

# Introduction to Communicable Disease Surveillance and Investigation in North Carolina



# Surveillance for Zoonotic Diseases

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# Learning Objectives

- Describe what makes a communicable disease zoonotic.
- Identify the causative organism for tularemia, brucellosis, and Q-Fever
- Describe the major routes of transmission for tularemia, brucellosis, and Q-Fever
- Locate guidance for case definition and disease investigation steps for reportable diseases in North Carolina



# Zoonotic Disease Resources

- NC DPH Communicable Disease Manual  
<http://epi.publichealth.nc.gov/cd/lhds/manuals/cd/to c.html>
- CDC: National Center for Emerging and Zoonotic Infectious Diseases  
<https://www.google.com/search?q=cdc+%2B+zoonotic+diseases&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a>
- *APHA Control of Communicable Disease Manual*, current edition
- Communicable Disease Branch On Call
- (24/7), 919-733-3419



# What is a Zoonosis?

- An infection or infectious disease transmissible under natural conditions from vertebrate animals to humans.
- Approximately 60% of human pathogens
- Approximately 75% of emerging infectious diseases
- Examples: anthrax, tularemia, brucellosis, Q-Fever, rabies, Lyme disease, West Nile Virus and many others



# REPORTABLE DISEASES & CONDITIONS

## 10A NCAC 41a .0101

a.) The following named diseases and conditions are declared to be dangerous to the public health and are hereby made reportable within the time period specified after the disease or condition is reasonably suspected to exist:

c.) Laboratories shall report

- Anthrax and Tularemia – immediately
- Brucellosis - within 7 days
- Q Fever - within 7 days



# General Investigation Steps

- Review case definition; read about the disease
- Contact the epidemiologist on call at the Communicable Disease Branch
- Complete the investigation steps and reporting form questions located in the CD Manual
- Enter the data into NC EDSS (clinical and risk history information is critical!)
- Determine source of transmission and follow up, including potential for bioterrorism event, and potential for exposures in the laboratory



# Tularemia

**Agent:** *Franciscella tularensis*

## Transmission

- Arthropods: dog tick, lone star tick and deerfly bites
- Skin contact with infected animals and carcasses (skinning, dressing, necropsies)
- Ingestion of contaminated water or food
- Inhalation of contaminated dusts or aerosols
- Bioterrorism





