

BVA, BSAVA, SPVS, and BVNA policy position on *Brucella canis*

Executive summary

Brucella canis is a bacterium and the primary causative agent of canine brucellosis, an infectious disease predominantly infecting dogs. Being zoonotic, it can also infect humans. Although a member of the *Brucella* genus, *B. canis* is distinct from other classical *Brucella* species, *B. abortus*, *B. melitensis* and *B. suis*, which infect livestock and humans and account for the vast majority of human infections globally¹.

While some infected dogs can be asymptomatic carriers, for others it can cause a wide range of clinical signs, including abortion in pregnant bitches. There is no proven, reliable treatment that fully eliminates the infection at present, and so euthanasia is currently the only effective means of completely preventing transmission.

As there may be no clinical signs, infected dogs can silently carry *Brucella canis* into the UK without detection when being transported. This disease was first detected in the UK in 2002², and in recent years there has been a rapid rise in identified cases. It is unclear whether this reflects a genuine increase in case numbers or an increase in testing and diagnoses, however there are now concerns that, if left unchecked, it could become endemic³ in the UK.

In 2022, news emerged of the first UK case of dog-to-human transmission⁴. This highlighted the risks to those handling and treating infected dogs, leading to heightened levels of concern within veterinary teams.

Our position seeks to explain the risks to dogs and humans and makes recommendations for how to prevent and manage canine brucellosis. The position includes:

- Background information, including prevalence, transmission and clinical signs.
- Information on diagnosis and testing, including legal requirements, determining infection status, the role of pre-import testing and testing in UK veterinary practices.
- Guidance on management of positive cases and managing risks in veterinary practice.
- Research requirements to fulfil the many knowledge gaps with respect to *B. canis*.
- Links to other useful sources of information, including the [APHA Canine Brucellosis: Summary information sheet for veterinary staff](#) and [BSAVA Scientific Information Document on *Brucella canis*](#)

Our recommendations for Government:

- **To reduce the risk of importation of disease endemic in other countries, the UK Government should restrict, on the basis of an appropriate risk assessment, the movement of dogs from countries that are endemic for diseases not currently considered endemic in the UK (eg canine brucellosis, babesiosis, ehrlichiosis,**

¹ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at:

<http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

² J. Dunne, K. Sehgal, A. McMillan and L. Perret (2002) Canine brucellosis in a dog imported into the UK. *Veterinary Record*, Vol. 151 Issue 8 Pages 247

³ Endemic is defined as “regularly found and very common among a particular group or in a particular area”.

<https://dictionary.cambridge.org/dictionary/english/endemic>

⁴ The first case of *Brucella canis* in a human in the UK was widely reported, eg <https://metro.co.uk/2022/08/14/woman-forced-to-put-five-dogs-down-after-contracting-rare-disease-17180788/>

dirofilariasis, leishmaniasis) and introduce appropriate testing for any such diseases as a mandatory requirement for dogs before travel to the UK.

- Government agencies should maintain a comprehensive record of all port checks, animal ID, and diagnostic results to feed into UK surveillance data on the diseases covered by PETS and those not considered as endemic for the UK (eg canine brucellosis, babesiosis, ehrlichiosis, dirofilariasis, leishmaniasis).
- UK Government should ensure that legislation is adequately enforced and border controls improved to prevent the importation of puppies and pregnant bitches.
- In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs (DAERA) should provide guidance as to what it means by suspicion of the disease and what actions should be taken following positive confirmation of a *Brucella canis*.
- Further research should be conducted into *B. canis*, based on the data gaps identified by the [UKHSA HAIRS risk assessment](#).

Our recommendations for UK veterinary professionals:

- The rise in detected cases of *Brucella canis* should be taken seriously and the risks appropriately conveyed to animal owners, but veterinary teams should also remember that the risk to humans, even for veterinary teams, is deemed to be low.
- In most cases, *B. canis* SAT and iELISA serological tests should be used to determine the infection status of a dog, using blood samples taken 3 months after potential infection. Serological tests alone should not be used to confirm infection, and results should be considered alongside additional evidence, such as clinical signs, movement history and likelihood of exposure to the infection. Veterinary professionals should refer to [APHA](#) for further guidance on testing.
- When a dog with no clinical signs or history of direct exposure tests positive for *B. canis* by serological test, they should be isolated if pregnant or while in season, otherwise they should be prevented from any breeding activity, isolated from vulnerable people, and their excreta appropriately isolated from all other animals or people pending retest. They should then be retested after 4–6 weeks to ensure the accuracy of testing.
- All veterinary professionals should work to improve awareness of clinical signs and risk factors amongst colleagues and the animal owning public to help manage and minimise spread of the disease, whilst continuing to provide appropriate care for potentially at-risk dogs.
- Veterinary professionals should use their clinical judgement to make a contextualised decision regarding testing for *B. canis*, based on risk assessment and conversations with the animal owner and all relevant stakeholders.
- Veterinary professionals should use the risk assessment information from [APHA](#) and [BSAVA](#) to assess the need to test a dog for *B. canis*, taking limitations of current testing protocols into account. Owners should be made aware of associated costs and potential outcomes before tests are conducted in order to ensure informed consent.
- When deciding on suitable treatment or euthanasia options following confirmation of *B. canis* infection, cases should be individually risk assessed. Quality of life and the potential impact on that dog, other dogs and people should take precedence over longevity for the infected dog.
- Employers and professional veterinary organisations have a role to play in supporting veterinary professionals by providing information relating to *B. Canis* positive dogs. Clear advice for pet owners is also needed. The APHA guidance for [veterinary staff](#) and [members of the public](#) are useful as is the information [BSAVA's SID](#).
- Veterinary professionals should take steps to minimise the risk of transmission of infection to people and to other dogs when handling dogs with suspected or confirmed cases of *B. canis*.

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Introduction

Brucella canis is a bacterium and the primary causative agent of canine brucellosis, an infectious disease. It predominantly infects dogs, though has also been detected in wild canids such as foxes and jackals^{5,6}, and being zoonotic, can also infect humans. Although a member of the *Brucella* genus, *B. canis* is distinct from other classical *Brucella* species, *B. abortus*, *B. melitensis* and *B. suis*, which infect livestock and humans and account for the vast majority of human infections globally⁷.

While some infected dogs can be asymptomatic carriers, for others it can cause a wide range of clinical signs, including abortion in pregnant bitches. There is no proven, reliable treatment that fully eliminates the infection at present, and so euthanasia is currently the only effective means of completely preventing transmission.

As there may be no clinical signs, infected dogs can silently carry *Brucella canis* into the UK without detection when being transported. This disease was first detected in the UK in 2002⁸, and in recent years there has been a rapid rise in identified cases. It is unclear whether this reflects a genuine increase in case numbers or an increase in testing and diagnoses, however there are now concerns that, if left unchecked, it could become endemic⁹ in the UK. In April 2021, changes to the Zoonoses Order made detection of brucellosis in dogs reportable¹⁰.

In 2022, news emerged of the first UK case of dog-to-human transmission¹¹. This highlighted the risks to those handling and treating infected dogs, leading to heightened levels of concern within veterinary teams.

Our position seeks to explain the risks to dogs and humans and makes recommendations for how to prevent and manage canine brucellosis.

