Borreliosis (Lyme disease) Fact Sheet

1. Disease overview

Lyme disease is an **infectious, non-contagious, tick-borne bacterial** disease**.** In Europe, it is the most common tick-borne disease, caused by the bacterium ***Borrelia burgdorferi***, transmitted mainly by *Ixodes* ticks*.* Animals can be a reservoir or have clinical manifestations of the disease. In humans, most of the infected patients will develop symptoms (despite a small proportion can be asymptomatic).

Lyme disease is **not** a **WOAH-notifiable disease**.

Lyme disease is **not listed** in the **European Animal Health Law**.

2. Agent

Borrelia spp. are pathogenic bacterial **spirochetes**. Although they possess an outer membrane and are generally classified as **Gram-negative**, they are poorly visualized by standard Gram staining due to atypical cell envelope architecture. Their **diderm structure** comprises inner and outer membranes, but unlike typical Gram-negative bacteria, the outer membrane lacks lipopolysaccharide (LPS) and is instead enriched with diverse **outer surface lipoproteins** (Osps) that mediate host-pathogen interactions. Motility is driven by **periplasmic flagella** located between the membranes, enabling a characteristic corkscrew-like motion. A peptidoglycan layer, providing structural support, is situated in the periplasm adjacent to the inner membrane.

The classification of *Borrelia* species associated with Lyme borreliosis is broadly categorized into the following:

- ***Borrelia burgdorferi sensu lato* Complex**: This complex encompasses a genetically diverse group of closely related *Borrelia* species, often referred to as genospecies, that are responsible for Lyme borreliosis globally. Key members of this complex include, but are not limited to, *B. burgdorferi sensu stricto*, *B. afzelii*, *B. garinii*, *B. bavariensis*, and *B. spielmanii*. These distinct genospecies exhibit varying geographical distributions and clinical manifestations of disease across North America, Europe, and Asia.
- ***Borrelia burgdorferi sensu stricto***: This designation refers to a single, specific species that is a member of the *B. burgdorferi sensu lato* complex. *B. burgdorferi sensu stricto* is the predominant causative agent of Lyme borreliosis in North America.

3. Geographical Distribution

The disease is not notifiable to WAHIS, however the agent was reported in the EU in the last 2 years.

For more detailed information and dynamic maps, visit the *Geographical Distribution* section of the **disease profile** (accessible via the button in the top right corner).

4. Animal hosts

4.1. Primary animal species affected

Clinical disease is mainly important for humans. However, there are reports of Lyme disease manifestation in non-human primates, wildlife animals, dogs, and cats. In Europe, confirmed competent reservoir hosts include many common species of small and medium-sized rodents (mice, rats, squirrels, hares and rabbits), as well as several bird species (especially passerines), reptiles and insectivores. Although there are a few reports of clinical cases in cattle and deer, many large wild and domesticated vertebrates (e.g. deer and sheep) are considered dead-end hosts.

4.2. Clinical Signs

Borrelia spp. have been isolated from several wild mammal and bird species. However, reports of clinical disease are infrequent, including synovitis, myositis, myocarditis in dusky-footed woodrats (*Neotoma fuscipes*); also, pneumonitis, encephalitis, perivascular lymphoplasmacytic infiltrates of kidneys and liver in white-footed mice (*Peromyscus leucopus*). Clinical signs of Borreliosis in domestic animals are often subtle and **non-specific**, with many infected animals remaining **asymptomatic**.

In **dogs**, common signs include shifting-leg lameness due to polyarthritis, fever, lethargy, and enlarged lymph nodes. Severe but rare complications like Lyme nephritis can occur.

Horses may show lameness, stiffness, and joint effusion. Less common but reported are neuroborreliosis (ataxia, behavioural changes), uveitis, and skin nodules.

Cattle can exhibit fever, anorexia, decreased milk production, and chronic weight loss. Stiffness and swollen joints have also been noted.

Cats rarely show clinical signs; when they do, they are typically mild, such as lameness, fever, or lethargy.

4.2.1. Incubation Period

In animals, the incubation period is not well defined, but clinical signs may appear **several months** after a tick bite.

4.2.2. Mortality

Although it is not trivial to accurately calculate a mortality rate, Lyme disease is rarely fatal.

4.2.3. Zoonotic Potential

Lyme disease is considered a **tick-borne zoonosis**.

5. Transmission

Borreliosis is transmitted to vertebrate hosts through the bite of certain species of ***ticks.*** The most common tick involved in transmission in Europe is the *Ixodes* tick. The tick lifecycle is divided into 4 stages: egg, larva, nymph, and adult. The larva and nymph must take a blood meal to advance to the next life stage, and the female ticks require blood to reproduce. During these meals, ticks become infected with bacteria. Ticks attach to an animal host reservoir, typically birds or other small mammals such as mice and voles, and feed for 3 to 7 days. Those infected nymphs and adult ticks spread the bacteria each time they subsequently feed. The spread regularly increases during warmer

and humid weather, typically in the spring (tick feed behavior). Climate change may be involved in increasing the risk of infection.

6. Diagnostic tests

There aren't WOAH-recommended tests for this disease.

The following table presents data on the sensitivity and specificity of several diagnostic tests from studies deemed eligible according to EFSA's systematic literature review protocol:

Target	Test	Specificity	N studies	Sensitivity	N studies
Antibody	Enzyme linked immunosorbent assay (ELISA)	100%	1	82%	1
Antibody	Western Blot	100%	1	100%	1

7. Prevention and control

7.1. Vaccination

Two vaccines are used in dogs to prevent Lyme disease: **whole cell lysate** and **recombinant outer surface protein A** (OspA). In wildlife, experimental vaccination trials against *B. burgdorferi* have been conducted; the majority of individuals produced antibodies against the bacterium.

7.2. Treatment

Pharmaceutical treatments applied to dogs for which the efficacy was tested include Doxycycline, Ceftriaxone, and Azithromycin. Additionally, **insecticides** applied to host (dogs) with tested efficacy include Imidacloprid + Flumethrin. For more information, visit the *Treatment* section of the disease profile.