Ministry of Health

Ontario Public Health Standards:
Requirements for Programs, Services and Accountability

Infectious Disease Protocol

Appendix 1: Case Definitions and Disease-Specific Information

Disease: Q Fever

Effective: August 2023

Ontario

Q Fever

☒ Communicable

☐ Virulent

Health Protection and Promotion Act (HPPA)[1]

Ontario Regulation (O. Reg.) 135/18 (Designation of Diseases)[2]

Provincial Reporting Requirements

☒ Confirmed case

☒ Probable case

As per Requirement #3 of the "Reporting of Infectious Diseases" section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- O. Reg. 569 (Reports) under the HPPA;
- The iPHIS User Guides published by Public Health Ontario (PHO); and
- Bulletins and directives issued by PHO.[3,4]

Type of Surveillance

Case-by-case

Case Definition

Confirmed Case

Clinically compatible signs and symptoms **AND** laboratory confirmation:

- Isolation of *C. burnetii* in culture from a clinical specimen, **OR**
- Demonstration of *C. burnetii* by immunohistochemistry from a clinical specimen, **OR**
- Detection of *C. burnetii* nucleic acid by molecular methods from a clinical specimen, **OR**
- In the context of **acute** Q fever: serological demonstration of a four-fold or higher rise in specific IgG antibody titre to *C. burnetii* phase II antigen by

indirect immunofluorescence assay (IFA) between acute and convalescent sera taken 3-6 weeks apart, **OR**
- In the context of **chronic** (or persistent) Q fever: serological demonstration of a single specific IgG antibody titre to *C. burnetii* phase I antigen ≥ 1:1024 by IFA.

Probable Case

- Clinically compatible signs and symptoms in a person with supportive laboratory evidence (serological demonstration of a specific IgG antibody titre to *C. burnetii* phase II antigen ≥ 1: 256 by IFA), **OR**
- Clinically compatible signs and symptoms in a person with an epi-link to a lab confirmed case, **OR**
- Asymptomatic individual with confirmatory laboratory evidence (as outlined above for a confirmed case) **AND** an epi-link to a confirmed source.

Outbreak Case Definition

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.[3]

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

Outbreak cases may be classified by levels of probability (*i.e.,* confirmed and/or probable).

Clinical Information

Clinical Evidence

Clinically compatible signs and symptoms of acute (or "primary") Q fever may include acute fever, sudden chills, myalgia, weakness, malaise, headache, sweats, acute hepatitis or pneumonia.

Clinically compatible signs and symptoms of chronic (or "persistent") Q fever may

include culture-negative endocarditis, osteomyelitis, osteoarthritis, chronic hepatitis, pneumonitis, and suspected endovascular infection.

Clinical Presentation

Approximately half of humans infected with *C. burnetii* do not show symptoms.[5] Q fever can cause acute (also referred to as "primary") or chronic (also referred to as "persistent") illness in humans. The acute symptoms caused by infection with *C. burnetii* usually develop within 2-3 weeks of exposure.[5,6]

Symptoms commonly seen with acute Q fever include fever, severe headache, general malaise, myalgia, chills/sweats, non-productive cough, nausea, vomiting, diarrhea, abdominal pain, and chest pain. However, it is important to note that the combination, duration, and severity of symptoms vary greatly from person to person.[5,6] Children with Q fever generally have a milder acute illness than adults.[7]

Although most persons with acute Q fever infection have mild illness that resolves on its own without complications, others may experience serious illness with complications that include pneumonia, granulomatous hepatitis, and rarely myocarditis or central nervous system complications.[2,3] Pregnant women who are infected may be at risk for pre-term delivery, miscarriage, stillbirth or low infant birth weight.[5]

