

Q Fever Summary

Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTTOOLS group of experts on Q Fever. They reviewed the current knowledge on the disease, considered the existing disease control tools, identified current gaps in the availability and quality of the control tools and finally determined the research necessary to develop new or improved tools. Full details can be downloaded from the web site at <http://www.discontools.eu/>.

Disease profile

2. Q fever is a zoonotic disease caused by the bacteria *Coxiella burnetii*. Outside the animal host, the bacterium becomes a spore-like resistant form enabling it to survive for variable periods in the environment and be a source of infection. Q fever was first identified in Australia in 1935 and has since been found widely throughout the world. Infection has been found in various wild and domestic animals and birds and in some arthropods, such as ticks. Cattle, sheep, and goats are the primary reservoirs of *C. burnetii* but other animals may play a role as secondary reservoirs.
3. *C. burnetii* infection in animals can persist for several years, and might be life-long. Sheep, goats and cows are mainly asymptomatic carriers, but can shed considerable numbers of organisms at parturition (à term or abortion). In addition the bacterium is excreted via milk and urine; faecal excretion is under debate. There is consensus among public health and veterinary professionals that most of the human Q fever outbreaks are linked to small ruminants, abortion waves on large farms representing the major risk. Large numbers of organisms are found in the placenta, foetal fluids, aborted foetus and to a lesser extent in milk and urine of infected animals. In some cases Q fever can cause abortion of almost all reproductive goats in a herd.
4. In humans, clinical symptoms of Q Fever may only be seen in around half of all people infected with *C. burnetii*. Infection is often self-limiting but some patients develop a flu-like illness and severe disease which is very difficult to cure develops in a few patients. Mortality rates in humans can be 1%-2%.

Risk

5. Because Q Fever is under-diagnosed and under-reported, there is no reliable assessment of how many cases of Q fever actually occur worldwide. Q fever was a major public health problem in the Netherlands with over 4,000 human cases notified over the years 2007-2010. Drastic control measures have been implemented, including the large-scale culling of pregnant goats on infected farms in order to block the possible excretion of the bacterium during parturition of goats in order to avoid the spread of the bacterium to humans. Control measures in goats were thus implemented to control Q fever in humans. Control can be difficult and can be compromised by the prolonged stability of the bacterium in the environment and the possible role of animal species other than ruminants as reservoir hosts.
6. Veterinarians, laboratory workers, farmers and abattoir workers or people living in proximity to herds or abattoirs are most at risk of exposure. High seroprevalence rates have been regularly reported among rural populations having contacts with ruminants but this may possibly lead to a natural immunisation. Most Q fever outbreaks have occurred in semi-urban areas, causing disease in people who have no direct contact with farms.
7. Transmission to humans mainly occurs through the inhalation of contaminated aerosols. These can originate from infected dust contaminated by dried placental material, birth fluids or excreta of infected animals or exposure to infected amniotic fluid or placenta. Other risks include direct contact with infected animals especially during parturition or the delivery season.
8. *C. burnetii* is a potential biological warfare agent being very infectious (low infectious dose) and very durable in the environment as well as capable of windborne spread.

Diagnostics

9. Diagnosis of infection can be made by direct (intracellular) isolation of the organism from tissues such as placenta, or by immunohistochemical staining for the antigens but PCR techniques are now recognised as the most sensitive method to detect *C. burnetii*.
10. A number of serological tests are available, the most commonly used assays including indirect immunofluorescence, ELISA and complement fixation. Bulk tank milk testing by PCR and antibody ELISA can be used monitoring *C burnetii* infection in dairy herds
11. Standardisation and harmonisation of current tests is needed The development of serological tools capable of distinguishing between previous infection and new infection would be very helpful as well as tests to distinguish between infected and vaccinated animals (DIVA). Rapid field tests are required. There is an urgent need for the development of a molecular method for the assessment of bacterial viability, especially in environmental samples and milk samples.

Vaccines

12. Animal vaccines have been developed and several are commercially available. Vaccination with an inactivated vaccine has been effective in cattle, goats and sheep and has reduced clinical problems as well as reducing shedding of the organism but is not eradicating the disease. An inactivated (phase 1) vaccine is in large scale use in France and has also been used in the Netherlands in goat herds.
13. Efforts are underway to develop safer to produce, less expensive, more effective, new-generation vaccines.

Pharmaceuticals

14. Several antibiotics have been used in the treatment of infection in humans, but better treatments are sought, in particular for the chronic form of Q fever. In animals, antibiotics may suppress rather than eliminate infections and their efficacy is under study and debate.

Knowledge

15. Many aspects of the epidemiology and transmission of infection require further investigation. The role of wildlife and pet animals in the transmission and maintenance of *C. burnetii* needs to be further elucidated. The role of ticks in the transmission and maintenance of *C. burnetii* still remains a gap in our knowledge. Transmission routes within and between herds need further study and assessments of the efficacy of different control schemes are required.
16. A better understanding of the pathogenesis of *C. burnetii* in animals is required. There is insufficient information on the kinetics of bacterial shedding in goats, sheep and cattle, especially in the absence of clinical signs. More needs to be known concerning the risk of infection from different sources. The environmental conditions which facilitate the sporulation and survival of the organism outside the host are not well understood.

Conclusions

17. Q Fever has a worldwide distribution and is probably more widespread than is currently recorded. Outbreaks of Q fever are infrequently reported, and the disease may be endemic in areas where cases are rarely or never reported.
18. The epidemiology, transmission and pathogenesis of infection are not fully understood. More needs to be known about the efficacy of disease control approaches including the use of vaccines in livestock. Diagnostic methods could be further improved and rapid field tests are required.