Brucellosis
Summary

Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTOOLS group of experts on Brucellosis. 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. Details can be downloaded from the website at http://www.discontools.eu/. The gap analysis scoring on the website refers to cattle only. In addition, the expert group has provided separate gap analyses for small ruminants, *B. ovis*, swine, terrestrial wildlife, other domestic animals and marine animals, which are available by contacting the DISCONTOOLS secretariat.

Disease profile

2. The brucellae bacteria comprise several species and infect a wide range of animals. Cattle, yaks, water buffaloes, sheep, goats, reindeer, camelids, swine, horses, hares, seals (pinnipeds), dolphins and porpoises (and other toothed whales), and dogs are known to be susceptible. Whereas *B. melitensis*, *B. abortus*, *B. canis* and *B. ovis* have well defined characteristics, *B. suis* shows a great internal diversity in terms of both taxonomy and pathogenicity. New *Brucella* strains that do not fit within the classical species have been described recently and the known range is getting wider as the organism is looked for in more host species. In livestock and humans the geographical range of the disease is well known but in wildlife there is much less information.
3. Brucellosis is highly transmissible particularly in immunologically naïve flocks and herds. The disease is usually transmitted by ingestion of infective organisms. Infected ruminants and swine may shed brucellae via urine, but the aborted foetus, foetal membranes and fluids, genital discharges and milk are the most important sources of infection. Semen in the acute early stages of infection is also a source of infection.
4. Brucellosis lacks pathognomonic symptoms and signs in both humans and animals. In animals, abortion, birth of weak offspring, infertility and genital lesions in males are the most common manifestations of brucellosis. The rate of abortions varies between 0 to 40% in cattle, sheep, goats and swine, depending upon whether the disease has been recently introduced in a flock or the flock is chronically infected. The severity of brucellosis varies according to the host and the infective species and strain.

Risk

5. Human infection comes from direct or indirect contact with animals and animal products. A figure of 500,000 new human cases/year worldwide is often quoted but there are no reliable data for most countries. The human populations at greatest risk are those that regularly come into contact with infected animals and those that consume unpasteurised dairy products.
6. Less than 20 countries (including Northern European countries and France) are free of brucellosis in livestock. The movement of infected animals is the main mechanism for the spread of disease between herds. The animal disease is endemic in many areas and this makes eradication very difficult if surrounding areas still have infections. A major risk is reintroduction of the disease in areas where it has been eradicated and vaccination has been discontinued. In non-protected animals, the disease spreads very quickly.
7. The lack of outward clinical signs of disease in animals other than abortion and fertility reduction means that detection is difficult without a sustained and expensive surveillance programme.

Diagnostics

8. Many commercial diagnostic kits are available worldwide but, although costs of tests are generally competitive, they are out of reach for many areas in Africa or Asia. Almost all kits require cold storage and this may be a problem in some resource poorer regions.
9. Several methods such as the Complement Fixation test, iELISA, cELISA, a fluorescence polarisation assay, Rose Bengal test and brucellin skin tests are available for the detection of *B. abortus*, *B. melitensis* or *B. suis*. Penside serological assays, such as lateral flow assays, are in development but are not yet in validation trials.
10. Culture of the organism is the only unequivocal diagnostic method and is especially important in non-endemic areas but this is slow, expensive and presents significant risks to diagnosticians. More effective selective enrichment and culture media are required. Conventional typing is difficult and poses reproducibility problems and could be advantageously replaced by molecular methods.
11. There are no commercially available PCR kits that claim to detect *Brucella* DNA. Several PCR protocols have been optimized for sensitivity and specificity under laboratory conditions but are insufficiently sensitive on accessible clinical material. These methods are currently expensive although cheaper alternatives are in development.
12. Information is lacking on the performance of serological tests in swine, camelids, yaks, water buffaloes and wildlife. All serological tests need validation according to local conditions and the specific animal host.

Vaccines

13. Vaccines are only available against *B. abortus* (cattle) and *B. melitensis* or *B. ovis* (small ruminants) infections. There have been several attempts to produce subcellular or DNA based vaccines but none are as practical and/or effective as the current vaccines. The effective vaccines are currently live attenuated strains.
14. There is a need for new vaccines that are more protective, able to generate immune responses easily differentiable from those of infected animals (DIVA assays are required) and less pathogenic for livestock (not abortifacient). More stable and more affordable vaccines are also required.

Pharmaceuticals

15. Therapy is seldom used in animals. For human brucellosis, more efficacious and cheaper antibiotics would be valued that avoid parental administration, have a shorter administration period, avoid relapses and make treatment more affordable.

Knowledge

16. The internal taxonomy of the genus needs revision and isolates from areas other than Europe, the near East and N. and S. America may not fall within the previously described species and biovars.
17. A better understanding of brucellosis in camelids, yaks, water buffaloes and other less common livestock species is needed. Knowledge is lacking concerning aspects of the epidemiology and diagnosis of brucellosis in swine and in wildlife. A better understanding of latent infection in animals is needed as the inability to screen out such animals during movement tests presents a risk to the disease-free status of target destinations.
18. Socio-economic studies under different situations are required to prioritize interventions in developing countries.

Conclusions

19. Although some argue that the tools required to control the disease are available and are effective if properly applied, improved and cheaper tools are needed as current costs of control are unsustainable for most economies where brucellosis is prevalent.
20. The epidemiology, diagnosis and immunoprophylaxis of brucellosis in less common livestock species and in wildlife needs further investigation.
21. Improved vaccines, including immunologically tagged vaccines and complementary DIVA tests, are needed.