Prevalence

The exact prevalence of *B. canis* in dogs is unknown, and it is not possible to generate a reliable estimate as there is no national surveillance programme, but it is thought to affect less than 0.05% of the UK dog population¹². Although it not currently considered to be endemic in the UK, a low level of regional endemicity cannot be discounted¹³.

Prior to 2020, there had only been 3 recorded cases¹⁴ in the UK, but there has since been a significant increase. From 2020 to 2022 (inclusive), there were 100 incidents¹⁵ with 143 dogs testing positive, and in the first half of 2023 a further 97 dogs from 72 incidents tested positive¹⁶. Most cases

⁵ Cirovic D , Chochlakis D , Tomanovic S , Sukara R , Penezic A , Tselentis Y , et al (2014) Presence of Leishmania and Brucella species in the golden jackal *Canis aureus* in Serbia. *BioMed Research International*. 2014 :728516

⁶ Hoff GL , Bigler J , Trainer DO , Debbie JG , Brown GM , Winkler WG , et al (1974) Survey of Selected Carnivora and Opossum Serums for Agglutinins to *Brucella canis*. *Journal of American Veterinary Medical Association*. 165 :830–1.

⁷ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at: <http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

⁸ J. Dunne, K. Sehgal, A. McMillan and L. Perret (2002) Canine brucellosis in a dog imported into the UK. *Veterinary Record*, Vol. 151 Issue 8 Pages 247

⁹ Endemic is defined as “regularly found and very common among a particular group or in a particular area”.

<https://dictionary.cambridge.org/dictionary/english/endemic>

¹⁰ There is a legal duty to report positive test results relating to the detection or diagnosis of *B. canis* in dogs to the competent government authority (along with the provision of specified statutory information). The primary legislation that covers brucellosis in dogs is the Animal Health Act 1981 (<https://www.legislation.gov.uk/ukpga/1981/22/contents>), with the secondary legislation being the Zoonoses Order 1989, amended to cover dogs in 2021.

¹¹ The first case of *Brucella canis* in a human in the UK was widely reported, eg <https://metro.co.uk/2022/08/14/woman-forced-to-put-five-dogs-down-after-contracting-rare-disease-17180788/>

¹² Figure derived from pre-export testing of dogs leaving the UK, Conducted by APHA. UK Health Security Agency (2023) HAIRS risk statement: *Brucella canis*. Version 1.0. Available at: <https://www.gov.uk/government/publications/hairs-risk-assessment-brucella-canis/hairs-risk-assessment-brucella-canis> Accessed September 2023

¹³ UK Health Security Agency (2023) HAIRS risk statement: *Brucella canis*. Version 1.0. Available at:

<https://www.gov.uk/government/publications/hairs-risk-assessment-brucella-canis/hairs-risk-assessment-brucella-canis> Accessed September 2023

¹⁴ Note that Defra considers a ‘case’ to be a single epidemiological event, which may involve one or more dogs. For example, a case could be a single imported dog, while another case may involve a breeder with a number of infected dogs.

¹⁵ APHA considers an incident to be a single epidemiological event, each of which may involve more than one dog.

¹⁶ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at:

involved dogs imported from eastern Europe or offspring of imported dogs¹⁷, which was consistent with a recent study from continental Western Europe¹⁸.

Globally, *B. canis* has a wide distribution and is endemic in parts of North and South America, Asia, Africa, and eastern and central Europe¹⁹. In recent years, incidence has increased in Western Europe, attributed in part to increased movement from endemic regions^{20,21}. The UK has seen an increasing number of dogs being imported. From January 2019 through to December 2021, over 170,000 dogs were imported from the EU for the pet market (including adult rescue dogs)²².

Due to challenges identifying the symptoms and the lack of validated tests for humans, human cases are rarely reported, and are likely to be underreported globally²³. However, in 2022, there was a well-publicised case of human infection in the UK²⁴, which alongside increased incidence and awareness of the disease, led to heightened levels of concern within the veterinary profession. We are concerned about the suspected rise in cases of *B. canis* in the UK and its zoonotic potential, but it should be noted that increased levels of awareness and testing may be contributing to the overall increase in case numbers. This increase has arisen from a small baseline of known cases, and evidence of zoonotic transmission has so far been limited to very few cases. The [2023 UK Health Security Agency \(UKHSA\) Human Animal Infection Risk Surveillance group \(HAIRS\) Risk Assessment](#) showed the probability of infection to be very low for the general UK population, and low for individuals with greater risk of exposure to infectious material (eg dog breeders, kennel, veterinary and laboratory staff and owners of infected dogs, especially those which are breeding or birthing)²⁵. Awareness is important for keeping the risks of transmission low, so veterinary professionals have an important role to play talking to clients about risk factors and public health concerns associated with *B. Canis*.

Recommendation 1: The rise in detected cases of *Brucella canis* should be taken seriously and the risks appropriately conveyed to animal owners, but veterinary teams should also remember that the risk to humans, even for veterinary teams, is deemed to be low.

Infection and clinical signs

Most infected dogs are thought to carry the disease without clinical signs, which represents a reservoir of infection that can be challenging to diagnose. For others, it can cause a range of signs of varying severity. *B. canis* preferentially infects reproductive tissue, often causing abortion in pregnant bitches. Infected puppies reaching full term may be very weak, dying shortly after birth, although others may survive and continue to carry the infection into adulthood. Other clinical signs include infertility, lameness, muscle weakness and spinal pain, as well as less-specific signs such as lethargy and weight loss. Products associated with abortion and birth (eg amniotic fluid, placentae, vaginal discharges) from infected bitches are highly infectious for dogs and people. Dogs with clinical signs may be more infectious than those without, although definitive evidence for this is limited²⁶.

<http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

¹⁷ Human Animal Infections and Risk Surveillance (HAIRS) group (2021) Risk review and statement on the risk *Brucella canis* presents to the UK human population.

¹⁸ Buhmann G , Paul F , Herbst W , Melzer F , Wolf G , Hartmann K , et al (2019) Canine Brucellosis: Insights into the Epidemiologic Situation in Europe. *Frontiers in Veterinary Science*; 6 :151

¹⁹ Santos RL, Souza TD , Mol JPS , Eckstein C , Paixão TA (2012) Canine Brucellosis: An Update. *Frontiers in Veterinary Science*; 8 :594291

²⁰ Buhmann G , Paul F , Herbst W , Melzer F , Wolf G , Hartmann K , et al (2019) Canine Brucellosis: Insights into the Epidemiologic Situation in Europe. *Frontiers in Veterinary Science*; 6 :151

²¹ van Dijk MAM , Engelsma MY , Visser VXN , Keur I , Holtslag ME , Willems N , et al (2021) Transboundary Spread of *Brucella canis* through Import of Infected Dogs, the Netherlands, November 2016-December 2018. *Emerging Infectious Diseases*; 27 :1783–8.

²² Freedom of Information request, TRACES data, cited in BSAVA Scientific Information Document on *Brucella canis*. Available at https://www.bsavalibrary.com/content/chapter/10.22233/9781910443514.chap9#ref9_28 Accessed September 2023

²³ Hensel ME, Negron M and Arenas-Gamboa AM (2018) Brucellosis in Dogs and Public Health Risk. *Emerging Infectious Diseases*; 24(8): 1401-1406.

