weeks. A 6-week period of higher concentrations of measles virus in samples corresponded to the outbreak peak.

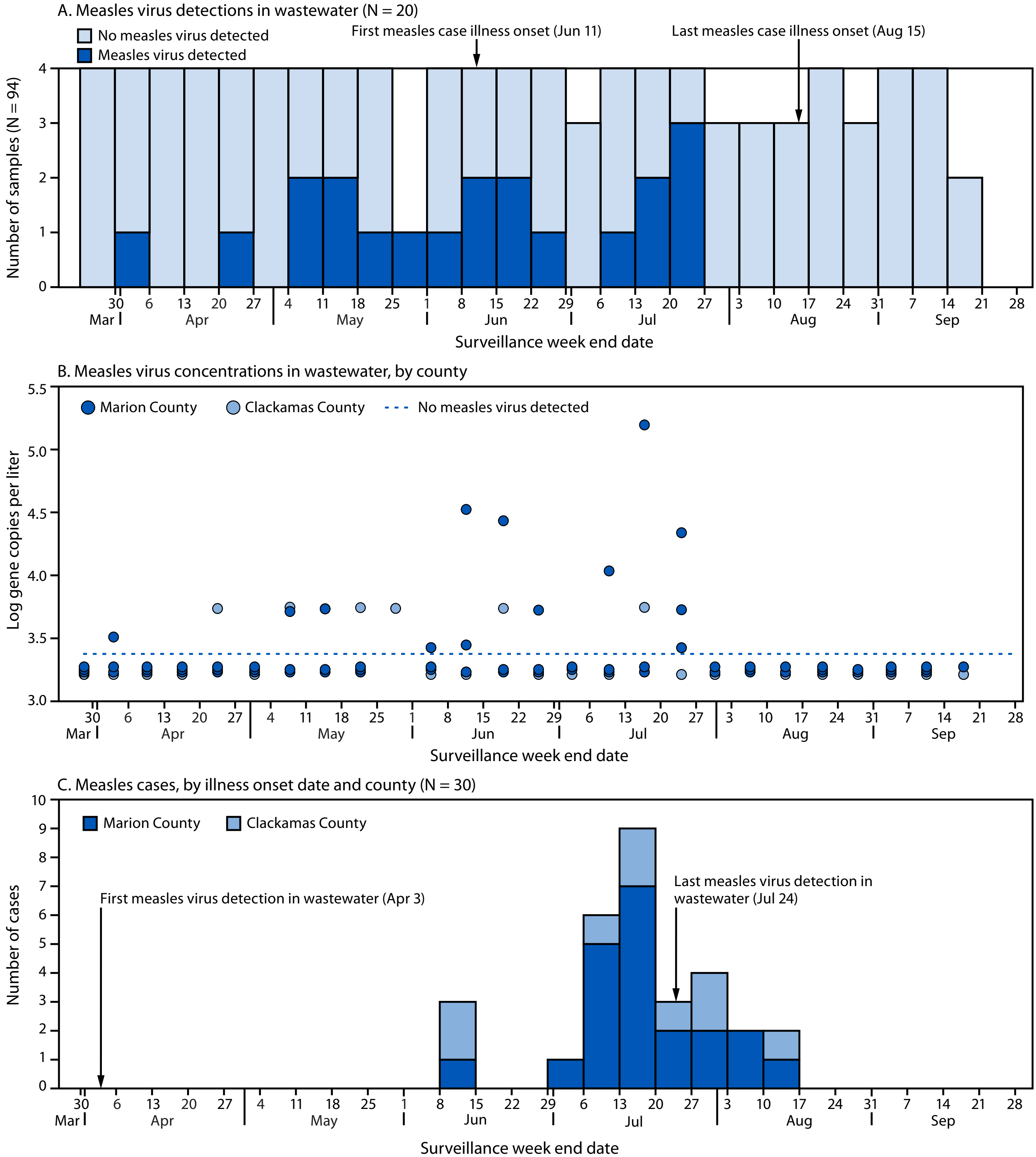
The findings in this study are subject to at least two limitations. First, because the measles viruses detected in the wastewater samples were not sequenced, whether all detections were epidemiologically linked to the outbreak is unknown. Second, the absence of measles virus detections in wastewater samples does not rule out the presence of measles in a community, as evidenced by identification of eight cases after the last wastewater sample tested positive for measles virus.

During 2025, the United States experienced the highest number of measles cases since elimination was declared in 2000. To prevent transmission, systems to rapidly identify, isolate, and investigate suspected measles cases, as well as high population immunity, are needed (*4*). This study highlights

The *MMWR* series of publications is published by the Office of Science, U.S. Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2026;75:[inclusive page numbers].

FIGURE. Wild-type measles virus detections (A) and concentrations* (B) in wastewater and confirmed and probable measles cases (C), by surveillance week end date — Clackamas and Marion counties, Oregon, March–September 2024



* Samples below the nondetection line were negative for measles virus. Jitter (slight displacement of data points from overlapping and obscuring one another) was applied to all nondetection and overlapping detection data points.

Summary

What is already known about this topic?

Wastewater surveillance can be used to monitor emerging pathogens, including wild-type measles virus.

What is added by this report?

During a June 11–September 26, 2024, measles outbreak in Oregon, which included a close-knit community that did not readily seek health care, a retrospective analysis of archived regional wastewater data collected during March 24–September 22, 2024, detected wild-type measles virus in 20 of 94 (21.3%) samples. The first detection of measles virus in wastewater was in a sample collected on April 3, 2024, which preceded the first confirmed measles case by 10 weeks.

What are the implications for public health practice?

Wastewater surveillance can provide an early warning of community measles circulation and can guide the public health response during outbreaks, including recommendations for vaccination.

the usefulness of wastewater surveillance as an early warning of measles in a community, with the potential to detect community transmission before the first cases have been identified. Wastewater surveillance can alert clinicians and the public to a current measles risk in the community, guide health care system screening procedures and testing practices, and direct important individual-level protective behaviors, including vaccination.

Acknowledgments

Staff members of Oregon's wastewater treatment facilities.

Corresponding author: Melissa Sutton, melissa.sutton@oha.oregon.gov.

[1]Oregon State University, Corvallis, Oregon; [2]Oregon Health Authority, Portland, Oregon.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Rebecca Falender, Christine Kelly, and Tyler Radniecki report institutional support from the Oregon Health Authority Wastewater Surveillance Program. Tyler Radniecki also reports receipt of grant support from the National Science Foundation, the Environmental Protection Agency, and the Oregon State University 2025 Transdisciplinary Research Seed Fund Program. No other potential conflicts of interest were disclosed.

