Rabies (Human)

IMMEDIATELY REPORTABLE DISEASE

Per N.J.A.C. 8:57, healthcare providers and administrators shall immediately report **by telephone** confirmed and suspected cases of human rabies to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made.

The health officer (or designee) **must immediately institute the control measures listed below in section 5, "Controlling Further Spread,"** regardless of weekend, holiday, or evening schedules. A directory of local health departments in New Jersey is available at http://localhealth.nj.gov.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to (609) 826-5964 or 4872, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to (609) 392-2020 during all other days and hours.

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1 THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

The virus that causes rabies is a rhabdovirus of the genus *Lyssavirus.*

B. Clinical Description and Laboratory Diagnosis

Rabies in humans is a progressive illness with a duration of approximately 2 to 21 days, which is almost always a fatal infection. The incubation period is usually 3 to 8 weeks. A prodromal phase, lasting about 2 to 10 days, is characterized by pain and numbness/tingling at the site of the bite (present in 50% to 80% of cases) and nonspecific complaints such as fatigue, headache, and fever. Behavioral changes, including apprehension, anxiety, agitation, irritability, insomnia, and depression, may also be apparent.

The prodromal phase is followed by the neurologic phase, which is characterized by disorientation and hallucinations, paralysis, episodes of terror and excitement, hydrophobia, hyperventilation, hypersalivation, and seizures. These symptoms are followed by coma and usually death. Once symptoms have begun, the disease is nearly always fatal, despite intensive treatment. There have been a small number of persons who have recovered from a documented rabies infection, after using an intensive protocol that included a drug-induced coma and the administration of antiviral drugs (Willoughby et al.). This recovery is considered highly unusual, however, and no single specific course of therapy for rabies in humans has been demonstrated to be effective after clinical signs manifest.

Several tests are necessary to diagnose rabies antemortem (before death) in humans; no single test is sufficient. All human rabies testing is conducted at the Centers for Disease Control and Prevention (CDC), after approval by the New Jersey Department of Health (NJDOH). Specimens for rabies testing should be collected only after more common etiologies of encephalitis or myelitis have been ruled out. Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape of the neck. Saliva can be tested by virus isolation or detection of rabies RNA by reverse transcription and polymerase chain reaction (RT-PCR). Serum and spinal fluid are tested for antibodies to rabies virus. Skin biopsy specimens are examined for rabies antigen in the cutaneous nerves

at the base of hair follicles. NOTE: all four specimens (saliva, serum, spinal fluid, and nuchal biopsy) are required for testing. Postmortem testing is also available at CDC in consultation with NJDOH.

C. Reservoirs

Although all species of mammals are susceptible to rabies virus infection, only a few species are important in maintaining the disease cycle in nature. In the United States, raccoons, skunks, foxes, and coyotes are the significant reservoirs in terrestrial animals, with bats being the other significant animal reservoir. Two variants of rabies virus are present in New Jersey, the bat and raccoon rabies virus variants. Any of the rabies variants can be passed to other animals and humans through exposure to infectious saliva. Small rodents and lagomorphs (e.g., squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, wild rabbits, and hares) have not been known to transmit rabies to humans and are almost never found to be infected with rabies. Domestic rabbits caged outdoors have been found rabid, because cages often allow exposure to rabid animals while still providing enough protection for the rabbit to survive and then develop the disease. Although groundhogs are rodents, they have been found to be rabid in areas where raccoon rabies is present. For this reason, they are considered a high-risk animal even though they are rodents.

Rabies occurs in more than 150 countries and territories worldwide. In contrast to the United States and Europe where wildlife rabies predominates, dogs remain the principal reservoir of rabies in Mexico, South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and Asia. Dogs are very effective in transmitting rabies to people in these regions and are the source of 99% of the human rabies deaths worldwide.

D. Modes of Transmission

Rabies is transmitted when the virus-laden saliva or other potentially infectious material (brain, spinal cord) from an infected animal is introduced into bite wounds, open cuts in the skin, or mucous membranes. Bites by some animals, such as bats, can inflict injury so minor that bites may go undetected. Direct person-to-person transmission is theoretically possible, but cases occurring under such conditions have not been documented. However, cases have been documented after transplants of corneas and other tissues from infected donor individuals. Airborne spread in specific situations (i.e., in a cave with a multitude of bats or in a laboratory with rabies virus or infected specimens) has occurred on rare occasions. Rabies is not transmitted through contact with blood, urine, skunk spray, or feces of an infected animal. Because rabies virus is rapidly inactivated by desiccation and ultraviolet irradiation, if the material potentially containing virus is dry to the touch, it can generally be considered noninfectious.