# Tularemia

**Incubation Period:** 1 to 14 days

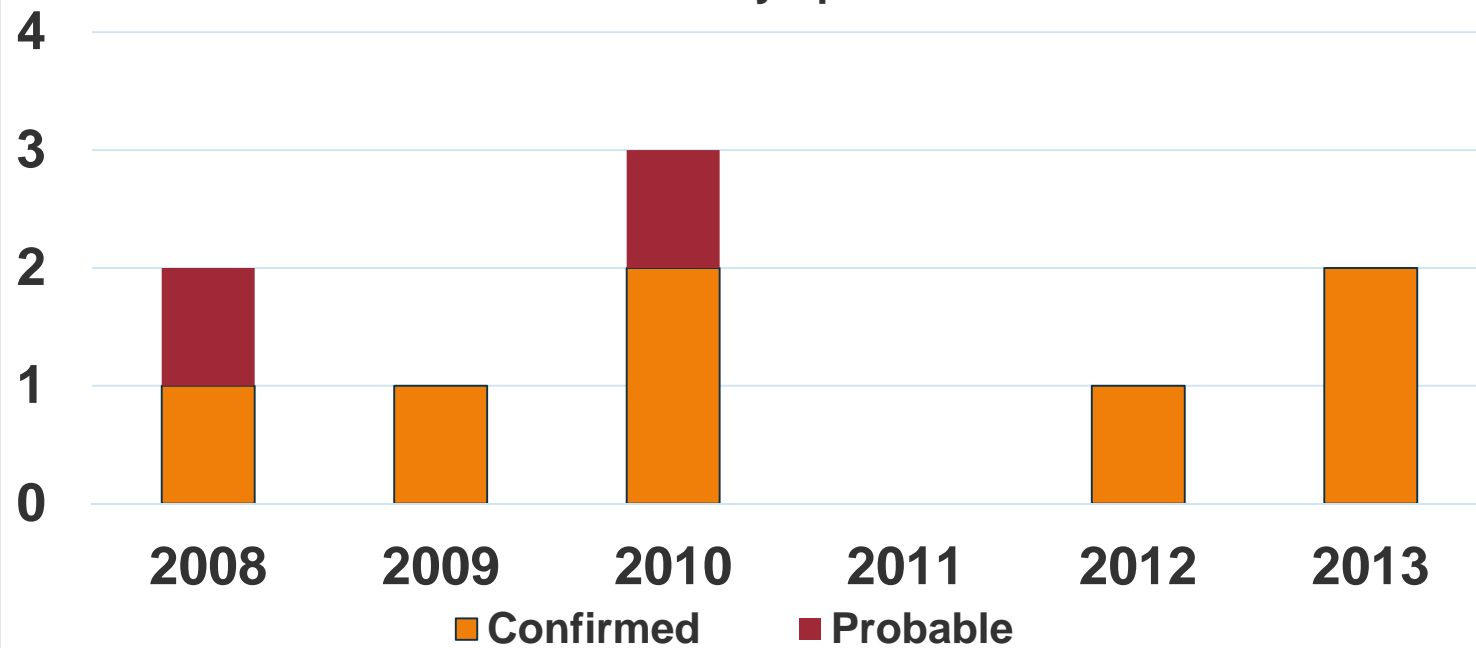
## **Risk History**

Occupational, Recreational

- Hunters (rabbits) -  
skinning, evisceration, food preparation
- Wildlife workers
- Campers, hikers (ticks, deerflies)
- Veterinarians
- Laboratorians
- Taxidermists
- Feral cat bites



**North Carolina Human Tularemia Cases  
(Confirmed and Probable)  
2008 – September 2013 (n = 9)  
NCEDSS Date of Symptom Onset**



# Tularemia Case Definition

## Clinical Description

An illness characterized by one or more distinct forms:

- Ulceroglandular
- Glandular
- Oculoglandular
- Oropharyngeal
- Intestinal
- Pneumonic
- Typhoidal



# Tularemia Case Definition

## Confirmed

An illness characterized by one or more of the clinical forms

**and**

Confirmatory lab results including

- Isolation of *F. tularensis* in a clinical specimen, **or**
- Fourfold or greater change in the serum antibody titer (DFA) to *F. tularensis*



# Tularemia Case Definition

## Probable

An illness characterized by one or more of the clinical forms

**and**

Presumptive Laboratory Results, including **either**

- Elevated serum antibody titer(s) to *F. Tularensis* antigen
- or**
- Detection of *F. tularensis* in a clinical specimen by Immunofluorescent Assay



# Tularemia

## Diagnosis and Treatment

- Difficult to diagnose
- Rare disease
- Clinical Risk History of exposures (animals, ticks)
- Treatment: antibiotics
- Duration and outcome depends on stage of illness
- Complete recovery not unusual



# *Franciscella tularensis*



## Laboratory Exposures

- Investigate potential laboratory exposures
- Determine all laboratories that may have cultured an isolate from a clinical specimen or blood from a tularemia patient
- See the CDC website  
<http://www.cdc.gov/tularemia/laboratoryexposure/>

# Tularemia



## Prevention Messages

Hunters (hunting, trapping, skinning animals)

- Use gloves; cook meat thoroughly

Hikers, campers, outdoor workers

- 20-30% DEET or other FDA approved skin repellent; long sleeves and pants
- Daily tick checks
- Don't drink surface waters

Don't mow over dead animals; wear a dust mask when mowing



# Brucellosis

## “Undulant Fever”

*Brucella spp.* (bacterium)

**Agent** (animals infected by species)

- *Brucella suis* – pigs (feral swine)
- *Brucella mellitensis* - goats and sheep
- *Brucella abortus* – cattle, camels, bison, elk, caribou, moose
- *Brucella canis* – dogs



# Brucellosis

## Transmission

- Eating or drinking  
raw, unpasteurized dairy products; eating undercooked meat
- Inhalation  
laboratory workers, butchering feral swine, slaughterhouses
- Skin wounds, mucous membranes  
butchering/necropsying animals, excretions, birthing products; meat packing, hunters
- Person to person  
breastfeeding, sexual, tissue transplants, blood transfusions