Chronic Q fever is a severe disease occurring in <5% of infected patients. It may present soon (within 6 weeks) after an acute infection, or potentially manifest years or decades later.[5,7] Endocarditis is the most commonly identified manifestation of chronic Q fever and is fatal if untreated, whereas with treatment the 10-year mortality rate is 19%.[5,6] Other forms of chronic Q fever include aortic aneurysms and infections of vascular aneurysms, the bone, liver or reproductive organs, such as the testes in males.[5] The three groups at highest risk for chronic Q fever are pregnant women, immunosuppressed persons and patients with pre-existing heart valve defects.[6]

Although the majority of people with acute Q fever recover completely, a post-illness fatigue syndrome has been reported to occur in up to 20% of patients with acute Q fever. This syndrome is characterized by constant or recurring fatigue, night sweats, severe headaches, photophobia, pain in muscles and joints, mood changes,

and difficulty sleeping.[7]

Laboratory Evidence

Laboratory Confirmation

- In the context of acute (or "primary") Q fever: serological demonstration of a four-fold or higher rise in specific IgG antibody titre to *Coxiella burnetii (C. burnetii)* phase II antigen by indirect immunofluorescence assay (IFA) between acute and convalescent sera taken 3-6 weeks apart.
- In the context of chronic (or "persistent") Q fever: serological demonstration of a single specific IgG antibody titre to *C. burnetii* phase I antigen ≥ 1:1024 by IFA.
- Isolation of *C. burnetii* in cell-based or axenic culture from a clinical specimen.
- Demonstration of *C. burnetii* by immunohistochemistry (IHC) from a clinical specimen.
- Detection of *C. burnetii* nucleic acid by molecular methods from a clinical specimen.

Supportive Laboratory Evidence of Infection

- Serological demonstration of a specific IgG antibody titre to *C. burnetii* phase II antigen ≥ 1: 256 by IFA.

Indications and Limitations

- IgM antibodies have lower specificity than IgG antibodies. IgM antibodies may cross-react with other bacteria (i.e., *Bartonella, Legionella, Rickettsia*, etc.).
- During acute infection, phase II antibodies appear first and are usually higher than phase I antibodies. Phase II antibodies are usually detectable by the third week of infection, and decrease within 3 to 6 months. Residual phase II IgG antibody titres may persist for years, therefore low levels of phase II IgG antibody titres (< 1:256) are considered non-specific.
- Phase I antibodies also normally decrease in the months following acute infection, and may become undetectable within years. Persistence or increase in phase I IgG antibody titres following primary infection, especially if

≥ 1:1024, is suggestive of chronic infection. However, documented chronic infections may occur at Phase I IgG antibody titres <1:1024.

- Serologic responses are time-dependent. Specimens obtained too early in the infection may not contain detectable antibody levels. If Q fever is suspected, obtain a second specimen 3 to 6 weeks after onset of symptoms.

For further information about human diagnostic testing, contact the PHO's Laboratory Services at: https://www.publichealthontario.ca/en/Laboratory-Services/Laboratory-Contact.

Case Management

In addition to the requirements set out in the Requirement #2 of the "Management of Infectious Diseases – Sporadic Cases" and "Investigation and Management of Infectious Diseases Outbreaks" sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection.[3] Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

Additional disease-specific information that may be collected includes:

- History of animal exposure during the 30 days prior to symptom onset
- History of out-of-province or international travel
- Consumption of unpasteurized (raw) milk or unpasteurized milk products (e.g., cheese)
- Earliest and latest exposure date
- Occupation, and
- Residency/living within 5 km of a farm or livestock operation.

Treatment is under the direction of the attending health care provider (acute cases generally require treatment with antibiotics).[6]

Provide cases with information about the infection and how it spreads.

If a source has been identified, ask the case(s) for a list of persons who may also have come in contact with the infectious item or area.

Individuals with previously confirmed Q fever and with new evidence of chronic infection should be managed as an update to their initial case status, as their initial infection usually leads to immunity against re-infection.

Contact Management

None, except if exposed to same source, then manage contacts as indicated above in Management of Cases and monitor contacts for clinical signs and symptoms of Q fever. Contacts should seek medical attention if they display signs and symptoms of Q fever.

