

Trichinosis (Trichinellosis)

Signs and Symptoms	<ul style="list-style-type: none"> Ranges asymptomatic to severe depending on host and dose Initial enteral phase (nausea, vomiting, diarrhea); later parenteral phase (fever, muscle aches, weakness, periorbital edema); can also be rash, retinal or subungual hemorrhages, myocarditis, pneumonia, thromboembolic disease, encephalitis 		
Incubation	Enteral phase a few days, systemic symptoms usually 1-2 weeks (range 5-56 days)		
Case classification	Clinical criteria: fever, myalgia, periorbital edema, eosinophilia		
	Confirmed: Clinically consistent with either <i>Trichinella</i> larvae in muscle biopsy <u>or</u> serologic test for <i>Trichinella</i> positive	Probable: Clinically consistent with shared epidemiologically implicated meal <u>or</u> epidemiologically implicated meat product <u>or</u> meat product in which the parasite was demonstrated	Suspect: No consistent illness but ate implicated meal or meat product <u>and</u> serologic test for <i>Trichinella</i> positive
Differential diagnosis	Extensive: angioedema, ascariasis, bacterial or viral gastroenteritis, encephalitis, filariasis, glomerulonephritis, hookworm, influenza, leptospirosis, polyarteritis nodosa, rheumatic fever, schistosomiasis, strongyloidiasis, typhoid, etc.		
Treatment	Early antiparasitic drugs, sometimes corticosteroids. Rare fulminant cases can be fatal.		
Duration	Even after treatment, may be extended symptoms from larvae embedded in muscle		
Exposure	Through ingestion of meat: wild game (bear, cougar, arctic mammals), home-raised or rarely free-range pigs or boars, rats; affected meat (particularly from arctic area) may not be inactivated by freezing or drying (jerky)		
Laboratory testing	<p>Local Health Jurisdiction (LHJ) and Communicable Disease Epidemiology (CDE) arrange testing for individual cases and environmental testing for suspected outbreaks. Serology is done at CDC.</p> <ul style="list-style-type: none"> Washington State Public Health Laboratories can look at food samples Best specimens: <u>serum</u> collected ≥ 3 weeks from onset; <u>skeletal muscle biopsy</u> collected ≥ 2 weeks from onset; <u>implicated meat</u> (preferably large muscle, diaphragm, tongue, jaw, shank) in sterile leak-proof container and original packaging <p><i>Specimen shipping (Section 4):</i></p> <ul style="list-style-type: none"> Keep all specimens cold, ship according to PHL requirements: https://doh.wa.gov/public-health-provider-resources/public-health-laboratories/lab-test-menu Specimen Collection and Submission Instructions https://www.doh.wa.gov/Portals/1/Documents/5240/SCSI-Para-SpecID-V1.pdf https://www.doh.wa.gov/Portals/1/Documents/5240/SCSI-Food-Trich-V1.pdf 		
Public health actions	Immediately report to CDE any cases with commercial food exposures		
URGENT	<ul style="list-style-type: none"> Identify any risk exposures including during international travel Conduct traceback for implicated commercial product Identify others sharing exposure and recommend early antiparasitic treatment if symptoms develop Educate case about safe handling of risk meats <p><i>Infection Control:</i> standard precautions</p>		

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1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To identify sources of transmission (e.g., contaminated meat) and to prevent further transmission from such sources.
2. To educate exposed persons about signs and symptoms of disease, thereby facilitating early diagnosis.
3. To educate people about how to reduce their risk of infection.

B. Legal Reporting Requirements

1. Health care providers and Health care facilities: notifiable to local health jurisdiction within 3 business days.
2. Laboratories: notifiable to local health jurisdiction within 2 business days; submission on request – specimen associated with positive result, within 2 business days
3. Local health jurisdictions: notifiable to the Washington State Department of Health (DOH) Communicable Disease Epidemiology (CDE) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Begin follow up investigation within one business day.
2. Report all *confirmed* cases to CDE (see definition below). Complete the standard case report form <https://www.doh.wa.gov/Portals/1/Documents/5100/210-062-ReportForm-Trichinosis.pdf> and enter the data into the Washington Disease Reporting System (WDRS).

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Trichinosis is caused by intestinal roundworms (nematodes) in the genus *Trichinella*. *T. spiralis* occurs worldwide and causes most human infections; a *T. murrelli* outbreak was due to bear meat (<https://www.ajtmh.org/view/journals/tpmd/87/2/article-p297.xml>).