References

1. Falender R, Radniecki TS, Kelly C, et al. Avian influenza A(H5) subtype in wastewater—Oregon, September 15, 2021–July 11, 2024. MMWR Morb Mortal Wkly Rep 2025;74:102–6. PMID:40014649 https://doi.org/10.15585/mmwr.mm7406a5
2. Committee on Infectious Diseases, American Academy of Pediatrics. Measles. In: Kimberlin DW, Banerjee R, Barnett ED, Lynfield R, Sawyer MH, eds. Red book: 2024–2027 report of the Committee on Infectious Diseases. Itasca, IL: American Academy of Pediatrics; 2024. https://doi.org/10.1542/9781610027373
3. Wu J, Wang MX, Kalvapalle P, et al. Multiplexed detection, partitioning, and persistence of wild-type and vaccine strains of measles, mumps, and rubella viruses in wastewater. Environ Sci Technol 2024;58:21930–41. PMID:39651927 https://doi.org/10.1021/acs.est.4c05344
4. Mathis AD, Raines K, Filardo TD, et al. Measles update—United States, January 1–April 17, 2025. MMWR Morb Mortal Wkly Rep 2025;74:232–8. PMID:40273019 https://doi.org/10.15585/mmwr.mm7414a1

Notes from the Field

Wastewater Surveillance for Measles Virus During a Measles Outbreak — Colorado, August 2025

Grace M. Jensen, MPH[1]; Cyrus Gidfar, MPH[1]; Kirsten Weisbeck, MPH[1]; Meghan Barnes, MSPH[1]; Erin Minnerath, MSPH[2]; Shannon Matzinger, PhD[1]; Allison Wheeler, MSPH[1]

Measles, a highly transmissible vaccine-preventable respiratory virus, can cause severe illness and result in hospitalization or death.* During March–July 2025, Colorado reported 16 confirmed measles cases while measles outbreaks were occurring in neighboring New Mexico, Texas, and Utah (*1*); the first five Colorado cases were confirmed by late April. Measles virus RNA shed in feces and urine can be detected in wastewater (*2*), and sequencing of the nucleoprotein gene can identify the wild-type measles lineage genotype. Detection of measles virus in wastewater can precede clinical case reporting (*3*), and evidence of the value of supplementing clinical case reporting with wastewater surveillance is growing (*4*). On May 1, wastewater surveillance testing for measles virus was implemented in Colorado. In early August, the Colorado Department of Public Health and Environment (CDPHE) identified measles virus in a wastewater sample from a Mesa County wastewater treatment plant, providing local public health agency authorities with an early indicator of possible community transmission. During the next 4 days, two measles cases were reported among residents served by the same wastewater treatment plant where measles virus detection had occurred. This report describes the detection of measles virus through wastewater surveillance in Mesa County and its contribution to the subsequent outbreak response.

Summary

What is already known about this topic?

Measles is a highly infectious vaccine-preventable disease. Measles virus is shed into wastewater, and detection of the virus can precede reporting of cases, serving as an early warning of community transmission.

What is added by this report?

During August 4–6, 2025, measles virus was detected in wastewater samples from a wastewater treatment plant in Mesa County, Colorado. During the next week, two measles cases were reported among residents of the area served by the same treatment plant. Detection of measles virus in wastewater with subsequent reporting of measles cases in the same area facilitated coordinated and comprehensive messaging to health care providers, encouraging them to continue recommending measles vaccination.

What are the implications for public health practice?

Wastewater surveillance testing for measles can alert public health authorities to possible local measles transmission before and during a measles outbreak and help guide public health preparedness and response. Wastewater surveillance is conducted for both wild-type (highly contagious) and vaccine-derived measles (weakened strain in the measles, mumps, and rubella vaccine).

Investigation and Outcomes

Colorado Wastewater Surveillance Program

The Colorado wastewater surveillance program was established in 2020 in response to the COVID-19 pandemic. The wastewater surveillance program monitors wastewater statewide for respiratory viruses and emerging pathogens using digital polymerase chain reaction (dPCR).† On May 1, 2025, after the identification of five measles cases in the state, the wastewater surveillance program initiated a measles surveillance pilot project to supplement statewide clinical measles surveillance. Sampling occurs twice weekly at 21 sentinel wastewater treatment facilities across the state.

Detection of Measles Virus from the Measles Wastewater Pilot Project

Between May 1, 2025, when wastewater surveillance was implemented, and August 4, 2025, no wild-type measles was detected in wastewater in Mesa County. On August 9, 2025, the state laboratory identified low-level measles detection§ in a sample collected on August 4 at a treatment plant serving 90,000 residents in Mesa County (Figure).

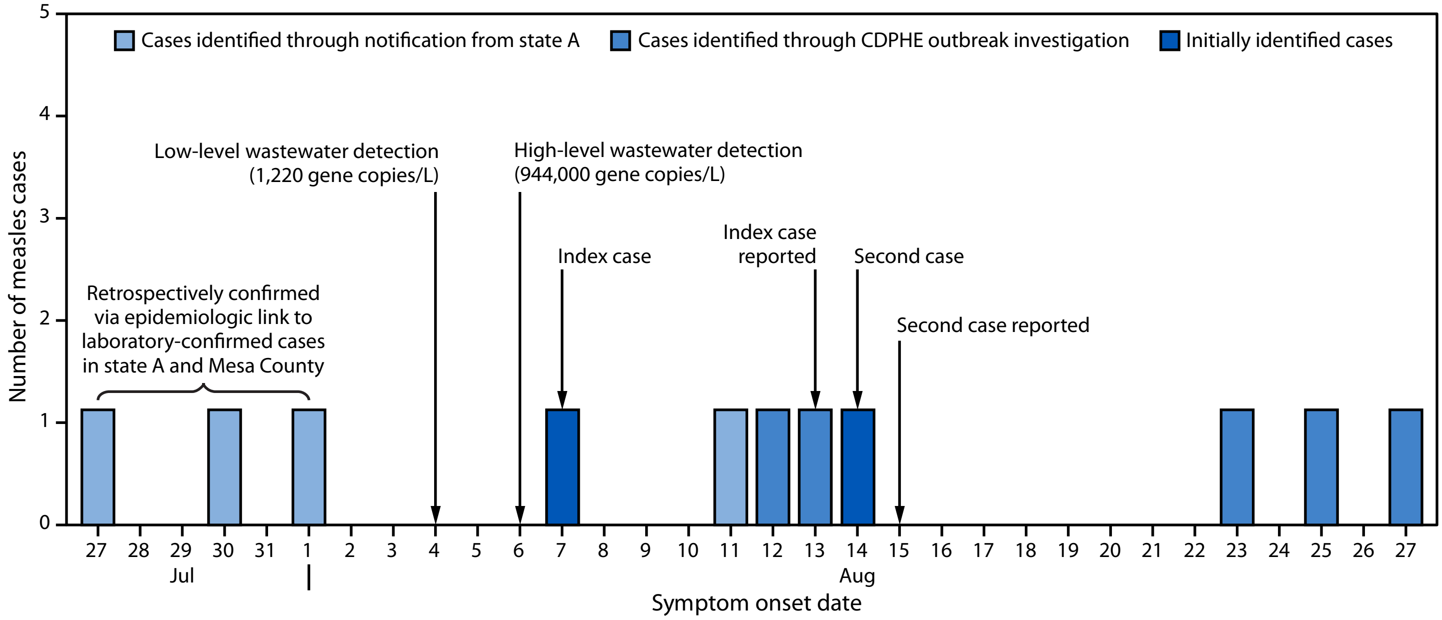
At that time, no measles cases had been reported among residents of Mesa County during 2025. A second wastewater sample collected on August 6 with results received on August 11 had the highest concentration of measles virus RNA (944,000 gene copies per liter) since the pilot began in May; genomic sequencing after dPCR confirmed measles virus genotype D8. The sharp increase in measles virus concentration identified between the two sequential samples suggested community transmission (*1*). The local public health agency was notified the same day and coordinated with local and state public health officials, including planning for increased

* Measles Symptoms and Complications | Measles (Rubeola) | CDC

† dPCR: A Technology Review | PMC

§ A measles viral concentration that is below the empirically established limit of detection. The limit of detection is defined as >1,200 gene copies per liter and ≥3 positive partitions per sample well. A low-level detection indicates that measles genetic material was likely present, but the concentration was too low to be reliably quantified with statistical certainty.

