



HM Government

# **Bovine tuberculosis:** Guidance on management of the public health consequences of tuberculosis in cattle and other animals (England)



## About Public Health England

Public Health England's mission is to protect and improve the nation's health and to address inequalities through working with national and local government, the NHS, industry and the voluntary and community sector. PHE is an operationally autonomous executive agency of the Department of Health.

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## Introduction

The incidence and geographic spread of tuberculosis in cattle caused by infection with *Mycobacterium bovis* (*M. bovis*, bovine TB) has increased in the UK since the mid 1980s. In addition, a small number of cases of *M. bovis* infections are diagnosed each year in non-bovine livestock and domestic animals, including household pets.

A systematic approach is required for the management of possible public health consequences of tuberculosis in cattle and other animals. This revised guidance updates the previous document<sup>a</sup> and provides greater clarity and uniformity to the approach taken by local public health authorities in England when assessing the risk to people who have been in close contact with *M. bovis*-infected animals. It includes risk assessment algorithms and, for the first time, advice for public health follow-up of tuberculosis in non-bovine animals. However, whilst evidence-based, it is acknowledged that the underpinning evidence, including that related to the risk of recent indigenous zoonotic transmission, is lacking. Consequently revisions to this guidance may be required in future.

This guidance has been prepared by Public Health England (PHE) in consultation with Defra, Animal Health and Veterinary Laboratories Agency (AHVLA), the Food Standards Agency (FSA), Health and Safety Executive, the Chartered Institute of Environmental Health and the Department of Health.

Similar guidance is already in place in Wales and Northern Ireland. Scotland is officially TB free and therefore manages incidents on an individual case by case basis.

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<sup>a</sup> Department of Health and the National Assembly for Wales, June 2000. Bovine tuberculosis: guidance on management of the public health consequences of tuberculosis in cattle in England and Wales

# Background information

## Epidemiology of *Mycobacterium bovis* in cattle

A compulsory eradication campaign for bovine TB began in Great Britain (GB) and Northern Ireland in 1950 and 1959 respectively. This involved routine screening of herds by intradermal tuberculin testing, slaughter of all test positive animals (known as reactors), and cattle movement restrictions in infected herds. The basic principle of the bovine TB test and slaughter programme is to identify infected cattle as early as possible and minimise the risk of the disease being transmitted to other cattle, wildlife and people. The main screening test for TB in cattle in GB is the single intradermal comparative cervical tuberculin test (SICCT) using bovine (*M. bovis*) and avian (*M. avium*) tuberculins. This is more commonly known as the tuberculin skin test, which is used throughout the world to screen cattle, some other animals (deer, goats, pigs, sheep and camelids) and people<sup>b</sup> for TB. On-farm TB surveillance of cattle herds is supplemented with post-mortem inspection of all cattle slaughtered for human consumption in abattoirs by Food Standards Agency (FSA) officials. Pasteurisation of milk is the third component of the programme.

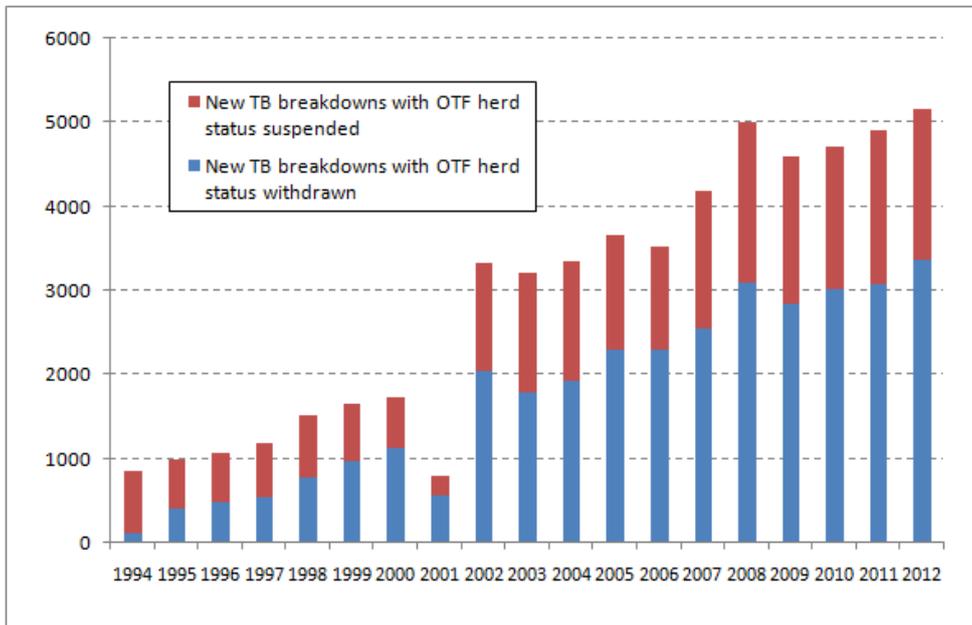
By 1979 the campaign had reduced the incidence of infection in cattle herds in England to a very low level (0.49% of herds, 0.02% of cattle tested) and infection was restricted to small pockets in the Southwest of England (1). However, since the mid 1980s, the number and geographical distribution of new incidents of bovine TB in cattle herds have steadily increased in England and Wales (Figure 1). This trend accelerated immediately after the foot and mouth disease outbreak in 2001, during which the routine TB testing and slaughter programme was suspended for almost ten months, but the rate of increase has slowed down in more recent years.