E. Incubation Period for Human Rabies

The incubation period of rabies infection in humans is highly variable and is usually between one and three months after exposure but can range from 9 days to several years in rare cases. The length of the incubation period depends in part on wound severity, wound location in relation to nerve supply, the relative distance from the brain, the amount and variant of the virus, vaccination history, and the degree of protection from clothing. Therefore, a bite to the face may have a shorter incubation period compared to a bite to an extremity and deep or multiple bites may have a shorter incubation period than a single superficial bite.

F. Period of Communicability or Infectious Period

The period during which a patient is considered infectious begins up to ten days before symptom onset and lasts until death. Saliva, brain and spinal cord tissue, and spinal cord fluid are potentially infectious. It should be noted, however, that except for organ transplants unknowingly received from rabies-infected persons, there have been no documented cases of person-to-person transmission of rabies in the United States.

G. Epidemiology

National: The number of rabies-related human deaths in the United States declined during the twentieth century, from more than 100 annually in the early 1900's to just 1-3 per year since 1960. This decline can be attributed to successful pet vaccination and animal control programs, public health surveillance and testing, and availability of post-exposure prophylaxis (PEP) for rabies.

In the United States today, human fatalities are rare but typically occur in people who do not seek prompt medical care. While the exact reason for not seeking care is often unclear, lack of awareness of the risk of rabies is thought to be an important factor. This is of particular concern for bat bites, since bats can have small teeth and leave bite marks that are the size of the tip of a pencil.

From 1960 to 2018, 127 human rabies cases were reported in the United States, with roughly a quarter resulting from dog bites received during international travel. Of the infections acquired in the United States, 70% were attributed to bat exposures. There have been 25 cases of human rabies have been reported in the United States in the past decade (2009-2018). Seven of these infections were acquired outside of the U.S. and its territories.

New Jersey: The last indigenous case of human rabies in New Jersey was in 1997 in a man who had direct contact with bats but did not seek treatment. He was infected with the silver-haired/pipistrelle bat rabies variant strain. The last case prior to that was in 1971 and was due to incomplete post exposure prophylaxis (PEP) following a bat bite.

In 2011, New Jersey confirmed one case of human rabies (canine variant) in a Haitian woman without a reported history of animal exposure. This is the third report of human rabies in the United Sates acquired in Haiti since 2000 and highlights the importance of

obtaining a detailed history for patients who have traveled from a rabies-endemic country and the value of prompt consultation with medical and public health professionals regarding any animal bites.

2 CASE DEFINITION

A. New Jersey Department of Health (NJDOH) Case Definition

The NJDOH Zoonotic Disease Program follows the most current case definition as published on the CDC National Notifiable Disease Surveillance System (NNDSS) website.

Human Rabies Case Definition: https://wwwn.cdc.gov/nndss/conditions/rabies-human/

Case definitions enable public health to classify and count cases consistently across reporting jurisdictions and should not be used by healthcare providers to determine how to meet an individual patient's health needs. Every year, case definitions are updated using CSTE's Position Statements. They provide uniform criteria of nationally notifiable infectious and non-infectious conditions for reporting purposes. To search for other notifiable diseases' case definitions by name and by year, use the search tools on the left side of the NNDSS website: http://wwwn.cdc.gov/nndss/

Clinical Description

Rabies is an acute encephalomyelitis that usually progresses to coma or death within 14 days after the first symptom if prompt post-exposure prophylaxis is not administered.

Laboratory Criteria for Diagnosis

Detection of Lyssavirus antigens in a clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck) by direct fluorescent antibody test, OR

- Isolation (in cell culture or in a laboratory animal) of a Lyssavirus from saliva or central nervous system tissue, OR
- Identification of Lyssavirus specific antibody (i.e. by indirect fluorescent antibody test or complete rabies virus neutralization at 1:5 dilution) in the cerebrospinal fluid (CSF), OR
- Identification of Lyssavirus specific antibody (i.e. by indirect fluorescent antibody test or complete rabies virus neutralization at 1:5 dilution) in the serum of an unvaccinated person, OR
- Detection of Lyssavirus viral RNA (using reverse transcriptase-polymerase chain reaction [RT-PCR]) in saliva, CSF, or tissue.