# Brucellosis Risk History

## N.C. Occupational, Recreational

- Slaughterhouse workers, meat packers
- Veterinarians
- Hunters & wildlife workers - feral swine, elk bison, caribou, and moose
- Laboratory workers – manipulation of culture isolates outside of the hood



# Brucellosis Risk History

## Travel/Military/Tourist

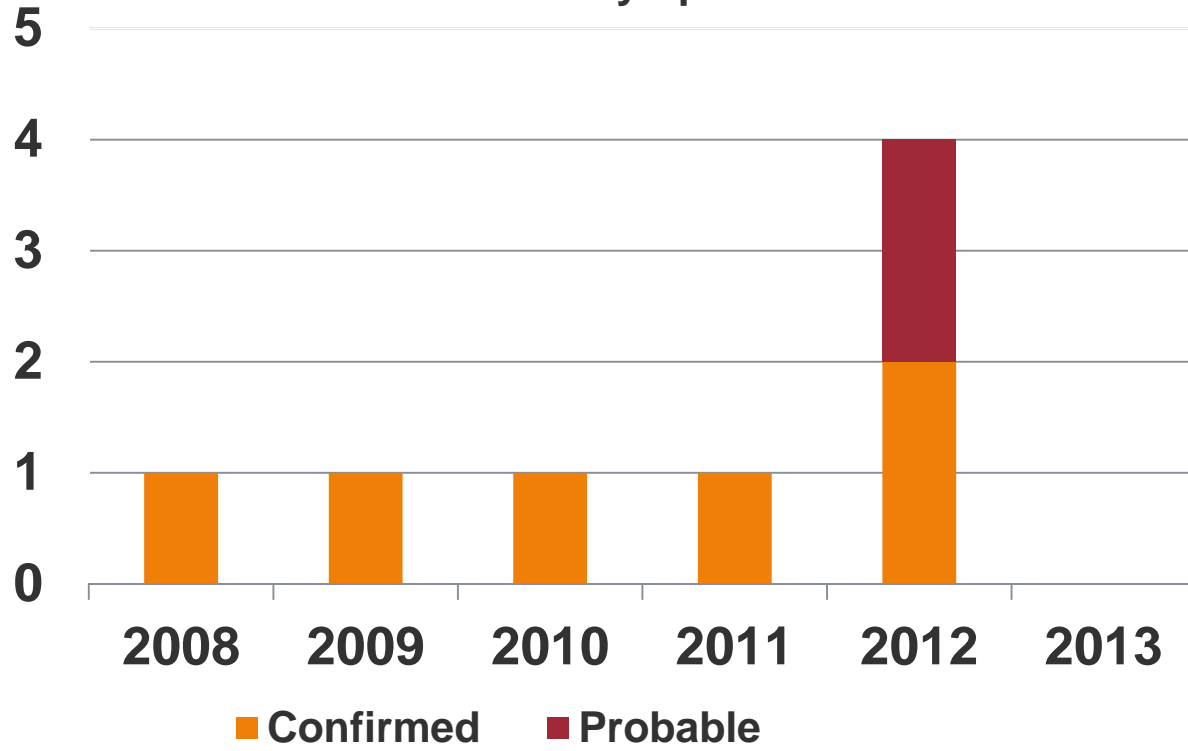
Unpasteurized, raw dairy products; “Village Cheeses”; undercooked meat

Areas at risk

- Mediterranean Basin
- Mexico, South and Central America
- Eastern Europe
- Asia
- Africa
- The Caribbean
- The Middle East



**North Carolina Human Brucellosis Cases  
(Confirmed and Probable)  
2008 – September 2013 (n = 8)  
NCEDSS Date of Symptom Onset**



# Brucellosis Case Definition

## Clinical Description

- An illness characterized by acute or insidious onset of fever, **and**
- One or more of the following: night sweats, arthralgia, headache, fatigue, anorexia, myalgia, weight loss, arthritis/spondylitis, meningitis, **or** focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly)

**Incubation period:** 1-2 months, up to 6 months



# Brucellosis Case Definition

## Confirmed

Clinical criteria, **and**  
Definitive Lab Criteria

- Culture and identification of *Brucella spp.* from clinical specimens, **or**
- Evidence of a fourfold or greater rise in *Brucella* antibody titer (standard tube agglutination test (SAT) or *Brucella* microagglutination test (BMAT)) between acute and convalescent phase serum specimens obtained greater than or equal to 2 weeks apart