²⁴ Boyden P (2022) My View: Should we be doing more about *Brucella canis*? *Veterinary Record*; 191 :82

²⁵ UK Health Security Agency (2023) HAIRS risk statement: *Brucella canis*. Version 1.0. Available at:

<https://www.gov.uk/government/publications/hairs-risk-assessment-brucella-canis/hairs-risk-assessment-brucella-canis> Accessed September 2023

²⁶ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at: <http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

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The most common routes of transmission between infected dogs are:

- through mating
- contact with products associated with abortion and birth from an infected bitch eg amniotic fluid, placentae, vaginal discharges
- vertical transmission from mother to pup within the uterus and/or from ingestion of infectious milk post-partum (all puppies mothered by an infected bitch will have been exposed and are at high risk of infection)
- contact with infectious seminal fluid; then, to a lesser extent, contact with infectious urine (as infected dogs may excrete *B. canis* in the urine)
- potentially and if so, infrequently and to a lower extent, contact with potentially infectious faeces, saliva, tears or nasal secretions²⁷

As reproduction is a common route of transmission, surgical neutering can reduce the risk of transmission, but has not been proven to eliminate it²⁸. Breeding bitches can shed bacteria during their season so neutering can also reduce transmission via this route. Neutering reduces reproductive transmission and is thought to reduce the risk of horizontal transmission by decreasing the level of shedding and improving the response to antimicrobials by reducing the volume of potentially infectious tissue²⁹.

Dogs are unlikely to become infected from brief, non-breeding contact with an infected animal, but multiple or sustained contacts increase the risk accordingly³⁰. Dogs are also at risk from infectious material in the environment, eg urine, even without direct physical contact with an infected dog^{31,32}. Kennels therefore are at increased risk of disease outbreaks due to the close contact, mixing, and frequent movement of dogs^{33,34}. Breeding establishments are at further increased risk due to transmission during mating and exposure to products of birth or abortion, as well as frequent movement for breeding, showing, trade in frozen semen and transfer of ownership. Outbreaks within breeding facilities have been reported in Italy, Netherlands, Sweden, Switzerland, France, Portugal, and the UK^{35,36,37,38}.

Further research into the impact on humans is needed to fully understand this disease, but the most common signs of infection include fever sometimes accompanied by loss of appetite, weight loss, sweating, headaches, fatigue, back and/or joint pain³⁹. The disease can also lead to severe illness

²⁷ Weber A and Christoph H (1982). Untersuchungen zur natürlichen Übertragung von *Brucella canis* bei Hunden. Fortschr. Veterinarmed. 35, 351–355

²⁸ Davidson AP and Sykes JE (2002) Chapter 71: Canine Brucellosis, in *Greene's Infectious Diseases of the Dog and Cat. (5th Edition)*. Elsevier - OHCE, 2022.

²⁹ BSAVA Scientific Information Document on *Brucella canis*. Available at https://www.bsavalibrary.com/content/chapter/10.22233/9781910443514.chap9#ref9_28 Accessed September 2023

³⁰ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at: <http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

³¹ Carmichael LE and Joubert JC (1988). Transmission of *Brucella canis* by contact exposure. *Cornell Vet*; 78 :63–73

³² Serikawa T and Muraguchi T (1979) Significance of urine in transmission of canine brucellosis. *Nihon Juigaku Zasshi*. 41 :607–16

³³ Buhmann G , Paul F , Herbst W , Melzer F , Wolf G , Hartmann K , et al (2019) Canine Brucellosis: Insights into the Epidemiologic Situation in Europe. *Frontiers in Veterinary Science*; 6 :151

³⁴ Santos RL , Souza TD , Mol JPS , Eckstein C , Paixão TA (2012) Canine Brucellosis: An Update. *Frontiers in Veterinary Science*; 8 :594291

³⁵ Human Animal Infections and Risk Surveillance (HAIRS) group (2021) Risk review and statement on the risk *Brucella canis* presents to the UK human population

³⁶ De Massis F , Sacchini F , Averaimo D , Garofolo G , Lecchini P , Ruocco L , et al (2021) First Isolation of *Brucella canis* from a breeding kennel in Italy. *Veterinaria Italiana*

³⁷ Kaden R , Agren J , Baverud V , Hallgren G , Ferrari S , Borjesson J , et al (2014) Brucellosis outbreak in a Swedish kennel in 2013: determination of genetic markers for source tracing. *Veterinary Microbiology*; 174 :523–30

³⁸ Kolwijck E , Lutgens SPM , Visser VXN , van Apeldoorn MJ , Graham H , Koets AP , et al (2022) First Case of Human *Brucella canis* Infection in the Netherlands. *Clinical Infectious Diseases* 75 :2250–2

³⁹ APHA (2023) *Brucella canis*: Information for the public and dog owners, September 2023. Available at:

<https://www.gov.uk/government/publications/brucella-canis-information-for-the-public-and-dog-owners/brucella-canis-information-for-the-public-and-dog-owners> Accessed September 2023

and complications such as endocarditis, osteomyelitis, arthritis, meningitis and septicaemia^{40,41}. It is therefore a threat to owners and veterinary teams as well as dogs, and it can take months or years before any symptoms develop⁴². The greatest risk of contracting *B. canis* arises from contact with products associated with whelping or abortion. Veterinarians and laboratory technicians may face other significant risks, eg contact with infectious tissue and cultured blood. Anecdotally, attempting 'mouth-to-snout' resuscitation of newborn puppies is a feature common to several human cases. Anyone concerned about potential exposure should contact their GP and alert them of their possible exposure to a dog with *B. canis* specifically. The clinical disease caused by *B. canis* in humans is generally less severe than that caused by other *Brucella* species, and there have been no documented reports of associated fatalities⁴³.

Diagnosis and testing

Diagnosis of canine brucellosis is difficult since many infected dogs will not show clinical signs, and others will show non-specific signs associated with many more common diseases. Testing is therefore an essential tool for preventing the spread of disease.

Legal requirements for testing and reporting

In England, Wales and Scotland, the detection of *B. canis* infection in dogs (by positive culture, PCR, or serological assay) is reportable by both the diagnosing veterinary surgeon and the laboratory performing the test. This means there is a legal requirement to report positive test results relating to the detection or diagnosis of *B. canis* in dogs to the competent government authority, along with the provision of specified statutory information, including details of the veterinary practice, diagnosing veterinary surgeon, client, and dog. Where tests have been performed at APHA, there is no need to report the result although there is an obligation to provide statutory information. Where tests have not been carried out by APHA, there is a legal requirement to report any positive result, and to supply the diagnostic material upon request. Reports can be made to: brucellagroup@apha.gov.uk. Note that, unlike *B. abortus*, *B. melitensis* or *B. suis*, infection with *B. canis* is not notifiable in England, Wales or Scotland.

In Northern Ireland, *B. canis* is notifiable, meaning both suspicion of the disease and confirmation of results must be reported to the local Department of Agriculture, Environment and Rural Affairs (DAERA) Direct Regional Office⁴⁴. If *B. canis* infection is suspected, the relevant local [DAERA Direct Regional Office](#) should be contacted, and failure to do so is an offence. However, it is difficult to define what qualifies as suspicion when many infected animals will not show any signs or may only show non-specific signs. DAERA has not provided guidance as to what constitutes suspicion of the disease and what action should be taken after confirmation of a positive test.