Outbreak Management

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.[3]

Outbreaks are generally of short duration. Control measures focus primarily on the elimination of sources of infection, observation of exposed persons and provision of antibiotics.[6]

Cases involved in foodborne transmission may not display localized geographical clustering. Non-foodborne illness outbreaks of Q fever will tend to manifest with geographically linked cases.

Prevention and Control Measures

Personal Prevention Measures

Preventive measures:

- Education of workers in high-risk occupations such as sheep and dairy farmers, veterinary researchers, abattoir workers, veterinarians and meat workers about the sources of infection and the need for adequate disinfection and disposal of animal products from parturition;[6]
- Education on proper hygiene practices; and
- Consumption of only pasteurized milk and dairy products from cows, goats and sheep.

Infection Prevention and Control Strategies

Refer to PHO's website to search for the most up-to-date information on Infection Prevention and Control (IPAC).[8]

Disease Characteristics

Aetiologic Agent - Q fever is caused by *Coxiella burnetii (C. burnetii)*, a gram-negative intracellular bacterium.[9] *C. burnetii* can be found in the urine, feces, and milk of infected animals, with the highest numbers of bacteria shed in birth products such as the placenta and amniotic fluid. *C. burnetii* is highly resistant to many disinfectants and environmental conditions.[6]

C. burnetii is at risk for use as a bioterrorism agent.[9]

Modes of Transmission - Infected animals shed the bacteria in urine, feces, milk, and especially birth products such as placenta.[6,9] Shedding of organisms may be intermittent, and environmental contamination may persist for prolonged periods in products such as hides or wool.[7]

Transmission occurs most commonly through airborne dissemination of *C. burnetii* in dust or aerosols from premises contaminated by placental tissues, birth fluids, and excreta of infected animals. Airborne particles containing organisms may be carried downwind for many kilometres. As a result, individual cases may occur where no animal contact can be demonstrated. Infections may also occur from direct exposure to infected animals or tissues or through exposure to contaminated materials such as wool, straw, or even laundry.[6,9] Raw milk from infected goats or cows contains viable organisms and may be responsible for human transmission.[6] Person-to-person transmission is possible, though rare, through sexual transmission, transplacental transmission, and by blood or marrow transfusion.[6,7]

Incubation Period – The incubation period depends on the size of the infectious dose, usually 2-3 weeks for acute Q fever, with a range of 3-30 days.[6] Chronic Q fever can develop within a few weeks of acute Q fever, and up to years after an initial infection.[9]

Period of Communicability - *C. burnetii* is extremely resistant to physical stresses, including heat, disinfectant chemicals and desiccation and can survive in the

environment for months to years.[7,9] Direct person-to-person transmission occurs rarely, although sporadic cases of nosocomial transmission during autopsies and obstetrical procedures of infected women have occurred.[6]

Reservoir - Sheep, cattle, and goats are the primary reservoirs for *C. burnetii*. However, infection has been confirmed in other species, including cats, dogs, some wild mammals (*e.g.,* rodents), birds and ticks.[6] Infected animals, including sheep and cats, are usually asymptomatic but shed high numbers of organisms in placental tissues and birth fluids at parturition.[5,6]

Host Susceptibility and Resistance - Susceptibility is general, with higher rates of symptomatic presentation in men or individuals aged 15 years or older. Persons with valvular heart disease or vascular defects, pregnant women, and persons who are immunosuppressed are at greater risk for chronic Q fever after an acute infection.[6] Those who recover from infection may possess lifelong immunity against re-infection.[7]

Please refer to PHO's Infectious Disease Trends in Ontario (IDTO) interactive tool for the most up-to-date information on infectious disease trends in Ontario.[10]

For additional national and international epidemiological information, please refer to the Public Health Agency of Canada and the World Health Organization.

