



## Leptospirosis: A waterborne zoonotic disease of global importance

### INTRODUCTION

Leptospirosis is considered one of the most common zoonotic diseases globally. In the United States, outbreaks are increasingly being reported among those participating in recreational water activities (Centers for Disease Control and Prevention [CDC], 1996, 1998, and 2001) and sporadic cases are often underdiagnosed. With the onset of warm temperatures, increased outdoor activities, and travel, Georgia may expect to see more leptospirosis cases.

Leptospirosis is a zoonosis caused by infection with the bacterium *Leptospira interrogans*. The disease occurs worldwide, but it is most common in temperate regions in the late summer and early fall and in tropical regions during rainy seasons. It is not surprising that Hawaii has the highest incidence of leptospirosis in the United States (Levett, 2005). The reservoir of pathogenic leptospires is the renal tubules of wild and domestic animals. Leptospires are usually shed in the urine of infected animals for about a month after infection. However, following acute illness, leptospiuria in infected animals can last for months to years. Infection in humans occurs following exposure to contaminated water sources or the urine or tissue of infected animals (Heymann, 2004). Human infection occurs through exposure to *Leptospira* spp. via cuts and scrapes, passage across the conjunctiva and mucous membranes. Inhalation of microscopic droplets or passage across the mucous membranes in the mouth and gut via ingestion are other possible, though less likely, routes of exposure to leptospires (Levett, 2005).

Human disease caused by *Leptospira* spp. can be an occupational hazard for veterinarians, those working in animal husbandry or meat processing, wastewater treatment employees, and military troops (Heymann, 2004). In recreational settings, leptospirosis is a hazard for those who come into direct contact with contaminated water such as travelers to tropical countries (e.g., ecotourism), campers, hikers, swimmers, and hunters (Levett, 2005; Heymann, 2004). Consequently, with the increased popularity of adventure racing, a growing population of susceptible individuals has emerged. First documented among competitive triathletes in 1998 in Illinois and Wisconsin (CDC, 1998), and later seen among participants of the Eco-Challenge in Borneo (Sejvar, 2003), leptospirosis has been recently classified as an emerging waterborne disease (Bharti, 2003).

Leptospirosis is commonly diagnosed in animals including cattle, pigs, and dogs. Human infections are caused by *L. interrogans* of which there are over 200 known pathogenic serovars (Levett, 2005). For most serovars, the epidemiology is poorly understood, as there are more serovars than known animal reservoir species, but certain serovars have been linked strongly to specific animal reservoirs. A few of the more common serovar-reservoir relationships are *L. interrogans* serovars Pomona (swine), Bratislava (swine), Canicola (dogs), Bovis (cattle), Autumnalis (raccoons), and Icterohemorrhagiae and Copenhageni (rats) (Heymann, 2004).

### SYMPTOMS OF LEPTOSPIROSIS

In humans, the incubation period of leptospirosis ranges from 2 to 21 days with a mean of 10 days. *Leptospira* infections can be asymptomatic or symptomatic depending on host susceptibility and the serovar involved (Cachy, 2005). Of the symptomatic illnesses, 90% are self-limited, flu-like illnesses, but 5-10% of infections can result in multi-organ damage, including liver failure, renal failure, and hemorrhagic pneumonitis. Men seem to be more likely to manifest severe disease than women (Cachy, 2005). Mortality among those with severe disease can range from 5% to 25%. The classic clinical

syndrome has two phases: a septicemic and an immune phase (Levett, 2005). It is in the immune phase that organ-specific damage and more severe illness is seen. See text box for more information on the two phases. The typical presenting signs of leptospirosis in humans are fever, headache, chills, conjunctival suffusion, and myalgia (particularly in calf and lumbar areas) (Heymann, 2004). Less common signs include a biphasic fever, meningitis, photosensitivity, rash, and hepatic or renal failure.

### DIAGNOSIS OF LEPTOSPIROSIS

#### Detecting serum antibodies against leptospira

- Microscopic Agglutination Titers (MAT)
  - Paired serum samples which show a four-fold rise in titer confirm the diagnosis; a single high titer in a person clinically suspected to have leptospirosis is highly suggestive
  - Antigens from different leptospiral serogroups are reacted with each sample of serum and inspected using darkfield microscopy for agglutination.
  - Confirmed diagnosis requires a 4-fold rise in titer to one or more serovars (Levett, 2004; Ooteman, Vago, & Koury, 2006).
- IgM Enzyme Linked Immunosorbent Assay (ELISA)
  - Acute and recently infected individuals are identified with this test by the presence of specific IgM antibodies (Ooteman et al., 2006; Bajani, 2003).
- LEPTO dipstick
  - A simple dipstick method that rapidly detects *Leptospira*-specific IgM antibodies in human serum or whole blood samples (KIT Biomedical Research, 2000).