Recommendation 2: In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs (DAERA) should provide guidance as to what it means by suspicion of the disease and what actions should be taken following positive confirmation of a *Brucella canis* test.

Determining infection status

A range of tests are available for *B. canis*. As with any tests, none can be 100% accurate (ie 100% sensitive and 100% specific), with false positives or negatives possible, and at present, there are no universally recognised and internationally established testing processes in place for *B. canis*. To determine the infection status of a dog, test results should be considered alongside additional evidence, such as clinical signs, movement history and likelihood of exposure to the infection.

⁴⁰ Krueger WS, Lucero NE, Brower A et al (2014) Evidence for unapparent *Brucella canis* infections among adults with occupational exposure to dogs. *Zoonoses and Public Health*; 1–10.

⁴¹ Sánchez-Jiménez MM, Zuluaga JJC, García-Montoya GM et al. (2020) Diagnosis of human and canine *Brucella canis* infection: development and evaluation of indirect enzyme-linked immunosorbent assays using recombinant *Brucella* proteins. *Heliyon*; 6(7): e04393.

⁴² Kawakami N, Wakai Y, Saito K et al. (2019). Chronic Brucellosis in Japan. *Internal Medicine*; 58(21): 3179-3183.

⁴³ UK Health Security Agency (2023) HAIRS risk statement: *Brucella canis*. Version 1.0. Available at: <https://www.gov.uk/government/publications/hairs-risk-assessment-brucella-canis/hairs-risk-assessment-brucella-canis> Accessed September 2023

⁴⁴ <https://www.daera-ni.gov.uk/articles/notifiable-diseases-northern-ireland>

Sensitivity, specificity, and the Positive Predictive Value (PPV) should be considered when evaluating the overall performance of a diagnostic test and a particular result in an individual dog:

- Diagnostic sensitivity: The proportion of *diseased animals* that can be expected to yield a positive test result (True positive). Tests with higher diagnostic sensitivity generate fewer false negatives and therefore greater confidence in negative results.
- Diagnostic specificity: The proportion of *non-diseased animals* that can be expected to yield a negative test result (True negative). Tests with higher diagnostic specificity generate fewer false positives and therefore greater confidence in positive results.
- Positive Predictive Value (PPV): The proportion of all *positive results* that can be expected to be from diseased rather than non-diseased animals. This proportion is influenced by pre-test probability as well as (predominately) specificity. Restated, it is the probability that a positive diagnostic test result is a true reflection of the presence of the disease being tested for that dog.
- Negative Predictive Value (NPV): The proportion of all *negative results* that can be expected to be from non-diseased rather than diseased animals. This proportion is influenced by pre-test probability as well as (predominately) sensitivity. Restated, it is the probability that a negative diagnostic test result is a true reflection of the absence of the disease being tested for that dog.

Predictive values, ie the confidence that a positive or negative result is true, are influenced by the pre-test probability (prevalence) of the disease in the population being tested, not just by sensitivity and specificity. Pre-test probability, and therefore confidence in results, can be influenced by the selection of animals being tested. In situations where the disease is rare, such as the likely prevalence of *B. canis* in the entire UK dog population, even a test with a high specificity can yield a low PPV, as false positives become a larger proportion of the total positives. It is therefore important to consider how likely a dog is to be positive for *B. canis* (ie what the prevalence of *B. canis* is in the population of dogs to which they belong – as determined by travel history, exposure events, and clinical signs) when deciding whether, or not, to perform screening serology, and what level of confidence can be placed on any test result generated.

Various tests are available in the UK, and the diagnostic sensitivity and specificity will vary depending on the type and manufacturer. Table 1 summarises test options currently available in the UK^{45,46}:

Test and type	Tests for	When to use	Diagnostic performance	Next steps
Serum agglutination test (SAT; also known as tube agglutination test or TAT) Serology	IgM antibodies in the blood specific to <i>B. canis</i> in the early stages of infection, providing evidence that the dog's immune system has responded to infection.	If screening for <i>B. canis</i> based on travel history or clinical signs. Ideally 3 months after the dog was last in contact with infected dog or infectious materials.	High sensitivity. High specificity, but where pre-test probability of infection is low (ie no clinical signs or travel history), the positive predictive value is low (ie high risk of false positives).	If positive, dog is considered serologically positive for <i>B. canis</i> . Dog should be treated as a suspected case and isolated pending further investigations. If negative, but a strong suspicion of canine brucellosis remains, continue investigations. Dog should remain isolated pending results.

⁴⁵ BSAVA Scientific Information Document on *Brucella canis*. Available at https://www.bsavalibrary.com/content/chapter/10.22233/9781910443514.chap9#ref9_28 Accessed September 2023

⁴⁶ APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at: <http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

Indirect enzyme-linked immunosorbent assay (iELISA) Serology	IgG antibodies in the blood specific to <i>B. canis</i> in later stages of infection, providing evidence that the dog's immune system has responded to infection.	If screening for <i>B. canis</i> based on travel history or clinical signs. Ideally 3 months after the dog was last in contact with infected dog or infectious materials.	High sensitivity. High specificity, but where pre-test probability of infection is low (ie no clinical signs or travel history), the positive predictive value is low (ie high risk of false positives).	If positive, dog is considered serologically positive for <i>B. canis</i> . Dog should be treated as a suspected case and isolated pending further investigations. If negative, but a strong suspicion of canine brucellosis remains, continue investigations. Dog should remain isolated pending results.
Rapid slide agglutination test (RSA) Serology	IgM antibodies in the blood specific to <i>B. canis</i> , providing evidence that the dog's immune system has responded to infection.	If screening for <i>B. canis</i> based on travel history or clinical signs. Ideally 3 months after the dog was last in contact with infected dog or infectious materials.	High sensitivity. High specificity, but where pre-test probability of infection is low (ie no clinical signs or travel history), the positive predictive value is low (ie high risk of false positives).	If positive, dog is considered serologically positive for <i>B. canis</i> . Dog should be treated as a suspected case and isolated pending further investigations. If negative, but a strong suspicion of canine brucellosis remains, continue investigations. Dog should remain isolated pending results.
Point-of-care tests (immunomigratory a.k.a. lateral-flow tests and semi-quantitative iELISAs). Serology	Antibodies in the blood specific to <i>B. canis</i> , providing evidence that the dog's immune system has responded to infection.	In emergency settings. These are widely available in the UK as point-of-care tests.	Limited data suggest that in dogs with clinical disease these tests have reasonable sensitivity and specificity (~90%) but are subject to analytical error.	If positive, dog should be treated as a suspected case and isolated pending further investigations. If negative, but dog has clinical signs and risk of exposure, confirm results at a UKAS accredited commercial laboratory using a combination of SAT, RSA, and iELISA tests. Dog should remain isolated pending results.
Bacterial culture Bacteriology	<i>B. canis</i> in blood or tissue samples	If there is a strong clinical suspicion of infection. Not appropriate for routine screening or to confirm serological results. Only performed at the National Reference Laboratory for Brucellosis at APHA.	Highly specific – the only type of test to definitively confirm a positive infection status. Poor sensitivity (less than 50%). Positive results are often only seen in early infection or acute clinical disease stages.	Positive results alone definitively confirm <i>B. canis</i> infection. Consider treatment options. A negative result does not provide a sufficient guarantee against the risk of infection or shedding.