References

1. *Health Protection and Promotion Act*, RSO 1990, c H.7. Available from: https://www.ontario.ca/laws/statute/90h07
2. *Designation of Diseases*, O Reg 135/18. Available from: https://www.ontario.ca/laws/regulation/180135
3. Ontario. Ministry of Health. Infectious diseases protocol, 2023. Toronto, ON: King's Printer for Ontario; 2023. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/infectious_disease_protocol.pdf
4. *Reports*, RRO 1990, Reg 569. Available from: https://www.ontario.ca/laws/regulation/900569

5. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector-Borne Diseases. Q fever [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; [2019] [cited 2023 Jul 06]. Available from: https://www.cdc.gov/qfever/index.html
6. Heymann DL, editor. Control of communicable diseases manual. 21st ed. Washington, DC: American Public Health Association; 2022.
7. Anderson A, Bijlmer H, Fournier PE, Graves S, Hartzell J, Kersh GJ, et al. Diagnosis and management of Q fever — United States, 2013: recommendations from CDC and the Q Fever Working Group. MMWR Recomm Rep. 2013;(RR-03):1-30. Available from: https://stacks.cdc.gov/view/cdc/13330. Erratum in: MMWR Recomm Rep. 2013;62(35):730. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a8.htm
8. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Infection prevention and control [Internet]. Toronto, ON: King's Printer for Ontario; 2023 [cited 2023 Jul 06]. Available from: https://www.publichealthontario.ca/en/Health-Topics/Infection-Prevention-Control
9. Committee on Infectious Diseases, American Academy of Pediatrics. Section 3: summaries of infectious diseases: Q fever (*Coxiella burnetii* infection). In: Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH, editors. Red book: 2021-2024 report of the Committee on Infectious Diseases. 32nd ed. Itasca, IL: American Academy of Pediatrics; 2021. p.617-9.
10. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Infectious Disease Trends in Ontario [Internet]. Toronto, ON: King's Printer for Ontario; c2023 [cited 2023 Jul 06]. Available from: https://www.publichealthontario.ca/en/Data-and-Analysis/Infectious-Disease/Reportable-Disease-Trends-Annually

Case Definition Sources

World Health Organization; Pan American Health Organization. Zoonoses and communicable diseases common to man and animals. Vol 3. 3rd ed. Washington, DC: Pan American Health Organization; 2003. Available from: https://iris.paho.org/bitstream/handle/10665.2/711/ZoonosesVol-3.pdf

Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases, Division of Vector-Borne Diseases. Q fever: reporting and in-depth information [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; [2019] [cited 2023 Jul 06]. Available from: https://www.cdc.gov/qfever/info/index.html

Centers for Disease Control and Prevention, Office of Public Health Data, Surveillance, and Technology. National Notifiable Disease Surveillance System: Q fever (*Coxiella burnetii*) 2009 case definition [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; [2009] [modified 2021 Apr 16; cited 2023 Jul 06]. Available from: https://ndc.services.cdc.gov/case-definitions/q-fever-2009/

Anderson A, Bijlmer H, Fournier PE, Graves S, Hartzell J, Kersh GJ, et al. Diagnosis and management of Q fever — United States, 2013: recommendations from CDC and the Q Fever Working Group. MMWR Recomm Rep. 2013;(RR-03):1-30. Available from: https://stacks.cdc.gov/view/cdc/13330. Erratum in: MMWR Recomm Rep. 2013;62(35):730. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a8.htm

Heymann DL, editor. Control of communicable diseases manual. 21st ed. Washington, DC: American Public Health Association; 2022.

Document History

Revision Date	Document Section	Description of Revisions
April 2022	Epidemiology: Occurrence section	Removed.
April 2022	ICD Codes	Removed.
August 2023	Case Definition	Technical update to case definitions for confirmed and probable cases.
August 2023	Clinical Information	Technical update to clinical evidence and clinical presentation.
August 2023	Laboratory Evidence	Technical update to laboratory confirmation, supportive laboratory evidence of infection, indications and limitations.
August 2023	Case Management	Updated wording.
August 2023	Prevention and Control Measures	Updated wording.
August 2023	Disease Characteristics	Updated wording.