FIGURE. Measles symptom onset and report dates and measles wastewater detection dates* — Mesa County, Colorado, July–August 2025



Abbreviation: Colorado Department of Public Health and Environment.

* The low-level detection in a sample collected on August 4 was reported on August 9, and the high-level detection in a sample collected on August 6 was reported on August 11.

staffing to support an outbreak response in the event of a confirmed measles case in the area. Delivery of wastewater samples collected on August 11 and August 13 was delayed at the laboratory because of a wildfire; these samples were not in the acceptable temperature range for testing and were considered invalid. Measles virus was not detected in the next sample, which was collected on August 18. This activity was considered public health surveillance and exempt from human subjects review by CDPHE.

Identification of Measles Cases in the Region of the Affected Sewershed

On August 13, 2 days after the high-concentration measles virus detection was reported, the local public health agency was notified of a suspected measles case in an unvaccinated patient aged 10–19 years. This index patient had spent time in the area served by the sewershed while infectious (i.e., from 4 days before through 4 days after rash onset) and had symptom onset on August 7. A second case, in an unvaccinated patient aged 10–19 years who worked with the index patient, was identified in the same region on August 15, 1 day after symptom onset. Neither patient had traveled outside the immediate area, and neither reported a known measles exposure. Both patients were confirmed to have measles through laboratory testing.

State and local public health authorities launched an outbreak investigation including contact tracing, symptom monitoring, and laboratory confirmation of clinical and wastewater samples. The CDPHE outbreak investigation identified five additional laboratory-confirmed measles cases with symptom onset during August 11–27 among 225 household and health care facility contacts of the first two identified patients. Among the seven patients, one had documentation of measles vaccination. Local health care providers were encouraged by state and local authorities to continue recommending measles vaccination and to review vaccine inventories to ensure adequate stock.

Retrospective Identification of Likely Source Cases

In early October, CDPHE was notified by public health officials in state A that members of an ill Mesa County family had exposed residents of their state during a family gathering in early August. CDPHE identified this Mesa County family as the likely source of the Mesa County measles outbreak. Although three family members sought care for symptoms in late July and specimens were obtained for measles testing, the request was canceled when one of the family members received a coincidental positive test result for group A *Streptococcus*, because of a nationwide shortage of measles immunoglobulin M testing reagents. All three family members were unvaccinated. Before being identified, after travel to state A, the family had been exposed to measles in state B in mid-July and subsequently interacted with the first two recognized measles patients in Mesa County during July 25–26. The family cases were epidemiologically linked through the CDPHE outbreak investigation. This linkage explains both the initial local spread in Mesa County and the viral detections in the early August wastewater samples.

Preliminary Conclusions and Actions

The detection of measles virus RNA in consecutive wastewater samples likely indicated ongoing community transmission, and the detection of a high concentration alerted the local public health agency to transmission before cases were reported. The first cases were reported ≤4 days of wastewater specimen collection, allowing dissemination of comprehensive messaging regarding both wastewater surveillance measles detections and clinical data to local health care providers. Timeliness is critical for wastewater surveillance to serve as an alert to local public health authorities. Ongoing monitoring of wastewater surveillance data by local public health agencies in Colorado can provide an early indication of community measles circulation and guide public health messaging regarding potential transmission, signs and symptoms of measles, recommendations for vaccination, and instructions for seeking care. Wastewater surveillance data complement surveillance for clinical cases, alerting local authorities and aiding resource allocation for outbreak investigations and containment (*2*,*5*).

Acknowledgments

Colorado Wastewater Surveillance Team; participating Colorado wastewater utilities; Mesa County Public Health; Colorado Department of Public Health and Environment response epidemiologists.

Corresponding author: Grace M. Jensen, grace.jensen@state.co.us.

[1]Colorado Department of Public Health and Environment; [2]Mesa County Public Health, Grand Junction, Colorado.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

References

1. CDC. Measles cases and outbreaks. Accessed December 18, 2025. Atlanta, GA; Department of Health and Human Services, CDC; 2025. https://www.cdc.gov/measles/data-research/index.html
2. Chen W, Bibby K. Temporal, spatial, and methodological considerations in evaluating the viability of measles wastewater surveillance. Sci Total Environ 2025;959:178141. PMID:39709841 https://doi.org/10.1016/j.scitotenv.2024.178141
3. Rector A, Bloemen M, Hoorelbeke B, Van Ranst M, Wollants E. Detection of measles virus genotype D8 in wastewater of the Brussels Capital Region, Belgium. J Med Virol 2025;97:e70251. PMID:39957688 https://doi.org/10.1002/jmv.70251
4. Gan C, Pitton M, de Korne-Elenbaas J, et al. Retrospective wastewater tracking of measles outbreak in western Switzerland in winter 2024. Environ Sci Technol Lett 2025;12:689–94. PMID:40520145 https://doi.org/10.1021/acs.estlett.5c00244
5. Benschop KSM, van der Avoort HG, Jusic E, Vennema H, van Binnendijk R, Duizer E. Polio and measles down the drain: environmental enterovirus surveillance in the Netherlands, 2005 to 2015. Appl Environ Microbiol 2017;83:e00558–17. PMID:28432101 https://doi.org10.1128/AEM.00558-17

Imported Human Rabies — Kentucky and Ohio, 2024

Alexandra Barger[1,2]; Sara F. Margrey[3]; Allison W. Siu[1,4]; Ryan Wallace[5]; Rebecca Earnest[5]; Molly Frankel[6]; Hermella Eshete[1,6]; Carolyn Swisshelm[6]; Eli Shiltz[7]; Kimberly Wright[7]; Arminda Allen[7]; Lillian A. Orciari[5]; Crystal M. Gigante[5]; Rene Condori[5]; Pamela Yager[5]; Michael Niezgoda[5]; Panayampalli S. Satheshkumar[5]; Douglas Thoroughman[1,4]; Kathleen Winter[1]; Kelly Giesbrecht[1]

Abstract

Human rabies cases are rare in the United States; most result from domestic wildlife exposure. U.S. residents can acquire rabies abroad, typically through contact with dogs in areas where dog-maintained rabies is endemic. In November 2024, a man from Haiti was admitted to a Kentucky hospital with an 8-day history of progressive lower extremity pain and weakness. Soon after admission, he experienced hypersalivation, dysphagia, agitation, and eventually, respiratory failure requiring invasive mechanical ventilation. Ten days after admission, he was transferred to a referral hospital in Ohio, where his condition further deteriorated. Despite early consideration of rabies in the differential diagnosis, testing was delayed until late in the clinical course while other diagnostic possibilities were pursued. Rabies testing was initiated on the 29th hospital day and was confirmed 5 days later; the patient died that day. Phylogenetic analysis of the nucleoprotein gene supported acquisition of a dog-maintained rabies virus variant in Haiti. In total, 709 possible contacts during the patient's infectious period underwent risk assessment; 60 (8%) were recommended to receive rabies postexposure prophylaxis (PEP) because of exposure to saliva. Before the patient's rabies diagnosis, standard precautions were used inconsistently during his care; among 60 persons recommended to receive PEP, 52 (88%) were health care workers. Earlier rabies diagnosis and regular adherence to standard infection control precautions, recommended for all patient care, might have reduced health care–associated exposures. This case underscores the importance of early public health consultation upon clinical suspicion of rabies and universal adherence to standard precautions.

