### LEPROSY

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<th>Animal Group(s) Affected</th>
<th>Transmission</th>
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<td>Humans, 9-banded armadillos</td>
<td>Unclear Indirect or direct contact Respiratory droplets Consumption of or contact with 9-banded armadillos</td>
<td>Primarily affects the peripheral nerves, skin, upper respiratory tract, eyes, and limbs. Sensory loss in skin, muscle weakness. Long term lack of sensation leads to traumatic injury and potential loss of use in hands and feet.</td>
<td>Severity of clinical signs based on immunity of host. Left untreated, it may result in permanent damage to skin, nerves, eyes, limbs.</td>
<td>Multi-drug antibiotic therapy.</td>
<td>Humans treated early in course of disease are no longer infective. Avoid exposure to 9-banded armadillos. Cleaning and eating their carcasses may pose increased risk.</td>
<td>Yes</td>
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**Fact Sheet compiled by:** Lara M. Cusack  
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**Fact Sheet Reviewed by:** Richard W. Truman, David M. Scollard

**Susceptible animal groups:** Humans, 9-banded armadillos (*Dasypus novemcinctus*). Other armadillo species such as 6-banded armadillos (*Euphractus*) common as exotic pets, and 3-banded armadillos (*Tolypeutes*) are not known to be susceptible to *M. leprae*.

**Causative organism:** *Mycobacterium leprae*

**Zoonotic potential:** Infectious between people and from 9-banded armadillos

**Distribution:** Organism is found worldwide. Persons in close contact with patients with untreated, active, predominantly multibacillary disease, and persons living in countries with highly endemic disease have higher risk of disease. Most (75%) of cases originate from Angola, Brazil, Central African Republic, Democratic Republic of Congo, India, Madagascar, Mozambique, Nepal and the United Republic of Tanzania. In the US, cases are documented primarily in Louisiana, Texas, California, New York, Massachusetts, and Hawaii. Infections among wild 9-banded armadillos reported in Alabama, Arkansas, Louisiana, Mississippi and Texas, as well as in Argentina, Brazil, Colombia, and Mexico.

**Incubation period:** While typical incubation period is approximately 5 years, it can be up to 20 years for clinical signs to appear.

**Clinical signs:**
Humans: Majority of healthy individuals will not develop disease. Susceptibility to infection appears to be genetic. The form of the disease developed depends on host immunity. Indeterminate form - Earliest clinically detectable form of leprosy found in 10% to 20% of infected people. Hypopigmented macules, without developed tuberculoid or lepromatous characteristics, are present. Tuberculoid leprosy (pauci-bacillary leprosy) - Single or few well demarcated hypopigmented skin lesions, frequently with active, spreading edges and a clearing center, are noted. Peripheral nerve swelling or thickening also may occur. Acid fast bacilli rare or not visible.
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Lepromatous leprosy (multi-bacillary leprosy) - Very numerous symmetrically distributed erythematous skin lesions, nodules, plaques, thickened dermis, and involvement of the nasal mucosa (congestion, nose bleeds). Acid fast bacilli are always present and may be found in dermal nerves. High titer of antibodies to *M. leprae* but little cellular immune response to the bacillus. Changes in immunity and/or treatment can lead to worsening of clinical signs.

Borderline - Few or several, asymmetrical, hypopigmented, erythematous or coppery skin lesions that are usually positive for acid fast bacilli. These cases may be further sub-divided according to the number and cellularity of the lesions. Borderline Tuberculoid (BT) are usually well demarcated, somewhat dry, and few in number. Borderline Lepromatous (BL) have many roughly symmetrical, shiny macules, nodules, or plaques with sloping or poorly defined edges.

All forms will involve some degree of peripheral neurological damage, leading to sensory loss in skin and muscle weakness. In long term cases, lack of sensation leads to repeated traumatic injury and potential loss of use in hands and feet. Left untreated, may result in permanent damage to skin, nerves, eyes, and limbs.

9-Banded Armadillos: Cutaneous lesions are discerned only in the late stages. One may observe repeated foot ulcers or scrapes around the nose, eyes or legs that do not respond well to normal therapies. Armadillos generally manifest a diffuse lepromatous form of the disease with systemic involvement of reticuloendothelial tissues. Impression smears or swabs of skin lesions can reveal acid fast bacilli or may PCR as *M. leprae*. Leprous armadillos have been reported to show an increase in basal metabolic rate. With one of the lowest metabolic rates of any placental mammal, the cost of infection may represent an important impact but studies to date are undecided as to ecological consequences in wild population. It does not appear to infect young animals which may be due to incubation period.

**Post mortem, gross, or histology findings:** *Mycobacterium leprae* is an obligate intracellular, acid-fast, Gram-positive bacillus with an affinity for macrophages and Schwann cells. Interaction with Schwann cells induces demyelination and stimulates a chronic inflammatory reaction. Swelling occurs in the perineurium, leading to ischemia, fibrosis, and axonal loss. Sensory fibers are affected prior to motor nerve involvement and the induced insensitivity can contribute to secondary trauma.

Infection in the armadillo is characterized by an insidious microcytic hypochromic anemia, with elevated LDH, ALT, and AST. On gross exam, the liver, spleen, and lymph nodes may be enlarged extensively, they may have a granular texture, and can contain massive numbers of acid fast bacilli. In late stages of disease, no organ system is spared and large numbers of bacilli can be found in all tissues.

**Diagnosis:** Clinical signs - Localized skin lesions have demonstrated sensory loss, thickened and enlarged peripheral nerves. Acid-fast bacilli in skin or dermal nerve, obtained from the full-thickness skin biopsy of a lepromatous lesion, can be demonstrated. In many cases, rod-shaped, red-stained leprosy bacilli, which are diagnostic of the disease, may be seen in the smears taken from affected skin when examined under a microscope after appropriate staining (weakly acid-fast; Fite stain better than Ziehl-Neelsen). Serology and PCR - not widely performed, fail to reliably detect early/mild forms of the disease.

9-Banded Armadillos: Ear notches- preserve in 100% ethanol for genetic screening and in 70% ethanol for (PCR) analyses to detect *M. leprae* DNA. Serum or eluted whole blood- ELISA test or immunoglobulin M (IgM) antibodies to *M. leprae*. Confirmation made with PCR.

**Material required for laboratory analysis:** Skin, blood, affected tissues (spleen, liver, lymph node), dermal swabs, and impression smears.

**Relevant diagnostic laboratories:** Any capable of performing acid fast stain or PCR for *M. leprae*.

**Treatment:** Hansen’s disease is a mild disease when treated early and prior to sensory impairment. Multidrug therapy (MDT) with dapsone, rifampicin, and clofazimine, is daily treatment and prolonged - multi-bacillary cases treated for 2 years, pauci-bacillary cases treated for 1 year. Drugs provided free of charge by the National Hansen’s Disease Programs (NHDP) 1-800-642-2477,
References