Polymerase Chain Reactions (PCR) Molecular biology	<i>B. canis</i> DNA in blood or tissue samples	If there is a strong clinical suspicion of infection, and rapid result needed. Not recommended for routine screening. Test not offered by APHA	Specificity and sensitivity data not available as there are currently no validated PCR tests.	If positive, dog should be treated as a suspected case and isolated pending further investigations. If negative, but a strong suspicion of canine brucellosis remains, continue investigations. Dog should remain isolated pending results.
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Table 1: A summary of test options for *B. canis* in dogs currently available in the UK.

Bacterial culture is the only test for which a positive result alone definitively confirms the animal is infected. However, as the sensitivity is low, it may not always be possible to detect infection using this method. Bacterial culture and PCR tests should not be used to screen at-risk dogs, and attempted culture of *Brucella* should only be attempted in a laboratory with appropriate biosafety controls. In the UK, this is limited to the National Reference Laboratory for Brucellosis at the Animal & Plant Health Agency (APHA).

Serology is therefore recommended in most cases, to provide results with significantly greater sensitivity than other test methods. However, not all dogs produce detectable antibodies, especially puppies with an immature immune system, and although antibodies are typically produced within two weeks of infection, this may take up to three months. When screening for brucellosis based on travel history or clinical signs, APHA's current recommendation is to perform the SAT and iELISA in parallel on separated serum. Respectively, these preferentially detect IgM and IgG antibodies and are, consequently, more likely to identify both acute and chronically infected dogs (combined ~90% sensitivity and ~99% specificity). Antibodies are typically produced within two weeks of infection, although it may take up to three months, so a blood sample for serological testing should ideally be taken three months after the dog was last in contact with an infected dog or infectious material.

False negative results are possible, so negative serology does not entirely exclude the possibility of infection. Where a strong suspicion of canine brucellosis remains in a dog with a negative test, repeat serology should be performed after 4-6 weeks and, if negative, again at 12 weeks, to allow time for any antibodies to develop. Due to risk of onward transmission, the dog should remain isolated pending results, with limited to no direct or indirect contact with other dogs and limited contact with people, particularly, young, old, pregnant, or otherwise immunocompromised individuals. Given the potential for transmission in urine this will have an impact on where the dog can be appropriately housed and exercised.

False positives are also possible, so following an unexpected positive result, dogs should not be immediately euthanased, and instead be isolated, with serology repeated after 4–6 weeks. If an animal is serologically positive, multiple criteria have to be taken into account in order to determine whether the dog can be considered as infected or false positive.

Interpreting test results is challenging, and a single serological test alone is not sufficient to definitively confirm a dog's infection status. Clinical signs, epidemiological links and diagnostics should all be considered when evaluating a dog's infection status and considering action to take. Note that, due to the lack of proven effective treatment options, APHA currently considers any dog persistently testing serologically positive to be confirmed infected, and therefore of potential risk to humans and other animals throughout its life, even if the titre is reducing or stable.

For more information on testing, including recommended test types and submission procedures, refer to the APHA [Frequently asked *Brucella canis* testing questions](#) and APHA [Canine Brucellosis: Summary information sheet for veterinary staff](#). The paper by [Djokic et al. 2023⁴⁷](#) provides further

⁴⁷ Djokic, V., Freddi, L., de Massis, F., Lahti, E., Esker, M.V.D., Whatmore, A., Haughey, A., Ferreira, A.C., Garofolo, G., Melzer, F. and Sacchini, F. (2023) The emergence of *Brucella canis* as a public health threat in Europe: what we know, and **BVA, BSAVA, SPVS, and BVNA policy position on *Brucella canis* December 2023**

detail on the many challenges associated with determining whether a dog should be considered confirmed infected, a suspected case or uninfected.

Recommendation 3: In most cases, *B. canis* SAT and iELISA serological tests should be used to determine the infection status of a dog, using blood samples taken 3 months after potential infection. Serological tests alone should not be used to confirm infection, and results should be considered alongside additional evidence, such as clinical signs, movement history and likelihood of exposure to the infection. Veterinary professionals should refer to [APHA](#) for further guidance on testing.

Recommendation 4: When a dog with no clinical signs or history of direct exposure tests positive for *B. canis* by serological test, they should be isolated if pregnant or while in season, otherwise they should be prevented from any breeding activity, isolated from vulnerable people, and their excreta appropriately isolated from all other animals or people pending retest. They should then be retested after 4–6 weeks to ensure the accuracy of testing.

Pre-import testing

B. canis is not currently considered to be endemic in the UK animal population⁴⁸, so minimising its import into the UK is of paramount importance for the overall health and welfare of the country's dog population. Rather than addressing suspected cases after their arrival in the UK, a proactive approach that emphasises reducing the risk of the introduction of *B. canis* into the UK is crucial.

We are concerned about the biosecurity risk posed by the movement of adult dogs or young puppies with an unknown health history into the UK for rehoming. These concerns were previously highlighted in the [BVA policy position on pet travel](#). The majority of dogs diagnosed with canine brucellosis in the UK were either imported by rescue organisations or were in direct contact with such dogs⁴⁹. In addition, we are concerned about imported puppies who may have been infected following vertical transmission.

Under current regulations, dogs with an unknown history can be moved from other countries⁵⁰ into the UK without pre-import testing for *Brucella canis* and several other significant diseases, despite the potential to be carrying or incubating the disease. Dogs that are not compliant with pet travel regulations are quarantined until they are compliant, but could still be allowed to enter the UK whilst incubating or carrying disease^{51,52}. This increases the risks of diseases not endemic to the UK being imported, including *B. canis*, and other potentially zoonotic diseases such as babesiosis, ehrlichiosis and leishmaniasis. In addition, given that many of these dogs originated from a street environment, their ability to adapt to a domestic environment and the welfare implications need to be considered. We therefore question whether it is appropriate to be importing stray dogs with unknown health histories and without test results from approved laboratories from countries with diseases not endemic in the UK. Ultimately, the wider consequences for the UK dog population should outweigh the benefit to the individual animal being imported.

The Government can reduce the risk of infected dogs entering the country by restricting the movement of dogs from countries which are endemic for diseases not currently considered endemic in the UK, and introducing pre-import testing at a Government approved laboratory for any such diseases as a mandatory requirement for dogs before travel to the UK. Serious consideration should be given to maintaining a comprehensive record of all port checks, animal identification eg microchip number and diagnostic results to feed into UK traceability and surveillance data on the diseases covered by PETS and those not considered as endemic for the UK. However, dogs that have moved

what we need to learn. Emerging Microbes & Infections, p.2249126

⁴⁸ UK Health Security Agency (2023) HAIRS risk statement: *Brucella canis*. Version 1.0. Available at: <https://www.gov.uk/government/publications/hairs-risk-assessment-brucella-canis/hairs-risk-assessment-brucella-canis> Accessed September 2023

⁴⁹ APHA (2002) Zoonoses and Veterinary Public Health, Annual Report 2022. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1163596/Zoonoses_Annual_Report_2022.pdf Accessed September 2023

⁵⁰ GOV.UK Bringing your pet dog, cat or ferret to Great Britain <https://www.gov.uk/bring-pet-to-great-britain/listed-and-unlisted-countries> Accessed July 2023

⁵¹ Boyden, P (2015) What is the true risk of imported dogs to the UK? Vet Record 176(26):670-1

⁵² Day, M (2010) Veterinary Immunology: Principles and Practice, Second edition

from endemic countries to a non-endemic European country and stayed there for a period of time before being moved to the UK are less likely to be detected.