Case Classification

Confirmed

A clinically compatible case that is laboratory confirmed by testing at a state or federal public health laboratory.

3 LABORATORY TESTING SERVICES AVAILABLE

NJDOH Public Health and Environmental Laboratories (PHEL) does not test human specimens for rabies; all testing for suspect human rabies cases in New Jersey is performed by the CDC rabies laboratory. CDC will not accept specimens from suspect human rabies cases unless reviewed and approved by NJDOH Infectious and Zoonotic Disease Program (IZDP) staff, approved by CDC rabies personnel, and shipped by PHEL.

For approval for human rabies testing, contact NJDOH IZDP at (609) 826-5964 or (609) 826-4872 (working hours) or (609) 392-2020 (emergency number for nights/weekends and holidays).

4 DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To promptly identify cases and prevent further transmission
- To provide clinicians, laboratorians, and residents with appropriate preventive health information
- To develop knowledge of the reservoir species in the State and the relative incidence of rabies in this and other species; to forward this information to CDC to add to national surveillance data
- From the above, develop educational information for the public, so they may avoid contact with the vector species, ensure rabies vaccination of pets and livestock, and report all animal bites for the evaluation of rabies exposure risk
- To educate the healthcare community about the risk of rabies in various species and ensure appropriate post-exposure treatment of exposed individuals

B. Laboratory and Healthcare Provider Reporting Requirements

1. Reporting of Animal Bites

New Jersey statutes (N.J.S.A. Title 26, Chapter 4-79 to 81) require all animal bites to be reported to the local health department (LHD) by the attending physician, bite victims themselves or their caretaker, or parent or guardian in the case of a child. As per state statutes (N.J.S.A. Title 26, Chapter 4-82 and 86) the LHD shall confine the biting domestic animal for observation for at least ten days and may order the animal's brain tested for rabies if the animal dies or is euthanized during the observation period. Wild animals that expose a person should be submitted to PHEL for rabies testing.

2. Reporting of Administration of Rabies Post-exposure Prophylaxis (PEP)

The administration of rabies PEP, which consists of rabies immune globulin and vaccine, is reportable to the local health officer by all healthcare providers using NJDOH Report of Rabies Post-Exposure Treatment Form (CDC-2). Healthcare providers are to submit a completed CDC-2 form to the LHD. The LHD are requested to investigate the exposure and confirm that the patient completes PEP. Upon completion, the LHD should submit a copy of the CDC-2 form to the NJDOH by encrypted email (zoonoticrn@doh.nj.gov) or fax (609-826-4874).

3. Reporting of Suspect Human Rabies

Because of the rarity and potential severity of human rabies, suspect or known human rabies cases are immediately reportable to the local health officer having jurisdiction over the locality in which the patient lives or, if unknown, to the health officer in whose jurisdiction the healthcare provider requesting the laboratory examination is located. Alternatively, healthcare providers may call NJDOH IZDP at (609) 826-5964 or (609) 826-4872 (nonholiday weekdays between 8 AM and 5 PM), or (609) 392-2020 (emergency number for nights/weekends and holidays). Detailed information on the clinical signs, laboratory test results, and patient history and/or medical records will be requested to be sent to the NJDOH IZDP. It should be emphasized that human rabies is an extremely rapidly progressing disease), and that patients who have had a more extended course of illness may not be considered suspect rabies cases.

C. Local Health Departments Reporting and Follow-Up Responsibilities

1. Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.9) stipulates that each local health officer must report the occurrence of any case of human rabies, as defined by the case definition in section 2A above. Current requirements are that cases be immediately reported to NJDOH IZDP.