*M. bovis* is currently endemic in cattle in large parts of southwestern England, south and mid-Wales (Figure 2), and most of Northern Ireland. In these areas *M. bovis* is also present in the badger population, which acts as a wildlife reservoir for the bacterium. By contrast, the disease is rare in the far North and East of England. Scotland was recognised by the European Commission as an Officially TB Free (OTF) region of the UK in September 2009. A small number of bovine TB incidents still occur sporadically in low-risk regions, due mainly to inward movements of infected cattle from high risk areas elsewhere in the UK and Ireland that escape detection by pre-movement TB testing.

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<sup>b</sup> *Mycobacterium tuberculosis* antigen only is used for human tuberculin skin tests.

**Figure 1. Number of new bovine TB herd breakdowns disclosed annually in GB between 1994 and 2012**



OTF = Officially TB Free.

The data include very small numbers of herd breakdowns identified every year in Scotland. Data for 2008-2012 were extracted from AHVLA’s replacement IT system (Sam). The data series for previous years was derived from the old IT system (VetNet) and is not directly comparable. Source: Defra.

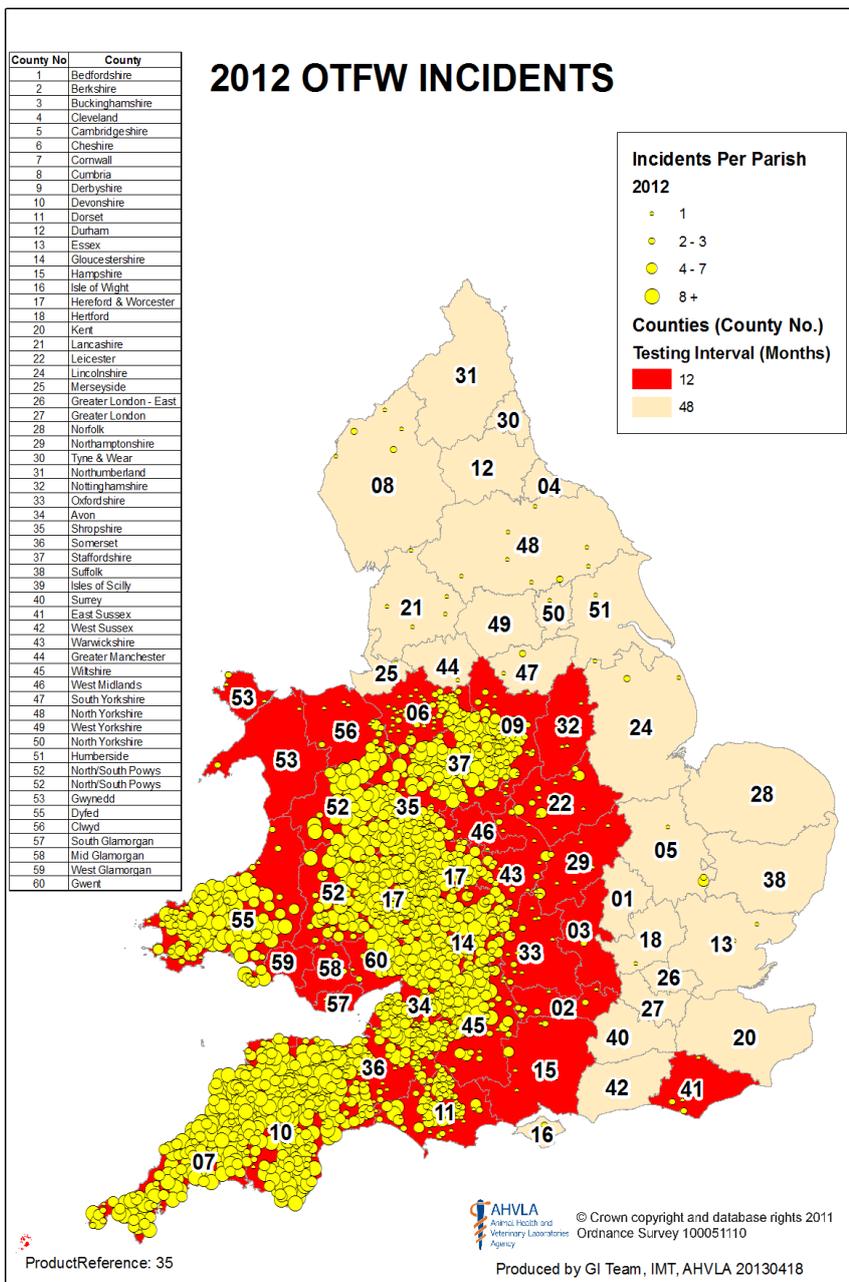
There were 79,267 cattle herds and 8.41 million cattle registered in GB during 2012. Of the 5,091 new bovine TB incidents (herd breakdowns) recorded in GB in that year, more than 97% occurred in England and Wales. A breakdown is defined as the detection in an OTF herd of one or more tuberculin skin test reactors or the presence of an animal with culture-positive lesions of TB at routine slaughter. Just over 36,600 cattle were slaughtered as tuberculin skin or interferon-gamma (blood) test reactors in England and Wales in 2012 (2, footnote<sup>c</sup>). Post-mortem evidence of lesions characteristic of bovine TB and/or culture of *M. bovis* was detected in 3,450 (66%) of the new bovine TB incidents in England and Wales.