We have also been campaigning for improved controls to prevent the import of puppies and pregnant dogs into the UK. This would further reduce the risk of *B. canis* entering the UK as there is a heightened risk of transmission associated with pregnancy and abortion, and it would improve pre-import testing, since test results in younger dogs may be less reliable⁵³. We are concerned that enforcement at borders is inadequate⁵⁴ and both puppies and pregnant bitches may not be identified. Measures to improve border checks and controls are urgently needed for both commercial and non-commercial movement of dogs.

Until such controls are legally required and enforced, it is imperative that individuals and organisations importing dogs from regions that have, or are thought to have, a high prevalence of *B. canis*, adopt a comprehensive strategy for pre-import testing of all dogs, to effectively safeguard the UK dog population. The disease is known to be endemic in parts of North and South America, Asia, Africa, and eastern and central Europe⁵⁵, but improved surveillance will be required to determine the infection status of other countries. Where status is unknown, testing should be considered as a precautionary measure. We strongly recommend the implementation of a dual-testing approach, preferably using both the SAT and iELISA. Dogs testing positive through either of these methods should not be imported into the UK, thereby significantly reducing the potential for the disease to establish itself within the country. This approach can potentially minimise the risk associated with the importation and transmission of *B. canis* in the UK. By taking proactive measures to minimise its introduction, we can better protect the health and welfare of the UK dog population and minimise the challenges of dealing with suspected cases once they have already reached our shores.

Some rescue centres and organisations do routinely test dogs and puppies that have potentially been imported from overseas or have a history of foreign travel from countries where *B. canis* is prevalent⁵⁶. Anyone adopting a dog from overseas should always ensure tests have been carried out before taking responsibility for the animal.

Recommendation 5: To reduce the risk of importation of disease endemic in other countries, the UK Government should restrict, on the basis of an appropriate risk assessment, the movement of dogs from countries that are endemic for diseases not currently considered endemic in the UK (eg canine brucellosis, babesiosis, ehrlichiosis, dirofilariasis, leishmaniasis) and introduce appropriate testing for any such diseases as a mandatory requirement for dogs before travel to the UK.

Recommendation 6: Government agencies should maintain a comprehensive record of all port checks, animal ID, and diagnostic results to feed into UK surveillance data on the diseases covered by PETS and those not considered as endemic for the UK (eg canine brucellosis, babesiosis, ehrlichiosis, dirofilariasis, leishmaniasis).

Recommendation 7: UK Government should ensure that legislation is adequately enforced and border controls improved to prevent the importation of puppies and pregnant bitches.

Testing in UK veterinary practices

Many dogs have already travelled to the UK without being tested for *B. canis*, and many more are likely to continue to do so until pre-import tests are required. As dogs can carry the disease without clinical signs for many years, potentially spreading it to other dogs and humans, there is value in testing animals previously imported into the UK, subject to appropriate risk assessment.

⁵³ APHA guidance states that “a young dog may not test positive after being infected until it is an adult (if at all). APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at:

<http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

⁵⁴ Eg Dogs Trust smuggles stuffed toy through border control using fake passport and microchip. Article available at <https://www.itv.com/news/2015-07-20/dogs-trust-smuggles-stuffed-toy-through-border-control-with-fake-passport-and-microchip> Accessed May 2023

⁵⁵ Santos RL, Souza TD, Mol JPS, Eckstein C, Paixão TA (2021) Canine Brucellosis: An Update. *Frontiers in Veterinary Science*; 8 :594291

⁵⁶ Eg Battersea Dogs & Cats home policy on *Brucella canis*, referenced at: <https://www.battersea.org.uk/pet-advice/dog-advice/canine-brucellosis-everything-you-need-know> Accessed October 2023

Some veterinary practices have begun to implement blanket policies to routinely test imported dogs, limiting treatment to emergencies only until a negative test is shown. It is understandable that there are concerns about the potential risks to human and animal health and welfare, and veterinary teams have a right to consider and protect their own health and wellbeing, balancing this against the risk to animal welfare, especially where emergency care is involved. Whilst the disease remains reportable rather than notifiable, we support veterinary professionals being able to use their clinical judgement to make a decision regarding testing, based on risk assessment and conversations with the animal owner about the implications of testing. It is also important to ensure that informed consent is granted by the owner for any tests carried out, with the vet explaining from the outset the options available depending on the test results. Costs should also be considered, as testing can be expensive and may be a significant barrier for the owner, especially where no clinical signs are present.

Awareness of clinical signs and risk factors is important for managing and preventing the spread of the disease. Education and information around this disease is needed to support veterinary professionals to make informed decisions in cases where *B. canis* is suspected. *B. canis* exposure risk can be categorised as follows⁵⁷:

High Risk	Moderate Risk	Low Risk	Negligible Risk
<ul style="list-style-type: none"> Littermate or dam of infected puppy Offspring of infected dam High probability of exposure to highly infectious material (eg products of abortion/parturition from infected dog) 	<ul style="list-style-type: none"> Littermate, dam, or sire (father) of infected dog Sexual contact of infected dog Household animal contact of infected dog Unknown exposure to highly infectious material 	<ul style="list-style-type: none"> Known (or suspected) history of importation from, or travel to/via, a country considered endemic for <i>B. canis</i> Offspring of a dog with a known (or suspected) history of importation from, or travel to/via, a country considered endemic for <i>B. canis</i> Dogs used for breeding Dogs in transient contact with an infected dog 	<ul style="list-style-type: none"> None of the risk factors listed in this table

Table 2: Categorisation of risk factors for *B. Canis*. Information from [BSAVA SID](#).

Careful questioning regarding provenance, travel, and mating are needed to identify whether testing in dogs both with or without clinical signs is necessary. APHA recommends that dogs with obvious and specific clinical signs that raise suspicion of canine brucellosis, particularly with a history of import or close association with imported dogs, should be tested⁵⁸. They also recommend that owners should be confident that no dog involved in breeding (including via artificial insemination) is infected, and to test the dog if there is any doubt (eg if they have been imported from or previously mated with a dog from a country where canine brucellosis occurs). In accordance with the [BSAVA SID](#), and taking into account key risk factors, we recommend dogs within the following groups should be considered for testing:

- dogs with clinical signs that raise clinical concern regarding brucellosis (particularly when combined with either or both of the above groups) – in particular: discospondylitis (supported by

⁵⁷ BSAVA Scientific Information Document on *Brucella canis*. Available at https://www.bsavalibrary.com/content/chapter/10.22233/9781910443514.chap9#ref9_28 Accessed September 2023

⁵⁸ APHA (2023) Chief Veterinary Officers' (CVOs) letter to veterinary surgeons on *Brucella canis*, from October 2023, Available at: <https://www.bsava.com/wp-content/uploads/2023/10/OFFICIAL-SENSITIVE-CVO-LETTER-TO-VETS.pdf>

diagnostic imaging findings if in isolation), infertility, epididymitis/orchitis, abortion/stillbirth, transmissible venereal tumour (indicator of uncontrolled breeding abroad)

- dogs imported from *B. canis* endemic countries – ideally, should be tested pre-travel (or at point of entry) by an approved laboratory and again after 3 months
- dogs (male and female) intended for breeding – prior to first mating, and subsequently on a frequency as indicated by their contact with other dogs. Stud dogs used for semen collection should also be tested
- in-contact dogs ie dogs that have been exposed to an infected dog – ideally, should be tested as soon as the risk has been identified and again after 3 months

Management of positive cases pending further tests will need to be considered (see options below). Veterinary teams should refer to the diagnosis section in the [BSAVA Scientific Information Document \(SID\) on *Brucella canis*](#) and [APHA guidance](#) for more information.