# Brucellosis Case Definition

## Probable

- Clinical criteria, **and**
- Presumptive Lab Criteria
  - *Brucella* total antibody titer of greater than or equal to 160 by standard tube agglutination test (SAT) or *Brucella* microagglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms , **or**
  - Detection of *Brucella* DNA in a clinical specimen by PCR assay





# *Brucella spp.*



## Laboratory Exposures

- Investigate potential laboratory exposures
- Determine all laboratories that may have cultured an isolate from a clinical specimen or blood from a brucellosis patient
- Contact the Communicable Disease Branch epidemiologist on call who will contact the Bioterrorism and Emerging Pathogens Unit (BTEP)

# Brucellosis

## Diagnosis and Treatment

- Physician diagnosis
- Doxycycline and Rifampin (6-8 weeks)
- Special consideration for allergic or pregnant or immune-compromised
- Recovery may take a few weeks to several months.
- Death from brucellosis is rare, occurring in no more than 2% of all cases.



# Brucellosis

## Prevention and Control

- Hunter education
- Education of travelers and military personnel to developing countries
- Unpasteurized dairy products, undercooked meat
- Laboratory exposure investigation
- Contact investigation; epidemiological link



# Q Fever

## **Agent: *Coxiella burnetti***

- Worldwide zoonosis
- Non-specific symptoms
- Acute and chronic stages
- Underreported, underdiagnosed
- Reservoirs: cattle, sheep, goats
- Excreted in milk, urine, feces, birthing fluids (high numbers)
- Resistant organism, survives long periods



# 2013 National Guidelines for the Diagnosis and Management of Q fever in the United States

- Recommendations for monitoring of high-risk patients
- Recommendations for treatment for acute Q fever during pregnancy
- Occupational health guidance



# Q Fever

## Transmission

- Inhalation – barnyard dust contaminated with dried birth fluids, excreta of infected animals
- Tick bites
- Ingestion of unpasteurized milk or dairy products
- Hardy; low infectious dose



# Q Fever

## Risk History

### Occupational

- Slaughterhouse workers
- Veterinarians
- Farmers

Rural – living within 10 mi of livestock

Urban outbreaks – no known exposure

Largest outbreak – 2007-2010, 4,000 cases

Netherlands, dairy goat farms, wind drift

Travel to endemic areas



# *Coxiella burnetii* Antigens

- Two antigenic phases – different reactions
- Phase I – virulent, highly infectious, transitions to Phase II
- Acute infection – Phase II
  - Phase II antibody response
  - Appears first and is higher than the Phase I antibody response
- Chronic infection – Phase I antibody response is higher than Phase II.





# Q Fever

## Acute Phase

Acute Q Fever: *C. Burnetti* antibody response to phase II antigen greater than phase I antigen

- Nonspecific febrile illness, hepatitis, pneumonia
- Asymptomatic up to 50%
- Mortality rate – less than 2% (hospitalized)
- Post-Q Fever Fatigue Syndrome



# Q Fever

## Chronic Stage

Chronic Q Fever: weeks, months to several years after acute infection

- Rare, <5% acute proceed to chronic
- Risk factors – pregnant, immunosuppressed, pre-existing heart valve defects
- Blood culture negative endocarditis 60-70%
- Difficult diagnosis– vegetative lesions on echo only 12%;
- Fatal without treatment
- Other forms