Introduction

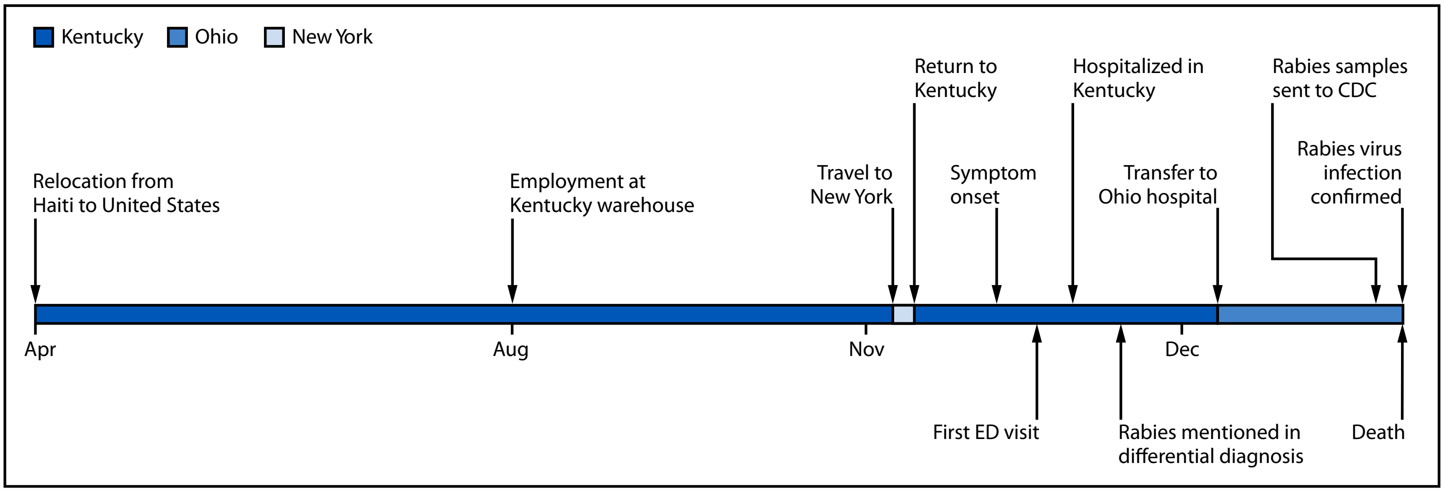
In November 2024, a man from Haiti who had been living in the United States for approximately 7 months sought care in a Kentucky emergency department three times over 4 days for progressive lower extremity weakness and pain; he was hospitalized, and shortly thereafter he experienced agitation and hypersalivation. Ten days later, after further neurologic deterioration, he was transferred to a referral hospital in Ohio. Although rabies was considered early in the patient's hospital course, in the absence of reported animal exposure, other diagnoses were initially pursued, and rabies testing was not sought for several weeks. Rabies testing was initiated on the 29th hospital day, and the diagnosis was confirmed by CDC 5 days later, the same day that the patient died. Analysis indicated that the virus was consistent with a rabies virus variant found in dogs in Haiti, one of the countries with the highest risk for rabies in the Western Hemisphere (*1*). An extensive contact tracing effort was undertaken to identify persons who might have been exposed to the patient's infectious material and to recommend postexposure prophylaxis when indicated. This report describes the patient's signs and symptoms, hospital course, and the subsequent contact tracing activities once a diagnosis of rabies was confirmed.

Investigation and Results

Clinical Signs and Symptoms and Initial Hospitalization

Information about the patient's clinical and hospitalization course was provided by the treating facilities through the local health departments. In April 2024, the patient had relocated from Haiti to the United States; he began working in a Kentucky warehouse in August (Figure). Three months later, in November, he sought treatment at a local emergency department (hospital A) for a 4-day history of knee and lower back pain. Knee and spine radiographs were normal, and he was discharged. He returned later the same day with worsening pain in both legs, nausea, and urinary frequency. Clinicians administered intravenous fluids and pain medication and discharged him again. No specific diagnosis other than musculoskeletal pain was documented. Two days later, he returned with dizziness and severe leg weakness and required assistance walking. Computed tomography of the head was normal, but magnetic resonance imaging of the lumbar spine revealed a bulging intervertebral disc; this was interpreted as a plausible mechanism for radiculopathy and the cause of his symptoms. He initially declined hospital admission, but the following day (hospital day 1), he returned to hospital A by ambulance after losing the ability to walk, experiencing weakness that had progressed to his arms, and experiencing respiratory difficulty. He was admitted to the hospital, and clinicians initiated an extensive evaluation in consultation with neurology and infectious disease specialists. On hospital day 2, he developed hypersalivation, dysphagia, and agitation, and by hospital day 3, progressive neurologic decline necessitated endotracheal intubation and invasive mechanical ventilation.

FIGURE. Timeline for human rabies case imported from Haiti — Kentucky and Ohio, 2024



Abbreviation: ED = emergency department.

Hospital A Course

Cerebrospinal fluid (CSF) from a lumbar puncture on hospital day 3 tested positive for toxoplasma immunoglobulin G (IgG); all other tests for infectious, autoimmune, and neoplastic etiologies were negative. Clinicians considered rabies in the differential diagnosis as early as hospital day 3; however, because of the critical nature of the patient's illness at that time, he was unable to respond to questions about animal exposure, and family members interviewed during the hospitalization were unaware of any animal exposure. Therefore, in the absence of known exposure, rabies testing was not initially pursued, in favor of plausible alternative diagnoses. The bulging lumbar disc was initially considered the likely cause of his leg weakness, but this did not explain his other symptoms. Recent receipt of several vaccines raised suspicion for Guillain-Barré syndrome, prompting treatment with intravenous immunoglobulin. He also received empiric treatment for central nervous system toxoplasmosis.

Transfer to Hospital B and Request for Rabies Testing

On hospital day 10, the patient experienced status epilepticus, requiring increasing sedation. He was transferred to an Ohio hospital (hospital B) for neurocritical care on hospital day 13. Because of the hypersalivation, he underwent salivary gland biopsy on hospital day 16; pathologic examination found nonspecific inflammation. A brain magnetic resonance imaging study on hospital day 17 showed anoxic injury with severe ventricular effacement (i.e., obliteration of the ventricular space as a consequence of mass effect) and brain stem herniation. Computed tomography angiography showed no cerebral blood flow.