2. Case Investigation

- Investigation:
  - Upon notification of a suspect human rabies case, the LHD should complete the NJDOH Human Rabies Information Worksheet located on the NJDOH Rabies website.
  - Once the LHD has completed the NJDOH Human Rabies Information Worksheet or has gathered a thorough clinical summary and epidemiological risk factors (including but not limited to patient demographics, clinical summary, risk factors, facility contact information), they should immediately notify the NJDOH IZDP who will direct the case investigation.
  - NJDOH IZDP staff will review the reported case information with the attending physician and contact CDC for further review, if warranted.
  - NJDOH IZDP staff will notify the Health Officer if testing is approved. At this time the NJDOH IZDP staff may request the LHD create a case in CDRSS and document the case investigation.
  - Institution of disease control measures is an integral part of case investigation. It is the local Health Officer's responsibility to understand, and, if necessary, institute the control guidelines listed below in section 5, Controlling Further Spread.
- If laboratory testing confirms human rabies, the Health Officer may be asked to assist in investigating the case within their community, including gathering the following:
  - If the patient was seen by a healthcare provider before hospitalization, or was seen at more than one hospital, including all contact names and telephone numbers
  - History of travel outside the United States within one year
  - History of bites, scratches, or other exposure to animals within the past year
  - Exposure to attics, barns, caves and other areas where bats might roost
  - Identification and notification to people and who have been exposed to the case and may need rabies PEP
- Specimen Submission and Laboratory Testing:
  - If testing for human rabies is approved, NJDOH IZDP staff will work with the physician/hospital to facilitate submission of specimens to CDC for testing. PHEL does not test human specimens for rabies, nor do other laboratories in New Jersey. Specimens must be forwarded (hand delivered if possible) to PHEL for shipment to CDC, as PHEL is highly experienced with the interstate shipping protocols for different classes of medical specimens. CDC will reject specimens sent directly from hospitals
  - NJDOH IZDP will enter the test results into CDRSS and notify the Health Officer directly.

5 CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements

1. Minimum Period of Isolation of Patient

Known or suspect human rabies cases should be placed in isolation for the duration of illness. The hospital should limit the total number of staff exposed to the patient. CDC recommends using standard precautions when providing care to persons suspected of having clinical rabies, including wearing gowns, goggles, masks, and gloves, particularly during procedures that might result in splashes or sprays from body fluids. Minimum Period of Quarantine of Human Contacts

None.

B. Managing Rabies Situations

1. Protection of Humans Exposed to a Rabid or Potentially Rabid Human

Minimize the number of healthcare workers interacting with the patient and educate them regarding the disease and its mode of transmission. Attending personnel should wear appropriate PPE (includes wearing gowns, goggles, masks, and gloves, particularly during intubation and suctioning.) to prevent any exposure to saliva or other infectious materials. Articles soiled with saliva should be disinfected. Persons exposed to a confirmed human rabies case via saliva or other infectious materials (through a bite, an open wound, or a mucous membrane) should be referred to a healthcare provider for PEP. Once a patient is diagnosed with rabies, other human contacts from the patient's home/family and work environment should be interviewed by the LHD to determine their exposure risk. The patient should be considered infectious for a period of ten days previous to their onset of illness date, and throughout the duration of illness.

2. Protection of Humans Exposed to a Rabid or Potentially Rabid Animal

N.J.S.A. 26:4-79, 80, and 81 establish that all animal bites or attacks are reportable to the LHD. If an animal is found to be positive for rabies, humans who were exposed to the infected animal's saliva or other infectious material through a bite, scratch, or mucous membrane contact should receive PEP as soon as possible.

- **Domestic animals** (i.e., dogs, cats, ferrets and domestic livestock) that have bitten, scratched, or otherwise exposed a human and appear healthy should be quarantined for ten days in lieu of euthanasia and testing. Dogs, cats, and ferrets that are incubating rabies will begin to exhibit signs of the disease very soon after they begin shedding virus in their saliva and die within seven days. Therefore, a ten-day quarantine is an acceptable and appropriate way to rule out rabies in these

animals; if the animal begins to show signs of rabies during the quarantine period, there is still time to safely administer PEP to the bite victim.