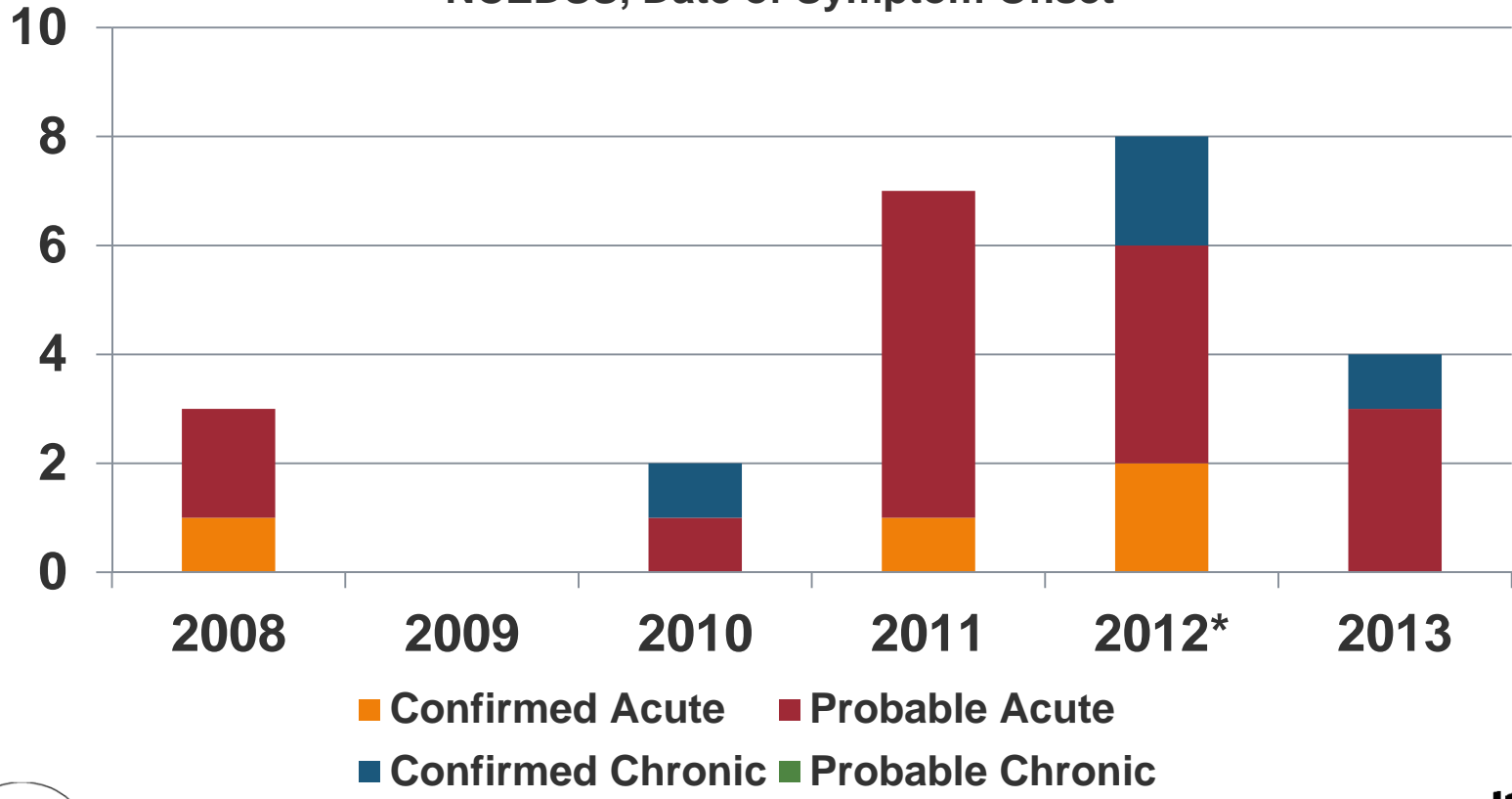


# Q Fever Epidemiology

- US incidence and prevalence
  - Persons  $\geq$  40 years
  - 60 - 64 years highest age-related risk
  - Males
  - Spring (livestock birthing or farm management practices)



**North Carolina Human Q Fever Cases  
(Confirmed and Probable)  
2008 – September 2013 (n = 24\*)  
NCEDSS, Date of Symptom Onset**



\* One patient in 2012 was confirmed an acute and chronic case



# Q Fever Case Definition

## Acute Form - Confirmed (2009)

### Clinical Evidence

- Acute fever and one or more:
- Rigors,
- severe retrobulbar headache,
- acute hepatitis,
- pneumonia or
- elevated liver enzymes

### Lab Supportive Criteria

One or more:

- 4 fold rise in IgG antibody titer to *C. burnetii* Phase II, antigen by IFA between paired sera, 3-6 wks apart, or
- Detection of *C. burnetii* DNA in clinical specimen by PCR, or
- *C. burnetii* in clinical specimen by IHC, or
- *C. burnetii* culture isolation