B. Description of Illness

Although most infections are subclinical, illness in humans is highly variable and can range from asymptomatic infection to a fulminating, fatal disease, depending on the number of larvae ingested and the person's age and immunologic status. In the week after being ingested in infected meat, larvae mature into adult worms in the intestine and may cause abdominal discomfort, nausea, vomiting and/or diarrhea. Weeks later as the larvae from these adult worms migrate into tissues, persons may develop fever, myalgias, weakness, malaise, and periorbital edema. Less frequently, persons develop rash, photophobia, and retinal or subungual hemorrhages. In severe cases, myocarditis, pneumonia, thromboembolic disease, and encephalitis may develop and cause death.

C. Trichinosis in Washington State

There are no or rarely 1 or 2 reports of trichinosis per year. The rare cases in recent years have been associated with wild game: cougar or bear meat, eaten raw or as jerky. Two cases in 2022 reporting eating venison.

D. Reservoirs

Many omnivores and carnivores can be infected. Reservoirs include home-raised or free-range pigs or boars, cougars, seals, bears/polar bears, dogs, rats, foxes, and wolves.

E. Modes of Transmission

Trichinosis is acquired by eating raw or insufficiently cooked flesh of mammals containing viable encysted larvae; meat jerky may be uncooked meat cured by drying. After ingestion, larvae develop into adult worms in the epithelium of the small intestine. Gravid female worms then produce larvae which penetrate the intestinal wall, disseminate via the bloodstream throughout the body, and become encapsulated in skeletal muscle. In the United States, trichinosis was associated historically with eating undercooked pork from domesticated sources when pigs were fed raw food scraps or could eat rats, but now wild game meat is the most common source.

F. Incubation Period

Gastrointestinal symptoms (enteral phase) may appear within a few days. Systemic symptoms (parenteral phase) usually appear 1–2 weeks after ingestion of infected meat but may appear between 5 and 56 days depending on the number of parasites involved.

G. Period of Communicability

The infection is not transmitted directly from person to person.

H. Treatment

Albendazole or mebendazole appear to be effective when given early in the course of the illness. Although these medications are active against adult worms in the gut, they have little effect on larvae embedding in tissue. If delayed, antiparasitic treatment may need longer duration. Corticosteroids are used when symptoms are severe.

3. CASE DEFINITIONS

A. Clinical Criteria for Diagnosis

A disease caused by ingestion of *Trichinella* larvae, usually through consumption of *Trichinella*-containing meat—or food contaminated with such meat—that has been inadequately cooked prior to consumption. The disease has variable clinical manifestations. Common signs and symptoms among symptomatic persons include eosinophilia, fever, myalgia, and periorbital edema.

B. Laboratory Criteria for Diagnosis

Human specimens

1. Demonstration of *Trichinella* larvae in tissue obtained by muscle biopsy, or
2. Positive serologic test for *Trichinella*.

Food specimens

Demonstration of *Trichinella* larvae in food (probable)

C. Case Definition (2014)

Suspect: a case where there is no clinically compatible illness should be reported as suspect if the person shared an epidemiologically implicated meal, or ate an epidemiologically implicated meat product, and has a positive serologic test for trichinosis (and no known prior history of *Trichinella* infection).

Probable: a clinically compatible illness in a person who shared an epidemiologically implicated meal or ate an epidemiologically implicated meat product.

OR

a clinically compatible illness in a person who consumed a meat product in which the parasite was demonstrated.

Confirmed: a clinically compatible case that is laboratory confirmed in the patient.

D. Comments

Persons who shared the implicated meat/meal should be investigated and considered for case status as described above.

Epidemiologically implicated meals or meat products are defined as a meal or meat product that was consumed by a person who subsequently developed a clinically compatible illness that was laboratory confirmed.

Serial or subsequent cases of trichinosis experienced by one individual should only be counted if there is an additional epidemiologically compatible exposure. Because the duration of antibodies to *Trichinella* spp. is not known, mere presence of antibodies without a clinically-compatible illness AND an epidemiologically compatible exposure may not indicate a new infection especially among persons with frequent consumption of wild game species known to harbor the parasite.

Negative serologic results may not accurately reflect disease status if blood was drawn less than 3-4 weeks from symptom onset.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

The diagnosis of trichinosis is likely in persons with myositis, fever, periorbital edema, eosinophilia and a history of consuming non-commercial high-risk meat (particularly wild game) that is raw or under-cooked. Laboratory confirmation is commonly made by detection of *Trichinella* specific antibodies in serum drawn at least 3 weeks after infection. The diagnosis can also be confirmed by identification of *Trichinella* larvae in a skeletal muscle biopsy specimen (taken at least two weeks after infection) but a biopsy is not often necessary.