On hospital day 29, physicians at hospital B consulted the Kentucky Department for Public Health (KDPH) and the Ohio Department of Health (ODH) to request rabies testing. Serum, CSF, saliva, and nuchal skin biopsy samples were sent to CDC by the ODH laboratory. The samples were received by CDC on hospital day 34, and rabies was confirmed later that day by the detection of rabies IgG and immunoglobulin M by indirect immunofluorescence assay in serum and CSF and by detection of rabies virus RNA by real-time reverse transcription–polymerase chain reaction in one of two saliva samples (*2*,*3*). The patient died on hospital day 34, 40 days after symptom onset.

Rabies virus neutralizing antibodies were later detected in serum and CSF by the rapid fluorescent focus inhibition test. The rabies virus RNA signal in nuchal skin was below the positivity threshold and was reported as inconclusive.

Identification of Rabies Virus Variant

Postmortem sampling of brain tissue was conducted by needle aspiration through the foramen magnum. Antigenic typing revealed a rabies virus variant similar to that found in Caribbean dogs and mongooses. Genomic sequencing and phylogenetic analysis of the complete nucleoprotein gene was consistent with rabies virus found in dogs in Haiti (Cosmopolitan clade, Haiti-Dominican Republic variant CAR1a).*

* Nomenclature for Caribbean rabies virus variants recently described in Frontiers | Using molecular approaches to determine rabies diversity in Haiti and Dominican Republic.

Public Health Response

Epidemiologic Investigation

After confirming rabies infection, KDPH, ODH, the Northern Kentucky Health Department, the Cincinnati Health Department, and CDC coordinated response activities. These activities were reviewed by CDC, deemed not research, and were conducted consistent with applicable federal law and CDC policy.[†] The participating health agencies considered these activities to be part of routine public health practice that did not require human subjects review.

Haiti Public Health Notification and Field Investigation

Rabies virus variant typing and sequencing results indicated that the patient had acquired rabies in Haiti, obviating the need for further U.S. animal source investigation. CDC issued a public health notification to Haiti, recommending follow-up to identify the exposure source and assess additional persons who had been exposed to the rabid animal and who might need postexposure prophylaxis (PEP). A field investigation team from Haiti's National Animal Rabies Surveillance Program was deployed to the patient's family's last known location to conduct in-person interviews. Their investigation did not identify any definite animal exposures. One report that the patient might have been scratched by a cat could not be verified. The patient had also traveled extensively within Haiti, precluding ascertainment of the source of his rabies exposure.

Contact Tracing

Health care contacts. Public health officials defined the infectious period as 14 days before symptom onset until the patient's death (*4*). Exposure was defined as contact between the patient's infectious body fluid or tissue and a contact's mucous membrane or broken skin. KDPH and the Northern Kentucky Health Department developed an online risk assessment plan to standardize data collection. Infection prevention specialists at hospitals A and B, in consultation with public health officials, identified potentially exposed employees at their respective facilities. A standardized questionnaire was administered to 645 employees, including 451 at hospital A and 194 at hospital B (Table). To collect additional information, telephone interviews were conducted with persons who reported possible contact with tears, saliva, or neural tissue. During the interview, details of the possible exposure, including the nature of the body fluid contact and use of personal protective equipment (PPE), were discussed. If a health care worker used PPE that prevented contact between the patient's infectious body fluid and the health care worker's mucous membranes or broken skin, the health care worker was not considered exposed.

[†] 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

TABLE. Number of contacts of a patient with rabies, recommendations to receive rabies postexposure prophylaxis, and completion of postexposure prophylaxis, by contact group — Kentucky and Ohio, 2024

	Contact group, no. (column %)			
Characteristic	Health care worker contacts	Household contacts	Other community contacts*	Total contacts
No. of potential contacts (row %)	645 (88)	7 (1)	84 (11)	**736 (100)**
Underwent risk assessment	645 (100)	7 (100)	57 (68)	**709 (96)**
PEP recommended[†]	53 (8)	7 (100)	0 (—)	**60 (8)**
Did not receive PEP[§]	1 (2)	3 (43)	0 (—)	**4 (7)**
Received partial PEP	5 (9)	1 (14)	NA	**6 (10)**
Completed PEP[¶]	47 (89)	3 (43)	NA	**50 (83)**

Abbreviations: NA = not applicable; PEP = postexposure prophylaxis.
* Includes close contacts in the workplace and classroom (i.e., coworkers, classmates, and instructors) and other community members.
[†] Among those who underwent risk assessment.
[§] Four persons who were recommended to receive PEP (one health care worker and three household contacts) did not complete PEP or receive partial PEP, despite multiple calls from local health department staff members.
[¶] Received at least 1 PEP dose but did not complete the vaccination series.

Community contacts. Overall, 91 household and community contacts were identified. The patient's partner, roommates, and family members were contacted, and their exposure risk assessed. His employer provided a list of coworkers on his shift during his infectious period. Public health officials conducted outreach through email, telephone calls, text messages, and multilingual letters distributed at work and mailed to homes. They also contacted classmates and instructors from English classes the patient attended and a nurse who vaccinated him during his infectious period.

The patient traveled to New York for 3 days early in his infectious period. The New York State Department of Health assessed exposure risk among three relatives with whom he stayed and determined that all three had potentially been exposed to saliva. The patient traveled by plane, initially raising concern for exposure of other travelers. However, he was not exhibiting hypersalivation or agitation at the time, and the risk for passenger exposure to infectious fluids (e.g., saliva) during the short flights was deemed minimal. Therefore, contact tracing of others on the planes was not pursued.

Recommendations for and Administration of PEP

Among 736 contacts identified in Kentucky, Ohio, and New York, 709 (96%) completed a risk assessment, 60 (8%) of whom were considered exposed through contact with saliva and recommended to receive PEP. These included 53 of 645 (8%) health care workers, all seven household contacts, and none of 57 other community contacts (Table). Local public health departments coordinated with the hospitals to ensure that rabies PEP administration aligned with Advisory Committee on Immunization Practices guidelines (*5*). Recommended PEP consisted of a single dose of human rabies immune globulin and 1 dose of rabies vaccine at the time of the first medical visit, followed by an additional vaccine dose on days 3, 7, and 14 after the first dose. Occupational health staff members at each hospital coordinated PEP administration for their respective employees, and community contacts' PEP was monitored by local health department staff members. Among all 60 persons recommended to receive PEP, 50 (83%) completed the vaccination series; six persons received at least 1 dose of vaccine but did not complete the series. Public health staff members reviewed the telephone interview statements of each health care contact who was recommended to receive PEP to determine the circumstances of their exposure. Among 49 of 53 (92%) exposed health care workers, recommendations to receive PEP might have been avoided through adherence to standard precautions. In the remaining four cases, enhanced precautions would have been required because of the nature of the patient contact.

Summary

What is already known about this topic?

Human rabies cases are rare in the United States; most result from domestic wildlife exposure. U.S. residents can acquire rabies abroad, typically through contact with dogs in areas where dog-maintained rabies is endemic.

What is added by this report?

A man who relocated to the United States from Haiti later died from infection with a dog-maintained rabies virus acquired in Haiti. Rabies diagnosis was delayed, and standard infection control precautions were not uniformly used during his medical care, leading to risk assessments of 709 contacts across three states and recommendations for postexposure prophylaxis for 60 persons, 88% of whom were health care workers.

What are the implications for public health practice?

Prompt diagnosis of human rabies is essential to limit potential exposure of health care workers and other contacts. Use of standard infection control precautions, recommended for all patient care, can help prevent exposure.