“OTF herd status withdrawn” (OTFW) implies that characteristic lesions of TB were identified during post-mortem inspection in at least one reactor in the affected herd, or that *M. bovis* was isolated from tissue samples from a reactor or slaughterhouse case. Other-wise (ie no visible lesions found in any of the reactors slaughtered) the herd is still suffering a breakdown and considered infected, but its OTF status is considered suspended and a less stringent follow-up testing regime is required to restore its OTF status. A herd can also have its OTF status temporarily suspended as a result of an overdue TB test, detection of a slaughterhouse case pending laboratory culture results or if inconclusive reactors are found in the three years following an OTFW breakdown.

<sup>c</sup> Complete set of official bovine TB statistics available at <https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/series/bovine-tb>

In 2012 there were just over 5,000 new breakdowns in England and Wales, of which nearly 3,450 resulted in the withdrawal of OTF herd status (OTFW). Only 40 of those new OTFW breakdowns occurred in the low risk area of the East and North of England, where herds are tested every four years. For at least half of those 40 OTFW breakdowns, there is epidemiological evidence to show that they were caused by movements of undetected infected cattle from herds in the annual testing area of GB, without subsequent secondary spread of TB to other herds (ie isolated introduced cases).

**Figure 2. Map of England and Wales showing locations of farms where Officially TB Free status was withdrawn due to herd breakdown in 2012**



Counties in red indicate the area of GB currently on annual TB herd testing. Source: Defra.

## Mycobacterial infections in other animals

The Tuberculosis (England) Order 2006 (3, footnote<sup>d</sup>) introduced for the first time in England a legal requirement to immediately notify the AHVLA when suspected tuberculous lesions are identified in the carcass of any farmed mammal or a mammal kept as a pet. It is also compulsory to notify the AHVLA if *M. bovis* is identified by laboratory examination of samples taken from any mammal (except humans). Since 2005 an increase in non-bovine animals investigated for *M. bovis* infection has been noted, which may partly reflect this change in legislation.

### *Mycobacterium bovis*

Bovine TB is predominantly a disease of cattle, but virtually all warm-blooded animals are susceptible to infection with *M. bovis* to a variable degree. In particular, there is a significant reservoir of infection in badgers in the West of England and large areas of Wales. Wildlife species are not routinely examined, but many incidents of infection in other non-bovine species (farmed animals and pets) are diagnosed each year by AHVLA, with 780 diagnoses being made between 2006-2012 (Table 1). Deer, camelids (alpaca and llama), pigs, cats and sheep are most commonly infected. In 2012, 98 incidents of *M. bovis* infection in non-bovine animals were confirmed by culture in GB.