Recommendation 8: All veterinary professionals should work to improve awareness of clinical signs and risk factors amongst colleagues and the animal owning public to help manage and minimise spread of the disease, whilst continuing to provide appropriate care for potentially at-risk dogs.

Recommendation 9: Veterinary professionals should use their clinical judgement to make a contextualised decision regarding testing for *B. canis*, based on risk assessment and conversations with the animal owner and all relevant stakeholders.

Recommendation 10: Veterinary professionals should use the risk assessment information from [APHA](#) and [BSAVA](#) to assess the need to test a dog for *B. canis*, taking limitations of current testing protocols into account. Owners should be made aware of associated costs and potential outcomes before tests are conducted in order to ensure informed consent.

Management of positive cases

There is currently no effective treatment option for *B. canis* that has been shown to consistently clear the infection, and it is impossible to confirm that an animal has eliminated it. This is possibly due to its ability to infect, survive, and replicate in various host cells⁵⁹, and its multiple strategies to evade immune response⁶⁰, leading to a higher likelihood of low treatment success rates and relapses in infected dogs even with prolonged antibiotic therapy⁶¹. Once confirmed infected, a dog is therefore currently assumed to be a carrier for life. Due to the ongoing risk an infected dog poses to other dogs and humans, euthanasia is currently the only option which eliminates all on-going risk of transmission. It is important to remember that a single serological test alone is not sufficient to definitively confirm a dog's infection status, and clinical signs, epidemiological links and diagnostics should all be considered when evaluating this and considering any actions to take (see 'Diagnosis and testing' section above). Individual risk assessments will be necessary for deciding how best to manage a specific case.

Management options for infected dogs are ultimately up to the owner, ideally in agreement with their vet. Except in the most extreme cases where there is a substantial threat to public health⁶², euthanasia of *B. Canis* infected dogs can only be recommended, not enforced. Whilst preventing the spread of the disease to protect other dogs and humans is very important, euthanasia is often a very upsetting choice as owners naturally become attached to their dogs. Some therefore will elect not to euthanise, particularly in dogs without clinical signs, and therefore efforts to reduce risk of transmission should be considered. Treatment is not recommended due to poor success rates and it

⁵⁹ Celli J. The intracellular life cycle of *Brucella* spp. *Microbiol Spectr*. 2019;7. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/30848234>.

⁶⁰ Stranahan LW, Arenas-Gamboa AM. When the going gets rough: The significance of *Brucella* lipopolysaccharide phenotype in host-pathogen interactions. *Front Microbiol*. 2021;12:713157. doi:10.3389/fmicb.2021.713157

⁶¹ Djokic, V., Freddi, L., de Massis, F., Lahti, E., Esker, M.V.D., Whatmore, A., Haughey, A., Ferreira, A.C., Garofolo, G., Melzer, F. and Sacchini, F. (2023) The emergence of *Brucella canis* as a public health threat in Europe: what we know, and what we need to learn. *Emerging Microbes & Infections*, p.2249126

⁶² For more information, refer to APHA (2023) Canine Brucellosis: Summary information sheet for veterinary staff, September 2023. Available at: <http://apha.defra.gov.uk/documents/surveillance/diseases/Canine-Brucellosis-Summary.pdf> Accessed September 2023

potentially providing a false sense of security, but it is not illegal to attempt. Following a positive test, it is important for veterinary professionals to have a full conversation with clients in a public health context, and direct owners to APHA's [Brucella canis: Information for the public and dog owners](#) for more information.

There is no universally acknowledged best practice treatment regime. The APHA [Summary information sheet for veterinary staff](#) provides more detailed information and links to further resources on this topic, but in general, the following are recommended:

- Isolate – Due to risk of onward transmission, pending confirmation and for the remainder of their lifetime following confirmation, infected dogs should have limited to no direct or indirect contact with other dogs and limited contact with people, particularly, the young, old, pregnant, or otherwise immunocompromised individuals. Given the potential for transmission in urine this will have an impact on where the dog can be appropriately housed and exercised. It is important to consider that, for some dogs, complete isolation might be almost impossible or may risk creating behavioural and welfare issues, for example those in flats with no private outdoor space. Animal owners should discuss their dog's specific needs with their veterinary team.
- Neuter – Infected dogs should be surgically neutered to limit bacterial shedding and risk of relapse. Pre-emptive administration of antimicrobials to a dog has been recommended to reduce risk of transmission to veterinary staff^{63,64}.
- Antimicrobials – Extended courses of multiple antimicrobials capable of intracellular penetration (typically combinations of two or more of doxycycline, aminoglycosides, fluoroquinolones, rifampicin) should be administered, usually for several months, and ideally until the dog becomes seronegative⁶⁵. It is important to remember that no treatment is considered 100% successful, all would have to be used 'off-label' under the Prescribing Cascade, and there are risks associated with the use of Highest Priority Critically Important Antibiotics (HP-CIAs). Owner and pet compliance should also be carefully considered where long courses of these types of antibiotics are used. When treatment is stopped, relapses of clinical disease and shedding are possible⁶⁶. Close monitoring for side-effects is also required, including gastrointestinal upset, dermatological lesions, and bone marrow, liver, or kidney toxicity.
- Monitor – Regular serological monitoring following diagnosis and treatment should be considered indefinitely to identify and manage relapses. Note that the value of repeat testing is dependent on several factors, eg presence of clinical signs. Repeat serological testing after antibiotic treatment of a dog with clinical signs may be useful to confirm whether the antibody titre is rising, indicating re-emergence of Brucella. If an infected dog with no clinical signs is retested and the titre increases, or it develops clinical signs consistent with infection due to *B. canis*, appropriate management options may need to be re-considered.
- Management of lifestyle – Infected dogs should not be used for breeding since this is associated with the highest risk of transmission. Non-reproductive means of transmission must also be considered, eg via excretion of infected urine, contact with other dogs, ingestion, inhalation, contact with mucous membranes (such as the eyes), and through broken skin (eg cuts and grazes).