# Q Fever Case Definition

## Acute Form - Probable (2009)

### Clinical Evidence

- Acute fever and one or more:
- Rigors,
- severe retrobulbar headache,
- acute hepatitis,
- pneumonia or
- elevated liver enzymes

### Lab Supportive Criteria

One or more:

- A single IgG titer
- $\geq 1:128$  to *C. burnetii* antigen by IFA, or
- Serological evidence of elevated phase II IgG or IgM antibody reactive with *C. burnetii* by ELISA, dot-ELISA, or latex agglutination



# Q Fever Case Definition

## Chronic Form – Confirmed (2009)

### Clinical Criteria

- Newly recognized culture- negative endocarditis, (particularly in a patient with previous valvulopathy or immune-compromise),
- suspected infection of a vascular aneurysm or vascular prosthesis, OR
- chronic hepatitis, osteomyelitis, osteoarthritis, or pneumonitis in the absence of other etiology

### Laboratory Supportive Criteria

One or more:

- IgG titer  $\geq 1:800$  to *C. Burnetii* phase I antigen by IFA, or
- Detection of *C. burnetii* DNA in a clinical specimen by PCR, or
- Demonstration of *C. burnetii* DNA in a clinical specimen by IHC, or
- Isolation of *C. burnetii* from a clinical specimen by culture



# Q Fever Case Definition

## Chronic Form – Probable (2009)

### Clinical Criteria

- Newly recognized culture- negative endocarditis, (particularly in a patient with previous valvulopathy or immune-compromise),
- suspected infection of a vascular aneurysm or vascular prosthesis, OR
- chronic hepatitis, osteomyelitis, osteoarthritis, or pneumonitis in the absence of other etiology

### Laboratory Supportive Criteria

- An antibody titer to *C. burnetii* Phase I IgG antigen  $\geq 1:128$  and
- $< 1:800$  by IFA





# Q Fever Summary

## Prevention

- Occupational - veterinarians, workers at meat processing plants, sheep and dairy workers, livestock farmers, and researchers at facilities housing sheep
- Travel/Military
- Pre-existing cardiac valvular disease or individuals with vascular grafts, and persons with immunosuppressive conditions.



# Zoonotic Disease Summary

Know your community

- Occupations/farmers/ranchers
- Animal industry - Species of animals
- Recreational
- Hunting

Educate your community



# Tularemia

## Resources and References

- CDC: Tularemia  
<http://www.cdc.gov/tularemia/>



# Brucellosis Resources & References



- Interpretation of Laboratory Results

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5722a3.htm>

- Assessing Laboratory Exposures

<http://www.cdc.gov/brucellosis/laboratories/risk-level.html>

- Hunter education

[http://www.cdc.gov/brucellosis/pdf/brucellosis\\_and\\_hoghunters.pdf](http://www.cdc.gov/brucellosis/pdf/brucellosis_and_hoghunters.pdf)

- MMWRs Brucellosis – Feral Swine

<http://www.cdc.gov/mmwr/preview/mmwr>

- CDC Brucellosis References & Resources

<http://www.cdc.gov/brucellosis/resources/articles.html>



# Q Fever

## Resources and References

- *Diagnosis and Management of Q Fever – United States, 2013. Recommendations from CDC and the Q Fever Working Group*  
<http://www.cdc.gov/mmwr/PDF/rr/rr6203.pdf>
- CDC - Q fever <http://www.cdc.gov/qfever/>
- NC DHHS Communicable Disease Manual  
<http://epi.publichealth.nc.gov/cd/lhds/manuals/cd/toc.html>
- *Evaluation of Factors that Would Initiate or Propagate Epidemic Coxiellosis in the U.S. Domesticated Goat Population*  
[http://www.aphis.usda.gov/animal\\_health/emergingissues/downloads/QFeverRiskAssessment\\_FINAL.pdf](http://www.aphis.usda.gov/animal_health/emergingissues/downloads/QFeverRiskAssessment_FINAL.pdf)



# Veterinary Public Health Contact Information

1902 Mail Service Center  
Raleigh NC 27699-1902

Phone: (919) 733-3410/733-3419

FAX: (919) 733-9555

<http://epi.publichealth.nc.gov/cd/diseases/rabies.html>