Discussion

Human-to-human transmission of rabies has only been confirmed through organ or tissue donation. Although rabies transmission from patients to health care workers is theoretically possible, it has not been documented. However, because infected humans shed virus in saliva, these persons should be considered potentially infectious to others through exposure to infectious tissue or body fluids. In this case, the prolonged hospitalization and delayed consideration of rabies as a diagnosis increased the period during which health care workers could have been exposed to infectious material. Because rabies is nearly universally fatal after symptom onset, prevention is critical. This case represents one of the largest health care–associated rabies exposure investigations in recent U.S. history and suggests how adherence to recommended infection control precautions, including use of PPE, along with early public health consultation, might reduce the unnecessary administration of PEP.

While caring for this patient, health care workers had extensive contact with his saliva. In a health care setting, exposure to rabies virus could occur through contact between a patient's saliva and a health care worker's eye, mouth, or broken skin. Despite this, only 8% of those assessed were recommended to receive PEP. Standardized risk assessment can help direct PEP recommendations to persons most likely to be at risk and reassure those without exposure, minimizing possible adverse effects and cost of PEP by reducing unnecessary administration.

Most exposures in this investigation were health care associated (53 of 60; 88%). Standard infection control precautions are recommended when caring for all patients, including those with suspected rabies (*6*,*7*). Use of gloves, gowns, masks, and eye protection can protect against body fluid exposure, particularly during intubation and suctioning. Although standard precautions should be used for all patient care, delayed diagnosis of rabies in this case and health care workers' lack of awareness of the risk for rabies transmission might have contributed to some health care workers' failure to use recommended precautions.

Human rabies is rare in the United States, and most U.S.-based clinicians have never encountered a case (*8*). Rabies diagnosis might therefore be delayed or missed because of clinician unfamiliarity or hesitancy to consult with public health departments. Although rabies was considered early in this patient's clinical course, testing was deferred while more common and easily tested diagnoses were assessed and ruled out. The typical rabies incubation period is approximately 3 weeks–3 months, although incubation periods of <1 week and >1 year have been reported (*9*). The long incubation period in this case (≥7 months) reduced the clinical suspicion for rabies. Although human rabies is rare, the virus remains enzootic in U.S. wildlife and is reported in mammals from all states except Hawaii. State health departments often have staff members who are experienced with rabies testing protocols and should be consulted promptly when rabies is suspected. Immediate public health consultation when rabies is being considered can prevent diagnostic delays and minimize exposures.

Implications for Public Health Practice

This patient had recently arrived in the United States from one of the countries with the highest risk for rabies in the Western Hemisphere and experienced classic rabies signs and symptoms. This case underscores the value of early public health consultation when a diagnosis of rabies is considered. The case also highlights the importance of adhering to standard precautions during all patient care activities and the use of standardized risk assessments to ensure timely and effective response efforts.

Corresponding author: Alexandra Barger, ABarger@cdc.gov.

[1]Kentucky Department for Public Health; [2]Division of Workforce Development, National Center for State, Tribal, Local, and Territorial Public Health Infrastructure and Workforce, CDC; [3]Ohio Department of Health; [4]Division of State and Local Readiness, Office of Readiness and Response, CDC; [5]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [6]Northern Kentucky Health Department, Florence, Kentucky; [7]Cincinnati Health Department, Cincinnati, Ohio.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Kimberly Wright reports travel support from the National Association of County and City Health Officials to attend a 3-day Education for the Prevention of Infection intensive course and support for conference registration for the 2025 Council of State and Territorial Epidemiologists' conference. No other potential conflicts of interest were disclosed.

References

1. Wallace R, Etheart M, Ludder F, et al. The health impact of rabies in Haiti and recent developments on the path toward elimination, 2010-2015. Am J Trop Med Hyg 2017;97(Suppl):76–83. PMID:29064363 https://doi.org/10.4269/ajtmh.16-0647
2. Gigante CM, Dettinger L, Powell JW, et al. Multi-site evaluation of the LN34 pan-lyssavirus real-time RT-PCR assay for post-mortem rabies diagnostics. PLoS One 2018;13:e0197074. PMID:29768505 https://doi.org/10.1371/journal.pone.0197074
3. Council for State and Territorial Epidemiologists. Revision of the surveillance case definition for human rabies. Atlanta, GA: Council for State and Territorial Epidemiologists; 2011. https://cdn.ymaws.com/www.cste.org/resource/resmgr/PS/10-ID-16.pdf
4. Fooks AR, Jackson AC, eds. Rabies: scientific basis of the disease and its management. 4th ed. Cambridge, MA: Academic Press; 2020.
5. Rupprecht CE, Briggs D, Brown CM, et al.; CDC. Use of a reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies: recommendations of the advisory committee on immunization practices. MMWR Recomm Rep 2010;59(No. RR-2):1–9. PMID:20300058
6. Manning SE, Rupprecht CE, Fishbein D, et al.; Advisory Committee on Immunization Practices CDC. Human rabies prevention—United States, 2008: recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2008;57(RR-3):1–28. PMID:18496505
7. Garner JS; The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. Infect Control Hosp Epidemiol 1996;17:53–80. PMID:8789689 https://doi.org/10.1086/647190
8. Ma X, Boutelle C, Bonaparte S, et al. Rabies surveillance in the United States during 2022. J Am Vet Med Assoc 2024;262:1518–25. PMID:39059444 https://doi.org/10.2460/javma.24.05.0354
9. Wilson PJ, Rohde RE, Oertli EH, Willoughby RE, eds. Rabies: clinical considerations and exposure evaluations. 1st ed. New York, NY: Elsevier; 2020.

Human Rabies Deaths — Minnesota and California, 2024

Malia Ireland[1,*]; Curtis L. Fritz[2,*]; Stacy Holzbauer[1]; Carrie Klumb[1]; Maria Bye[1]; Leah Bauck[1]; Amanda Bakken[3]; Michelle Dethloff[3]; Rebecca Campagna[2]; Mojgan Deldari[2]; Susan Hepp[2]; Ruth Lopez[2]; Sharon Messenger[2]; Christopher Preas[2]; Aimee Rendon[2]; Stephanie Koch-Kumar[4]; Maria Rangel[4]; Kanwaldeep Bains[4]; Jeffrey Bulawit[4]; Samer Al Saghbini[4]; Trinidad Solis[4]; Joe Prado[4]; John Zweifler[4]; Leticia Berber[4]; Rais Vohra[4]; Ignacio A. Santana[5]; Salvador Sandoval[5]; Parmjit Sahota[5]; Mark Hendrickson[5]; Megan Black[5]; Gloria Chavez[5]; Andrew Schwab[5]; Pamela A. Yager[6]; Michael Niezgoda[6]; Vaughn V. Wicker[6,7]; Crystal M. Gigante[6]; Lillian A. Orciari[6]; Jesse D. Blanton[6]; Sarah C. Bonaparte[6]; Rebecca Earnest[6,8]; Ryan M. Wallace[6]

Abstract

Rabies is an enzootic viral disease in the continental United States and is typically transmitted through the bite of an infected mammal. Infection is almost always fatal if rabies postexposure prophylaxis (PEP) is not received before the onset of symptoms. Bats are the leading source of U.S. human rabies cases. In 2024, CDC identified two U.S. human rabies deaths in September (Minnesota) and November (California) in persons who had a recognized bat encounter but might not have been aware of the potential rabies risk. Neither patient reported the bat encounter to public health officials nor sought medical attention, including PEP, before symptom onset. Health officials conducted risk assessments among 384 persons in Minnesota, North Dakota, and California who had possible contact with either the bats that were presumed to have rabies or the patients while they were infectious; 45 (12%) of these persons were recommended to receive PEP. Bat bites often result in trivialized or inapparent wounds. Anyone with a possible bat exposure, even in the absence of a recognized bite, should immediately report the encounter to a health care provider or to public health officials for risk assessment, consideration of options for bat testing, and PEP administration, if indicated. Increased awareness of the potential risk for rabies after any bat interaction, even without a visible bite wound, might help prevent deaths.