As infected dogs should not have contact with other dogs or humans, the isolation and restriction on their movement would negatively impact on their welfare. There are also considerable antimicrobial stewardship implications, financial costs, and impacts on the infected dog's lifestyle and health that should be considered. It is important to remember that an animal's welfare, and the principle of a life worth living, should take priority over lifespan, as animals "live in the now"⁶⁷, and therefore quality of

63 Boyden P (2022) My View: Should we be doing more about *Brucella canis*? Veterinary Record; 191 :82

64 Middlemiss C (2021). *Brucella canis* in dogs in the UK. Veterinary Record

65 James DR , Golovsky G , Thornton JM , Goodchild L , Havlicek M , Martin P , et al (2017). Clinical management of Brucella suis infection in dogs and implications for public health. Australian Veterinary Journal ; 95 :19–25

66 Wanke MM , Delpino MV , Baldi PC (2006). Use of enrofloxacin in the treatment of canine brucellosis in a dog kennel (clinical trial). Theriogenology; 66 :1573–8

⁶⁷ This refers to the concept that animals live, relatively speaking, in the present and unlike humans, do not wish to fulfil future hopes or ambitions. The implication of this is that it is vital to focus on the animal's current quality of life and not compromise this for some perceived (and possibly dubious) future benefit. Although humans can rationalise this type of sacrifice (such as enduring chemotherapy to enhance the likelihood of long-term survival), an animal cannot.

life is more important than quantity. The ethics of an infected dog potentially posing a risk to other dogs and humans should also be considered when discussing treatment options. The willingness of veterinary practitioners to see and treat dogs with suspected or confirmed cases of *B. canis* may also have an impact on the decision of owners with respect to euthanasia. Together, these issues can often mean that euthanasia is the best option for the dog's welfare, and to protect others. Owners of *B. canis* positive dogs should consult with their vet to help make this challenging decision.

Further research into diagnostic and treatment options for this disease are needed, to improve the evidence-base and options available for dogs testing positive. Employers and professional veterinary organisations also have a role to play in supporting veterinary professionals by providing information relating to *B. Canis* positive dogs. Clear advice for pet owners is also needed. The APHA guidance for [veterinary staff](#) and [members of the public](#) are useful starting points, as is the [BSAVA Scientific Information Document \(SID\)](#).

Recommendation 11: When deciding on suitable treatment or euthanasia options following confirmation of *B. canis* infection, cases should be individually risk assessed. Quality of life and the potential impact on that dog, other dogs and people should take precedence over longevity for the infected dog.

Recommendation 12: Employers and professional veterinary organisations have a role to play in supporting veterinary professionals by providing information relating to *B. Canis* positive dogs. Clear advice for pet owners is also needed. The APHA guidance for [veterinary staff](#) and [members of the public](#) are useful, as is the information [BSAVA's SID](#).

Managing risks within veterinary practices

We support veterinary professionals in prioritising the health and wellbeing of themselves and their team in cases where animals have tested positive, and recognise that their approach to risk may vary according to their personal circumstances and those of their team. It is important that these decisions are made by individual veterinary teams, weighing up risks of transmission and animal welfare on a case-by-case basis, and considering the needs of all team members (ie RVNs, care assistants, receptionists and all other staff).

Where there is a risk of exposure to *B. canis*, veterinary practices must carry out a local risk assessment and ensure appropriate control measures are in place⁶⁸. Although it may be possible to defer elective procedures pending outcome of serological testing, it may be necessary to perform emergency surgery pending confirmation of diagnosis. Where possible, immunocompromised staff should avoid handling such cases. Postmortems of suspected *B. canis* cases should only be carried out by trained individuals in appropriate laboratory facilities. When handling probable or confirmed cases of brucellosis in practice, veterinary teams can reduce the risk of transmission by:

- providing and using appropriate PPE while examining or nursing the patient, while performing procedures, and when handling potentially infectious material. The aim of the PPE is to prevent contact between potentially infectious material and broken skin or mucous membranes: this should include gloves and gown/apron during direct contact, with additional face mask (FFP3 face-fitted) and eye protection (eg glasses, goggles, or face shield) when handling potentially infectious material or where there is a risk of aerosolisation.
- limiting the potential for contact with other dogs and people (including in the practice waiting area, clinical areas, and outdoor toileting/exercise areas).
- judiciously using antimicrobials to reduce risk of shedding in a dog when performing surgical interventions/diagnostic procedures that might result in exposure to infected material.
- considering efforts to minimise aerosols during procedures.

⁶⁸ Useful resources for completing risk assessments include: Control of substances hazardous to health (Sixth edition) The Control of Substances Hazardous to Health Regulations 2002. Approved Code of Practice and guidance <https://www.hse.gov.uk/pubns/books/l5.htm>; Health and Safety at Work Act 1974 <https://www.hse.gov.uk/legislation/hswa.htm> ; Management of Health and Safety at Work Regulations 1999 <https://www.legislation.gov.uk/ukksi/1999/3242/contents/made> and <https://www.hse.gov.uk/pubns/hsc13.pdf>

- planning an effective means to dispose of potentially infectious waste and decontamination of materials. Any waste that may be contaminated with *B. canis* should be disposed of as infectious waste.
- ensuring appropriate cleaning and disinfection has taken place. Appropriate disinfectants include 1–2.5% sodium hypochlorite and quaternary ammonium compounds.

Whilst the zoonotic spread of *B. canis* is a concern, veterinary teams should remember that the risks to staff in veterinary practice remains low. Veterinary teams continue to treat dogs in countries in which the disease is considered to be endemic, and lessons may be learnt from their approaches to reducing their risk of infection. Lessons could also be learnt from the policies adopted in countries with similar risk profiles to the UK, though improved surveillance would be needed to accurately identify these.

Recommendation 13: Veterinary professionals should take steps to minimise the risk of transmission of infection to people and to other dogs when handling dogs with suspected or confirmed cases of *B. canis*.

Research requirements

There are many knowledge gaps with respect to *B. canis*, especially compared with other *Brucella* species. This is largely due to *B. canis* being thought to have less impact on human health and economics, and therefore less money has been made available to support research and development.

The [UKHSA HAIRS Risk Assessment](#) lists several areas in which they found data to be lacking, and this research could impact our understanding of *B. canis* and decision making associated with infected dogs. Some of the research requirements which believe to be of high priority are:

- systematic surveillance for disease in dogs in most countries. The current lack has resulted in an incomplete understanding of which countries are endemic, and the prevalence levels in their respective dog populations.
- potency of non-reproductive routes of transmission between dogs and the extent to which neutering dogs reduces risk of non-reproductive transmission of *B. canis* (and reduces susceptibility of infection).
- implications of the disease on human health, including any long term effects of subclinical infection, risk factors for severe disease, and impacts of repeated exposure, particularly in an occupational setting.
- Efficacy of antibiotic treatment in dogs and uncertainty with respect to whether new treatments (or treatment combinations) may be more effective.
- Extent to which antibiotic treatment may help to drive emergence of antibiotic resistant strains of *B. canis* (and other non-Brucella bacteria which may be present).

Recommendation 14: Further research should be conducted into *B. canis*, based on the data gaps identified by the [UKHSA HAIRS risk assessment](#).

Further reading

- BSAVA [Scientific Information Document on *Brucella canis*](#)
- APHA [Canine Brucellosis: Summary information sheet for veterinary staff](#)
- APHA [Frequently asked *Brucella canis* testing questions](#)
- APHA [Canine Brucellosis: information for the public and dog owners](#)
- UKHSA [HAIRS risk assessment: *Brucella canis*](#)
- BVA [policy position on pet travel](#)

BVA, BSAVA, SPVS, and BVNA policy position on *Brucella canis* December 2023