#### Isolating leptospires

- From the blood within the first 7 days of an acute infection
- From cerebrospinal fluid between the fourth and tenth day of an infection
- From urine after the 10<sup>th</sup> day (Heymann, 2004).

The Georgia Public Health Laboratory offers culture and PCR for *Leptospira*. Samples for serology are submitted to the CDC.

### TREATMENT OF LEPTOSPIROSIS

Antibiotic treatment early in the illness may shorten the duration of fever and hospitalization. However, health care is often not sought until the immune phase of the disease and antibiotic therapy at this stage is somewhat controversial because of uncertain benefits of antimicrobial therapy given in the immune phase of the illness, and a potential association between Jarisch-Herxheimer reactions and late stage antimicrobial therapy. A recent Cochrane review found that early treatment with antibiotics may reduce mortality, reduce hospital stays, and reduce leptospiuria when compared to placebo, although too few studies were available for the review to provide clear guidelines for treatment of leptospirosis (Guidugli, 2006).

- For severe cases, penicillin is the preferred drug.
- For allergic patients or less severe cases, doxycycline, ampicillin or erythromycin can be given (Heymann, 2004).

### RECENT OUTBREAK ASSOCIATED WITH ADVENTURE RACE

On December 2, 2005, the Division of Public Health received notification from the CDC of a leptospirosis outbreak associated with an adventure race held in a state park outside Tampa, Florida during early November. The race

included 200 participants from at least 23 states, including 24 Georgia residents. One of the participants was hospitalized with renal disease in New York on November 21, 2005, and leptospirosis was the suspected cause. An email listserve of race participants documented additional post race illnesses. Following lab confirmation of leptospirosis in the hospitalized patient and notification of the additional illnesses, the CDC began an investigation and contacted state and local health departments to call race participants and facilitate diagnostic testing.

The CDC defined a suspect leptospirosis illness as fever along with two or more of the following signs: headache, chills, sweats, muscle aches, eye pain, red eyes, dark urine or unusual bleeding. Seven of the 24 Georgia participants met the CDC suspect case definition. These seven suffered from all or most of the following symptoms: fever (7, 100%), chills (5, 71%), sweats (5, 71%), headache (6, 86%), muscle and joint pains (4, 57%), and eye pain or sensitivity to light (3, 43%). Five of the seven (71%) participants reporting illness submitted serum for testing. Serum was initially screened for the presence of *Leptospira*-specific IgM antibodies with the lepto dipstick assay and confirmed with MAT. Two of the five (40%) tested positive on both tests. Both of these participants had also reported dark urine in addition to the other symptoms. Of the seven Georgia participants reporting illness following the race, four (57%) had sought healthcare prior to being interviewed, including one of the two confirmed cases. No one, including the confirmed cases, was diagnosed with leptospirosis prior to being interviewed by the CDC. For those that received treatment, antibiotics had been prescribed and included levoquin, doxycycline, and amoxicillin.

One hundred ninety-two of the 200 race participants met the CDC's suspect case definition. The CDC interviewed these individuals and found fourteen serologically- positive infections of leptospirosis based on MAT (titer of >400 in a single specimen). The following factors were determined to be associated with a higher risk of leptospirosis among the outbreak group: swallowing untreated river water, swallowing untreated swamp water, and being submerged in water (Stern, 2005).

## CONCLUSION

Considering the growing popularity of eco-tourism, adventure races, and other extreme sports, there is a need to raise the index of suspicion for leptospirosis when evaluating illness in travelers returning from adventure sports activities which put them in contact with surface water or soil. In spite of increasing outbreak reports of this disease, leptospirosis remains an under-recognized zoonotic disease. Prompt recognition of leptospirosis and early antimicrobial treatment may help reduce the duration of illness and risk of severe complications. Please notify your County, District, or State Health Department within seven days of any probable or confirmed cases of leptospirosis. A Notifiable disease report form is available at <http://health.state.ga.us/pdfs/epi/notifiable/reportingform.05.pdf>. Please call the Notifiable Diseases Epidemiology Section, Epidemiology Branch, Georgia Division of Public Health, at 404-657-2588 with any questions about leptospirosis.

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This article was written by DeAnna Howell B.S., M.S. and Dana Cole, D.V.M., PhD.

## Phase 1 and Phase 2 Leptospirosis

Leptospiral infections consist of two phases: septicemic and immune. The septicemic phase lasts five to seven days, followed by a temporary decline in fever. The immune phase, consisting of more severe symptoms, lasts four to thirty days. Because of the flu-like nature of symptoms during the septicemic phase, many patients may not seek healthcare unless the more severe signs of the immune phase become evident.