- **Wild animals** may be classified as high or low risk.
    - **High-risk wild animals** are those that commonly carry rabies. In New Jersey, this includes raccoons, skunks, foxes, groundhogs (woodchucks), and bats. Because viral-shedding periods are not known for these animals, quarantining the animal following a bite to a human is not appropriate—the animal should be immediately euthanized and submitted for rabies testing. If the animal is unavailable for testing, it must be assumed that the animal is rabid, and PEP should be administered to the bite victim.
        - **Bats** pose a unique problem. A bite or scratch from a bat can be so small that it may be undetected. If an exposure cannot be ruled out and the bat is unavailable for testing, PEP may be considered. For more information, refer to the New Jersey Guide for Post-Exposure Prophylaxis.
    - **Low-risk wild animals** almost never carry rabies. These include small animals such as voles, mice, rats, squirrels, and chipmunks. PEP is not specifically recommended following provoked bites from healthy rodents of this type; however, it may be recommended if the animal is showing neurologic signs or is unusually aggressive. Bites by trapped mice and rats, by squirrels being fed, or by chipmunks and other animals captured by cats or dogs are considered provoked, and PEP is rarely recommended after such a bite.
    - **Other wildlife animals:** PEP decisions regarding exposure to other animals (e.g., beaver, opossum, coyotes) are made on a case-by-case basis. Refer to the New Jersey Guide for Post-Exposure Prophylaxis for more information.

4. Preventive Measures

Control of human rabies relies on preventing human exposures to rabid or potentially rabid animals. Therefore, it is important to enforce animal quarantine regulations and licensing requirements, encourage rabies vaccination of dogs, cats, and other domestic animals, and discourage public interaction with wildlife.

Personal Preventive Measures/Education

- Vaccinate pets. Dogs are required by state law to be vaccinated and licensed and most municipalities also require rabies vaccination and licensure of cats. Although not required by law, vaccination of ferrets and other indoor pets, is strongly encouraged. Vaccination of domestic animals will create a protective barrier between humans and rabid wildlife.
- Do not keep wild animals as pets. This may be illegal as well as dangerous.

- Do not feed or handle wild or stray animals. Avoid sick or strangely acting animals.
- Cover your garbage cans securely and keep pet food indoors so that wild animals are not attracted to your yard.
- Do not touch or handle dead animals. Wear gloves if there is a need to handle an animal carcass.
- Contact the local animal control officer concerning stray domestic animals and ill or strangely acting wild animals. The public should be discouraged from capturing these animals, as they may get bitten or exposed to saliva
- Never handle bats. A bat bite or scratch from a bat may be so small as to go unnoticed. When a bat is in a room, have the people leave and shut the door to keep the bat contained, or if it is on the floor, place a solid-walled garbage can around it so it is contained. Bats found in rooms with people should **NOT** be let go until a health department consultation is obtained as to whether the bat needs to be submitted for rabies testing.
- When handling a pet that was very recently fighting with or bitten by a wild or potentially rabid animal, avoid touching the animal until the fur is dry. If the pet must be handled, the handler should wear waterproof gloves to avoid direct contact with saliva and use soap and water to clean their hands and skin that may have touched the potentially rabid animal's saliva. Persons should consult with a healthcare provider if they may have been exposed to saliva.
- Travelers to developing countries with enzootic canine rabies may be recommended to receive pre-exposure prophylaxis if it is anticipated that they will be in situations where exposure is likely (e.g., camping, hiking, backpacking, or away from areas where they would be able to receive prompt treatment for a bite wound). Travelers should be warned to avoid petting or having other contact with all animals when in these areas; dog rabies is common in many international areas and pet dogs may not be vaccinated against rabies.

NOTE: For more information regarding international travel and rabies, visit the CDC Traveler's Health webpage at https://wwwnc.cdc.gov/travel/diseases/rabies.

5. Case Investigation for Human Exposed to Animal Rabies

The LHD should:

- Receive and investigate animal bite reports
- Receive reports of human PEP and assist healthcare provider in ensuring completion of the treatment according to the prescribed schedule
- Submit completed CDC-2 forms to the NJDOH IZDP via encrypted email to zoonoticrn@doh.nj.gov or fax (609-826-4874)

- Receive and investigate reports of suspect cases of animal rabies
- Train local police to as to the proper handling of "bat in the house" calls, because the public will often call the police at night about these situations—make sure police do NOT tell them to let the bats go outside!
- Assist veterinarians, animal control officers, and private citizens with preparing and submitting specimens to the PHEL Rabies Laboratory
- Conduct rabies education and awareness efforts within its jurisdiction

NOTE: Rabies educational materials for the public (e.g., brochures and pamphlets) are available online (https://www.nj.gov/health/cd/topics/rabies.shtml).

Additional Information

NJDOH Web site: https://www.nj.gov/health/cd/topics/rabies.shtml

CDC Web site: http://www.cdc.gov/rabies

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