Introduction

Although rabies is enzootic in the continental United States and is typically transmitted through bites from infected mammals, human rabies deaths in this country are rare (*1*). Each year, among an estimated 1.4 million persons in the United States who seek medical care after animal contact, 100,000 (7%) receive rabies postexposure prophylaxis (PEP). Rabies is nearly universally fatal if PEP is not administered before symptom onset. PEP is not indicated when the animal test results are negative or when public health officials determine that the contact does not pose a rabies risk (*2*). Bat exposures are the leading source of U.S. human rabies cases: among the 42 U.S.-acquired human rabies cases reported during 2000–2024, bat contact was the cause in 35 (83%) (*1*).

In September and November 2024, two human rabies deaths associated with bat contact in Minnesota and California, respectively, were reported to CDC. Although the Advisory Committee on Immunization Practices (ACIP) recommends that anyone with possible bat contact receive a rabies exposure risk assessment to ascertain the need for PEP, both of these deaths occurred in persons who, although aware of their bat encounter, did not consult with medical professionals or public health officials or receive PEP before symptom onset. CDC (and the California state laboratory for the California case) provided human rabies diagnostic testing. After confirming the rabies diagnosis, state and local health departments led the resulting animal exposure and patient contact investigations, with technical assistance provided by CDC. This report describes the characteristics and outcomes of these two fatal cases. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[†]

Investigation and Outcomes

Minnesota Case, July–September 2024

Bat encounter. In July 2024, a Minnesota woman who lived alone reported to family members that a bat or bird had been trapped in her house for several days. After discovering a bat in the sink, she reportedly killed it with a hammer and disposed of it. A bite was not mentioned; however, the method reportedly used to kill the bat could have produced splatter resulting in inoculation of infectious nervous tissue onto broken skin or mucous membranes. In addition, family members reported that the patient wore a hearing aid, was a deep sleeper who used a continuous positive airway pressure machine, and routinely consumed alcohol, factors that might have reduced her awareness of having had direct bat contact. Public health officials were not notified about the possible exposure, and the bat was not tested for rabies.

Clinical course and rabies diagnosis. In August, approximately 3 weeks after the bat encounter, the patient developed shoulder pain and weakness. During the next 9 days, she sought care several times for malaise, weakness, and continued

* These authors contributed equally to this report.

† 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

shoulder pain; her medical record contains no documentation that she reported the bat encounter at any of those health care assessments. Ten days after initial symptom onset, she returned to a Minnesota hospital emergency department with tremors, progressive weakness, confusion, anxiety, and muscular rigidity. The patient was admitted to the hospital for supportive care and diagnostic testing, which included a lumbar puncture, a head and cervical spine computed tomography scan, and a multiplex polymerase chain reaction meningitis/encephalitis panel.[§] On the first hospital day, the patient experienced an acute mental status change and was found to be minimally responsive, resulting in emergency endotracheal intubation and transfer to the intensive care unit. Family members reported the patient's bat encounter at that time, and rabies was considered, but public health officials were not consulted regarding diagnostic testing because test results for more common diagnoses were pending. On the second hospital day, the patient was transferred to a tertiary care hospital in North Dakota, where providers noted signs of encephalitis. Twelve days after admission, the encephalopathy had not resolved, and the patient's family elected to provide only palliative care. However, because extensive testing while the patient was hospitalized had still not identified a pathogen, after a consultation with state public health officials and CDC, a limited number of remaining antemortem samples (serum, cerebrospinal fluid, and plasma) were sent to CDC for rabies diagnostic testing. Later that day, the patient died, and her family declined both an autopsy and postmortem sampling for additional rabies testing. Rabies virus antibodies were detected in a plasma sample, confirming a diagnosis of rabies.

California Case, October–November 2024

Bat encounter. In October 2024, a woman living in California told family members that she had recently found a bat indoors at her worksite. Although the bat initially appeared to be dead, when she handled it with her bare hands, she felt movement and a possible bite. She discarded the bat, and in the absence of any apparent wound, did not consult a medical provider or public health officials, and the bat was not tested for rabies.

Clinical course and rabies diagnosis. Approximately 1 month after the bat encounter, the patient developed paresthesia and muscle spasms in her arm. Three days later, she was hospitalized with seizures. On admission, the patient's bat exposure was disclosed (whether this information was reported by the patient or family members is not known), prompting medical providers to contact public health officials regarding rabies testing. On the same day, the patient's seizure activity worsened and was followed by mental status changes, leading to endotracheal intubation and transfer to the intensive care unit. During the following 3 days, her condition deteriorated, ultimately progressing to liver and kidney failure. The patient died 4 days after admission, and the California state laboratory and CDC confirmed a diagnosis of rabies through detection of rabies virus antigen in an antemortem nuchal skin biopsy and viral RNA in antemortem nuchal skin biopsy and saliva. Viral sequencing confirmed a bat rabies virus variant.

[§] The multiplex polymerase chain reaction meningitis/encephalitis panel tests for 14 pathogens in a cerebrospinal fluid sample to rule out more common causes of meningitis or encephalitis; rabies virus is not included in the panel.

Summary

What is already known about this topic?

Rabies virus is maintained in wild mammals in the continental United States and is typically transmitted through bites from infected animals. Rabies is nearly universally fatal without administration of timely postexposure prophylaxis (PEP).

What is added by this report?

CDC confirmed two deaths of U.S. residents from rabies virus infection after bat encounters in 2024. Both patients recognized their bat interaction; however, they might not have been aware of the potential rabies risk, and neither sought health care consultation, bat testing, or PEP.

What are the implications for public health practice?

Increased awareness of the potential rabies risk after any bat encounter, even without a visible bite wound, might help prevent deaths.

Public Health Response

Identification of Exposed Contacts

The detection of each human rabies case prompted an investigation to 1) determine the exposure circumstances, 2) identify other persons possibly exposed to the same animal that was presumed to be rabid, and 3) identify persons exposed to the patients during their infectious period.

A rabies exposure is defined as direct contact between broken skin or mucous membranes and the tears, saliva, or nervous tissues of an infected animal or person. Health departments administered a risk assessment questionnaire to any person who had possible contact with either the bats that were presumed to have rabies or with the patients while they were possibly infectious; based on limited available data on duration of viral shedding, the infectious period was conservatively estimated to be 14 days before symptom onset until death and decontamination (*3*). These assessments included 155 persons in Minnesota, 185 in North Dakota, and 44 in California. All of the potential exposures were to the patients; no bat exposures were identified.