*Common symptoms of the septicemic phase (Phase 1):*

- High, remittent fever
- Headache
- Chills
- Rigors
- Myalgia, particularly in calves and lumbar back
- Conjunctival suffusion
- Abdominal pain
- Anorexia
- Nausea
- Vomiting
- Diarrhea
- Cough

*Less common symptoms of the septicemic phase (Phase 1):*

- Lymphadenopathy
- Splenomegaly
- Hepatomegaly

*Common symptoms of the immune phase (Phase 2):*

- Weil's syndrome (symptoms include but not limited to fever, hepatic and renal failure, jaundice, and pulmonary hemorrhage)
- Cardiac arrhythmias
- Aseptic meningitis
- Conjunctival suffusion
- Photophobia
- Eye pain
- Muscle tenderness
- Adenopathy
- Hepatosplenomegaly

Death is more common in the immune phase and generally results from renal failure, cardiopulmonary failure, or widespread hemorrhage (Heymann, 2004; Levett, 2005).

# 2005 Georgia Data Summary: PROSTATE CANCER

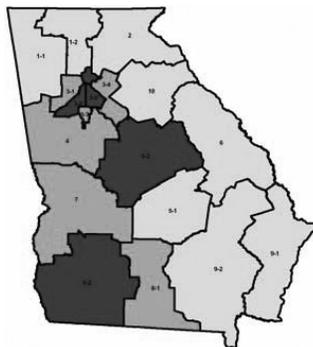


**Prostate cancer is the most commonly diagnosed cancer among Georgia men.**

## PROSTATE CANCER

- Prostate cancer is the most commonly diagnosed cancer among Georgia males.
- Over 6,100 new cases of prostate cancer were diagnosed in 2005.
- Prostate cancer accounts for 29% of all new cancer cases among males.
- The prostate cancer incidence rate among black males is 76% higher than among white males in Georgia.
- One in six American males in the United States will develop prostate cancer in his lifetime.

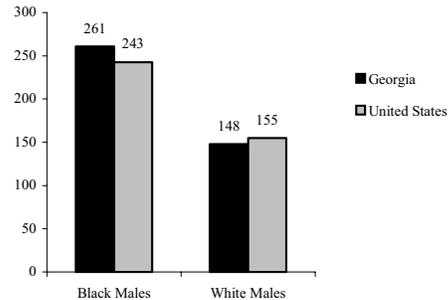
**Prostate Cancer Incidence Rates, by Health District, Georgia, 1999-2002**



- Rate significantly higher than the state
- No significant difference from the state
- Rate significantly lower than the state

- The Northwest (1-1), North Georgia (1-2) North (2), South Central (5-1), East Central (6), Coastal (9-1), Southeast (9-2), and Northeast (10) Health Districts have significantly lower prostate cancer incidence rates than the state average.
- The Fulton (3-2), DeKalb (3-5), North Central (5-2), and Southwest (8-2) Health Districts have significantly higher prostate cancer incidence rates than the state average.

**Age-adjusted Prostate Cancer Incidence Rate, Georgia (1999-2002) and United States (1998-2002)**



## RISK FACTORS

- Increasing age (about 90% of cases are diagnosed in males over age 55)
- Black
- Family history
- Obesity

## PREVENTION

There is no known way to prevent prostate cancer. Studies are underway to determine if early detection of prostate cancer in large groups of men will lower the prostate cancer death rate. Until that information is available, whether or not a man should undergo prostate cancer screening is a decision that should be made after discussing the risks and the benefits with the physician.

**Data source:** Georgia Comprehensive Cancer Registry (1999-2002)  
**Date updated:** December 2005  
**Publication number:** DPH05.122H  
 Visit <http://www.health.state.ga.us/programs/qccr/index.asp> for more information about cancer in Georgia.

Georgia Department of Human Resources, Division of Public Health – 2 Peachtree Street, NW – Atlanta, GA 30303 – (404) 657-3103 – [gdphinfo@dhr.state.ga.us](mailto:gdphinfo@dhr.state.ga.us) – <http://health.state.ga.us>

Division of Public Health  
<http://health.state.ga.us>

Stuart T. Brown, M.D.  
*Director*  
*State Health Officer*

Epidemiology Branch  
<http://health.state.ga.us/epi>

Susan Lance, D.V.M., Ph.D.  
*Director*  
*State Epidemiologist*

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Georgia Department of  
 Human Resources  
 Division of Public Health

Two Peachtree St., N.W.  
 Atlanta, GA 30303-3186  
 Phone: (404) 657-2588  
 Fax: (404) 657-7517

Please send comments to:  
[gaepinfo@dhr.state.ga.us](mailto:gaepinfo@dhr.state.ga.us)