B. Services Available at the Washington State Public Health Laboratories (PHL)

PHL can assist in identifying *Trichinella* species in a muscle biopsy or food specimen, and will forward serology specimens for testing at the CDC. Before submitting a

specimen Contact Office of Communicable Disease Epidemiology (206-418-5500) for approval.

Note that PHL require all clinical specimens have two patient identifiers, a name **and** a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date. For details see: <https://www.doh.wa.gov/Portals/1/Documents/5240/SCSI-Para-SpecID-V1.pdf>
<https://www.doh.wa.gov/Portals/1/Documents/5240/SCSI-Food-Trich-V1.pdf>

C. Specimen Collection

Label serum or biopsy specimens with two identifiers (e.g., name and date of birth). Keep all specimens **cold**, ship according to PHL requirements: <https://doh.wa.gov/public-health-provider-resources/public-health-laboratories/lab-test-menu>

5. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent information.

A. Identify Potential Sources of Infection

Ask about possible exposures 5–45 days before onset, including:

1. Handling or eating raw/undercooked pork or pork products or other meats
2. Handling or eating raw/undercooked wild game meat including dried or cured (salted) wild game such as deer jerky or feral pig sausage, or eating meat that could have been cross-contaminated with wild game meat on home meat grinders
3. Travel outside the United States (determine dates and locations)

B. Identify Potentially Exposed Persons

Identify persons who shared the same exposure as the patient. Persons exposed to the same source as the case should be educated about symptoms of trichinosis. Prophylaxis with antiparasitic agents should be recommended to persons who recently ingested contaminated meat.

C. Infection Control Recommendations:

Hospitalized patients should be cared for using standard precautions.

No work or child care restrictions are needed.

D. Environmental Evaluation

If the source of the patient's exposure is a commercial product, immediately contact Communicable Disease Epidemiology or the DOH Food Safety Program and work with them to begin a traceback investigation.

1. Potentially infected meat should not be consumed by others.
2. If improper cooking of meat is suspected at a restaurant, inspect the restaurant.

6. MANAGING SPECIAL SITUATIONS

A. Possible Foodborne Outbreaks

Trichinosis is not a frequent cause of foodborne outbreaks. . Clusters in the United States were recently associated with privately raised boar meat: (<https://www.cdc.gov/mmwr/volumes/67/wr/mm6708a3.htm>, walrus meat (<https://www.cdc.gov/mmwr/volumes/66/wr/mm6626a3.htm>), bear jerky (<https://www.cdc.gov/dpdx/monthlycasestudies/2016/case426.html>) or with black bear meat [[Outbreak of Human Trichinellosis — Arizona, Minnesota, and South Dakota, 2022 | MMWR \(cdc.gov\)](#)]. Consult Office of Communicable Disease Epidemiology (206-418-5500) if you suspect a common-source outbreak or a commercial food source.

7. ROUTINE PREVENTION

A. Immunization Recommendations: None

B. Prevention Recommendations <https://www.cdc.gov/trichinellosis/prevention/index.html>

- Cook meat products until the juices run clear or to an internal temperature of 170° F. Microwaving may not effectively kill all worms.
- Freeze pork less than 6 inches thick for 20 days at 5° F or colder to kill any worms.
- Cook wild game meat thoroughly. Freezing wild game meats, unlike freezing pork products, even for long periods of time, may not effectively kill all worms. Wild game from arctic regions is a particular risk.
- Curing (salting), drying (to make jerky), smoking, or microwaving meat does not consistently kill infective worms. Wild game from arctic regions is a particular risk.
- Cook all meat fed to pigs or other wild animals.
- Clean meat grinders thoroughly if you prepare your own ground meats, particularly wild game meat.
- Do not allow hogs to eat uncooked carcasses of other animals, including rats, which may be infected with trichinosis.

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UPDATES

January 2011: The Legal Reporting Requirements section has been revised to reflect the 2011 Notifiable Conditions Rule revision.

January 2014: Case definition changed to include *Suspect* and *Probable* categories. The former Controlling Further Spread section was combined into section 5.

February 2017: Front page added.

April 2022: Routine review.

December 2022: For WAC revision combined provider and facility reporting requirement, updated laboratory submission (Section 1B)

December 2023: For 2024 WAC revision updated laboratory submission.

July 2024: Routine review; CDC links updated.

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