PEP Recommendations for Identified Exposed Contacts

Among 155 assessed persons in Minnesota, five of 35 (14%) community contacts and nine of 120 (8%) health care worker contacts were recommended to receive PEP (Table). In North Dakota, all 185 assessed persons were health care workers, 23 (12%) of whom were recommended to receive PEP. In California, among assessed persons, two of six community contacts and six of 38 (16%) health care workers were recommended to receive PEP. Across both patient investigations, PEP was recommended for a total of 45 (12%) of 384 exposed persons, including seven (17%) of 41 community contacts and 38 (11%) of 343 health care worker contacts; information regarding receipt and completion of PEP is not available.

Public Health Recommendations Regarding Bat Exposures

Press releases about the rabies cases were issued by health departments in Minnesota and California. The press releases included rabies prevention messaging focused on the risks from bats and the importance of consulting health care providers or public health officials about bat contact or encounters, even in the absence of a recognized bite.

Discussion

Bats are the leading source of human rabies cases in the United States, largely because bat bites often result in trivialized or inapparent wounds (*4*). North American bat species are relatively small, and their bite wounds can be difficult to detect. The California case described in this report highlights the importance of reporting bat encounters, even when a bite or scratch is inapparent, and reinforces current ACIP guidance regarding bat handling. Bats should never be handled with bare hands; CDC advises wearing leather or bite-proof gloves when handling any bat. Furthermore, sick bats might appear dead and are more likely to be infected with pathogens, including rabies virus, than are apparently healthy bats. Bats are a critical part of the ecosystem, and healthy bats typically avoid human contact. For this reason, ACIP recommends a rabies risk assessment by a health care provider or public health professional for any direct bat contact and that PEP be administered in situations when a bat bite or scratch cannot be ruled out and the animal is unavailable for rabies testing (*5*).

Although most healthy persons would likely detect direct physical contact with a bat, certain conditions have been noted to increase the risk for unrecognized bat exposures, leading to rabies virus transmission. These conditions include reduced mental capacity or age-related factors that would affect awareness or ability to communicate an exposure; use of drugs, alcohol, or medications that could reduce perception of bat contact; and a tendency to sleep through noises or disturbances that typically awaken others, including contact with a bat (*5*). Therefore, ACIP recommends that persons who have slept in a room where a bat is present and are at increased risk for unrecognized exposure should receive PEP (*5*). Although the Minnesota patient described in this report was aware of a bat in her home, multiple characteristics that could have reduced her perception of direct bat contact were noted, including that she wore a hearing aid, was reported to be a deep sleeper who used a continuous positive airway pressure machine, and routinely consumed alcohol, and thereby would have met the criteria for PEP as described by ACIP.

Implications for Public Health Practice

At least 44 bat species are found in the continental United States (*6*), and rabies virus has been detected across nearly all species that have undergone testing (*1*). Among bats submitted for rabies testing in the United States, approximately 5% have been found to be infected with rabies virus (*1*). Given the prevalence of rabies virus among domestic bat species, the nearly universally fatal nature of rabies disease, and the risk for trivialized or unperceived exposures, persons should be vigilant for bats in occupied buildings and immediately report encounters to health care providers or public health officials for risk

TABLE. Health department assessment of contacts of two patients with rabies* and number of contacts† recommended to receive rabies postexposure prophylaxis,§,¶ by contact type — Minnesota, North Dakota, and California, 2024

	Contacts, no. (%)					
	Community		Health care workers		Total	
State	Assessed	PEP recommended	Assessed	PEP recommended	Assessed	PEP recommended
Minnesota	35	5 (14)	120	9 (8)	**155**	**14 (9)**
North Dakota	0	NA	185	23 (12)	**185**	**23 (12)**
California	6	2 (33)	38	6 (16)	**44**	**8 (18)**
Total	**41**	**7 (17)**	**343**	**38 (11)**	**384**	**45 (12)**

Abbreviations: NA = not applicable; PEP = postexposure prophylaxis.
* Both human rabies cases resulted from contact with bats.
† All potential exposures were to the patients; no contact was exposed to the bats that were presumed to have rabies.
§ Patient Care for Preventing Rabies |CDC
¶ Information regarding receipt or completion of PEP is not available.

assessment, animal testing options, and PEP administration, if indicated. Increased public awareness of the potential rabies risk after any bat encounter, including those that do not result in visible wounds, might prevent deaths.

Corresponding author: Rebecca Earnest, rearnest@cdc.gov.

[1]Minnesota Department of Health; [2]California Department of Public Health, Richmond and Sacramento, California; [3]North Dakota Department of Health; [4]Fresno County Department of Public Health, Fresno, California; [5]Merced County Department of Health, Merced, California; [6]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Diseases, CDC; [7]Oak Ridge Associated Universities, Oak Ridge, Tennessee; [8]Epidemic Intelligence Service, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Curtis L. Fritz reports receipt of travel and meeting support from the Council of State and Territorial Epidemiologists for a conference, and the American Veterinary Medical Association (AVMA) for House of Delegates biannual meetings; and service as an elected officer to the National Association of State Public Health Veterinarians (NASPHV) Executive Board and as the NASPHV representative to the AVMA House of Delegates Advisory Panel. No other potential conflicts of interest were disclosed.

References

1. Ma X, Boutelle C, Bonaparte S, et al. Rabies surveillance in the United States during 2022. J Am Vet Med Assoc 2024;262:1518–25. PMID:39059444 https://doi.org/10.2460/javma.24.05.0354
2. Charniga K, Nakazawa Y, Brown J, Jeon S, Wallace RM. Risk of rabies and implications for postexposure prophylaxis administration in the US. JAMA Netw Open 2023;6:e2317121. PMID:37294570 https://doi.org/10.1001/jamanetworkopen.2023.17121
3. Tepsumethanon V, Lumlertdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. Clin Infect Dis 2004;39:278–80. PMID:15307040 https://doi.org/10.1086/421556
4. Messenger SL, Smith JS, Rupprecht CE. Emerging epidemiology of bat-associated cryptic cases of rabies in humans in the United States. Clin Infect Dis 2002;35:738–47. PMID:12203172 https://doi.org/10.1086/342387
5. Manning SE, Rupprecht CE, Fishbein D, et al.; Advisory Committee on Immunization Practices, CDC. Human rabies prevention—United States, 2008: recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2008;57(RR-3):1–28. PMID:18496505
6. Adams AM, Trujillo LA, Campbell CJ, et al. The state of the bats in North America. Ann N Y Acad Sci 2024;1541:115–28. PMID:39407088 https://doi.org/10.1111/nyas.15225

Erratum

Vol. 74, No. 41

The report "Leisure-Time Physical Activity Among Women of Reproductive Age — United States, 2022 and 2024" contained an error.

On page 634 in the Abstract, the fourth sentence should have read, "Overall, an estimated 25.1% of women aged 18–44 years reported leisure time activity meeting recommendations for both aerobic and muscle-strengthening physical activity, **21.7%** reported leisure time activity meeting only the aerobic activity recommendation, and 6.1% reported leisure time activity meeting only the muscle-strengthening activity recommendation."

ISSN: 0149-2195 (Print)