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**Reported Cases of Selected Notifiable Diseases in Georgia Profile\* for May 2006**

| Selected Notifiable Diseases             | Total Reported for May 2006 | Previous 3 Months Total Ending in May |      |      | Previous 12 Months Total Ending in May |       |       |
|--|-----------------------------|---------------------------------------|------|------|--|-------|-------|
|  | 2006                        | 2004                                  | 2005 | 2006 | 2004                                   | 2005  | 2006  |
| Campylobacteriosis                       | 55                          | 131                                   | 141  | 141  | 611                                    | 582   | 616   |
| <i>Chlamydia trachomatis</i>             | 3070                        | 8710                                  | 8278 | 9292 | 34853                                  | 33867 | 35203 |
| Cryptosporidiosis                        | 16                          | 17                                    | 31   | 37   | 137                                    | 173   | 186   |
| <i>E. coli</i> O157:H7                   | 5                           | 11                                    | 4    | 9    | 33                                     | 18    | 35    |
| Giardiasis                               | 47                          | 187                                   | 161  | 138  | 856                                    | 881   | 698   |
| Gonorrhea                                | 1426                        | 3763                                  | 3642 | 4201 | 16582                                  | 15937 | 16754 |
| <i>Haemophilus influenzae (invasive)</i> | 12                          | 44                                    | 30   | 33   | 115                                    | 112   | 112   |
| Hepatitis A (acute)                      | 10                          | 87                                    | 19   | 18   | 701                                    | 197   | 112   |
| Hepatitis B (acute)                      | 13                          | 119                                   | 44   | 53   | 511                                    | 361   | 174   |
| Legionellosis                            | 4                           | 17                                    | 8    | 5    | 40                                     | 35    | 34    |
| Lyme Disease                             | 0                           | 5                                     | 1    | 0    | 9                                      | 6     | 5     |
| Meningococcal Disease (invasive)         | 0                           | 3                                     | 3    | 7    | 26                                     | 16    | 18    |
| Mumps                                    | 0                           | 0                                     | 1    | 1    | 2                                      | 3     | 2     |
| Pertussis                                | 1                           | 10                                    | 13   | 2    | 31                                     | 36    | 37    |
| Rubella                                  | 0                           | 0                                     | 0    | 0    | 1                                      | 0     | 0     |
| Salmonellosis                            | 129                         | 251                                   | 274  | 273  | 2068                                   | 1944  | 1966  |
| Shigellosis                              | 88                          | 167                                   | 128  | 224  | 836                                    | 566   | 837   |
| Syphilis - Primary                       | 5                           | 42                                    | 29   | 25   | 147                                    | 105   | 121   |
| Syphilis - Secondary                     | 22                          | 119                                   | 139  | 63   | 482                                    | 497   | 440   |
| Syphilis - Early Latent                  | 26                          | 130                                   | 103  | 64   | 594                                    | 336   | 355   |
| Syphilis - Other**                       | 49                          | 225                                   | 250  | 191  | 841                                    | 939   | 865   |
| Syphilis - Congenital                    | 0                           | 2                                     | 1    | 1    | 7                                      | 4     | 4     |
| Tuberculosis                             | 35                          | 165                                   | 122  | 119  | 548                                    | 485   | 495   |

\* The cumulative numbers in the above table reflect the date the disease was first diagnosed rather than the date the report was received at the state office, and therefore are subject to change over time due to late reporting. The 3 month delay in the disease profile for a given month is designed to minimize any changes that may occur. This method of summarizing data is expected to provide a better overall measure of disease trends and patterns in Georgia.

\*\* Other syphilis includes latent (unknown duration), late latent, late with symptomatic manifestations, and neurosyphilis.

**AIDS Profile Update**

| Report Period                    | Total Cases Reported* |         |        | Percent Female | Risk Group Distribution (%) |      |         |      |       |         | Race Distribution (%) |       |       |
|----------------------------------|-----------------------|---------|--------|----------------|-----------------------------|------|---------|------|-------|---------|-----------------------|-------|-------|
|                                  | <13yrs                | >=13yrs | Total  |                | MSM                         | IDU  | MSM&IDU | HS   | Blood | Unknown | White                 | Black | Other |
| Latest 12 Months:<br>09/05-08/06 | 4                     | 1,577   | 1,581  | 26.5           | 31.7                        | 6.8  | 1.8     | 8.2  | 1.1   | 50.4    | 22.3                  | 75.9  | 1.8   |
| Five Years Ago:<br>09/01-08/02   | 1                     | 1,623   | 1,624  | 26.8           | 39.1                        | 8.0  | 3.0     | 19.0 | 2.1   | 28.8    | 18.3                  | 76.9  | 4.8   |
| Cumulative:<br>07/81-08/06       | 228                   | 30,229  | 30,457 | 19.7           | 44.7                        | 15.5 | 4.9     | 14.1 | 1.8   | 19.1    | 31.6                  | 66.2  | 2.3   |

MSM - Men having sex with men      IDU - Injection drug users      HS - Heterosexual

\* Case totals are accumulated by date of report to the Epidemiology Section