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# *Brucella canis*: Emerging zoonotic disease? Implications for commercial breeding kennels and public health

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## Introduction

Canine brucellosis, a contagious disease affecting all breeds of dogs, is caused by the bacteria *Brucella canis*, which is transmitted between dogs via venereal and oral routes. Transmission occurs mainly through vaginal secretions during estrus and whelping (in both the fetus and placenta) and via semen. Bacteria can also be found in urine, and is more commonly found there in male dogs. Additional sources of infection include milk, saliva, nasal and ocular secretions, feces, and contaminated cages and equipment. Humans become infected through contact with tissue and secretions from infected dogs.

The disease represents a potential source of economic loss to breeding kennels. Outbreaks can result in the loss of hundreds of breeding animals. The cost associated with quarantine, including changes in the facility in order to isolate infected dogs, the costs of repeated testing, and not being able to breed, sell, buy or move dogs for any reason, can be prolonged (several months) and may result in kennels going out of business (Hollett, 2006). Therefore, it is important for kennel managers and owners of dog breeding facilities to understand the disease and its implications for dog care and welfare.

## *B. canis* infection in dogs

Clinical signs of brucellosis infection in dogs can range from weight loss and lethargy, to late-term abortions in females, epididymitis and prostatitis in males, and infertility, lymphadentitis (inflammation of the lymph nodes) and diskospondylitis (a destructive, inflammatory process of the intervertebral disks) in both sexes. Puppies can become infected in utero, during birth by contact with placenta and blood, and as neonates through milk or contact with infected surfaces. Many infected dogs remain asymptomatic.

Several diagnostic blood tests exist, but diagnosis can be difficult and often requires testing more than once, using two different diagnostic tests. One test commonly used for screening —the rapid slide agglutination test (RSAT) — is useful because false negatives are rare, it can be used for early detection, and it is easy to use, sensitive, and commercially available.

Antibiotic treatment has proven successful in some cases of *B. canis* infections, but no treatment has been found to be 100% effective. Consequently, many veterinarians recommend euthanasia for breeding dogs that test positive. For pet dogs, neutering, treating, and monitoring those that test positive is routinely recommended to decrease the risk of transmission. However, to date no scientific studies have validated this approach (Kazmierczak, 2012).

For all of these reasons, disease prevention — including routine testing of breeding dogs — is recommended. Yet a recent study reported that 35% of breeders surveyed were not testing for *B. canis* in their kennels (Krueger et al., 2014). Testing for canine brucellosis, therefore, is likely to become an increasingly important consideration in canine health, particularly for commercial breeders and others who manage large numbers of dogs.

The true prevalence of *B. canis* infections in the US dog population is unknown, but is thought to be relatively low (1-9%) (Brown, et al., 1976) compared to countries in Central and South America, where it is reported to be 20-30% (Kazmierczak, 2012; Samartino, 2002; Poester et al., 2002). Commercial breeding kennels often are the focus of control measures, but any sexually mature and reproductively active dog is susceptible to *B. canis*. Stray and feral dogs remain the predominant reservoir (Hollett, 2006). Several studies conducted in the 1970s suggested that 6-9% of the stray dog population was infected (Boebel, et al.,1979; Brown et al., 1976; Lovejoy et al., 1976). However, in recent years state animal health laboratories in Oklahoma have reported an increased prevalence among dogs, especially in kennel operations. Between 1994 and 1999, only 2-3% of tests were positive; by 2003, 14% of tests were positive (Welsh and Dirato, 2012).

Currently, interstate trade in dogs is thought to be a major source of *B. canis* transmission, resulting in economic loss and increased risk to human caretakers (Brower et al., 2007). In a recent study, three outbreaks of *B. canis* were traced from Missouri to Wisconsin as a result of the purchase of new breeding dogs that were untested. The study suggests that without a regulated testing and eradication program similar to that developed for *B. abortus* in cattle, *B. canis* will remain an endemic problem in the US dog population (Brower et al., 2007).

Further investigation of the status of dog populations in the US is needed to understand the current infection rates. Additionally, control measures that do not incorporate the testing of strays and shelter dogs are likely to be inadequate in control and eradication of the disease.

## Human health risks associated with canine brucellosis

In addition to the impacts on dog health, *B. canis* is a zoonotic disease, which can be transmitted from infected dogs to people. Even though in many states it is a reportable disease, the public health implications are not known. Nationally, cases of human brucellosis are notifiable to the Centers for Disease Control and Prevention (CDC) but reports are not separated by causative species, so the number of human cases caused by *B. canis* is unknown. Fifty-seven confirmed human cases of brucellosis have been reported worldwide (Hollett 2006; Krueger et al., 2014). These include cases of pet owners and laboratory workers who had come into contact with infected materials from canine abortions or estrus secretions (Wallach et al., 2004; Lucero et al., 2008). Additionally, two recent cases have been reported in HIV-positive, immunocompromised patients after exposure to infected dogs (Lucero et al., 2009; Lawaczeck et al., 2011). Lucero et al. (2010) reported the first documented outbreak that affected a family (three adults and three children) after they came into contact with their sick dog and her puppies. In people, the disease is most commonly reported as presenting with flu-like symptoms, and is treated with antibiotics, but more severe cases have been reported.

*B. canis* infections in people are thought to be underreported and underdiagnosed due to the undifferentiated symptoms and the lack of an appropriate test. Therefore, the true incidence of human infection with *B. canis* is unknown. Lack of available, valid human blood tests for *B. canis* has led researchers to explore the usefulness of veterinary tests for diagnosis of *B. canis* infection in humans (e.g. Lucero et al., 2005). A recent study aimed to do this by assessing the prevalence of positive titers to *B. canis* in humans as an indicator of past exposure to the disease (Krueger et al., 2014). Three hundred and six adults who had been exposed to dogs and 101 adults without canine exposure were tested. Of these subjects, 39 tested positive for the disease by the RSAT (33 of the dog-exposed group and 6 of the non-exposed group).

## Conclusion

*B. canis* is an infectious disease that has significant implications for both dog and human health. Outbreaks can have a disastrous economic impact on canine facilities. The prevalence of the disease is not well understood in either the US dog or human population, and therefore further research is warranted. Increased knowledge of the populations most at risk could lead to better recommendations for handling, housing, screening, and movement of dogs in locations where they tend to be found in large numbers. These include commercial kennels, shelters, dog parks, and dog shows.

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