**Table 1. Laboratory diagnoses of culture-positive *M. bovis* in non-bovine domestic animals & wild deer in GB, confirmed by AHVLA 2002-2012**

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Domestic Cat	2	2	6	13	14	15	18	26	23	19	9
Domestic Dog	1	0	1	0	0	1	1	3	2	0	1
Domestic Pig	1	8	1	12	2	5	10	23	29	44	18
Farmed Deer	8	8	0	1	5	1	1	1	1	6	2
Park Deer	2	0	2	1	17	4	2	0	6	0	0
Wild Deer	3	14	42	31	29	20	31	18	15	17	12
Alpaca	0	2	1	0	1	4	13	68	43	17	35
Llama	0	1	0	1	8	16	9	0	0	0	3
Sheep	1	0	3	2	0	0	1	5	13	35	16
Goat	0	0	0	0	0	2	33	0	1	0	2
Ferret	0	0	0	3	0	0	0	0	0	0	0
Farmed Wild Boar	0	0	0	0	2	0	0	0	1	1	0
<b>Total</b>	<b>18</b>	<b>35</b>	<b>56</b>	<b>64</b>	<b>78</b>	<b>68</b>	<b>119</b>	<b>144</b>	<b>134</b>	<b>139</b>	<b>98</b>

Source: Defra ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/232602/bovinetb-otherspecies-27aug13.xls](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/232602/bovinetb-otherspecies-27aug13.xls))

The figures represent submissions from individual animals rather than premises or herds, ie more than one submission may be from the same premises.

<sup>d</sup> This Order was subsequently repealed and replaced with an updated version which is currently in force, The Tuberculosis (England) Order 2007 (as amended): <http://www.legislation.gov.uk/uksi/2007/740/contents/made>

## Other mycobacterial infections in animals

Other mycobacterial species, particularly those belonging to the *Mycobacterium tuberculosis* complex, may also be determined as the cause of animal infections. While *M. tuberculosis* is rarely confirmed in animals in England, it can occur in captive elephants, non-human primates, and occasionally in dogs (4). *Mycobacterium microti* causes disease particularly in cats and camelids, with wild rodents acting as its natural host (5). A range of other species, such as *M. avium*, frequently affect animals including birds, pigs, cats, and deer. *M. avium* isolates from animals are not routinely subtyped. The role of animals in the epidemiology of human *M. avium* infection is unclear as the organism is found in the environment, but it is considered unlikely to be zoonotic from companion animals.

## *Mycobacterium bovis* infection in humans

Historically and prior to the introduction of animal disease controls, around 2500 people died each year from zoonotically acquired TB in the UK (6). This represented approximately 6% of deaths due to all forms of tuberculosis (7). The sustained decline in the incidence of human *M. bovis* infection in the UK has largely been attributed to the introduction of wide-scale milk pasteurisation, the compulsory, regular screening of cattle herds with the tuberculin test and compulsory slaughter of reactors (8).

In 2012, 35 of 5200 (0.7%) culture-confirmed cases of human TB in the UK were due to *M. bovis* (9), while the vast majority (5048/5200, 97.1%) of culture-confirmed cases were due to *Mycobacterium tuberculosis*. The number of cases of human *M. bovis* has remained low in the UK since 2000, with between 12 and 36 cases (mean 23 cases) identified per annum between 2000 and 2012 (Table 2).

Risk factor data are collected via questionnaire on all culture-confirmed cases of *M. bovis* in England, Wales and Northern Ireland, with data collated in the Enhanced *M. bovis* Surveillance database at PHE Colindale. However, as exposure may have taken place many years earlier due to the long latent period of TB, there is substantial patient recall bias and identification of the likely source of infection is frequently not possible.

Currently, different typing schemes are used for animal and human strains and so source attribution from direct comparison has not been possible. Sharing of isolates is encouraged, and proposals are in place to utilise whole genome sequencing. It is anticipated that this will enhance our understanding of *M. bovis* epidemiology in the UK.

**Table 2. Case notification numbers of *Mycobacterium bovis* from humans by country and region, UK 2000-2012**

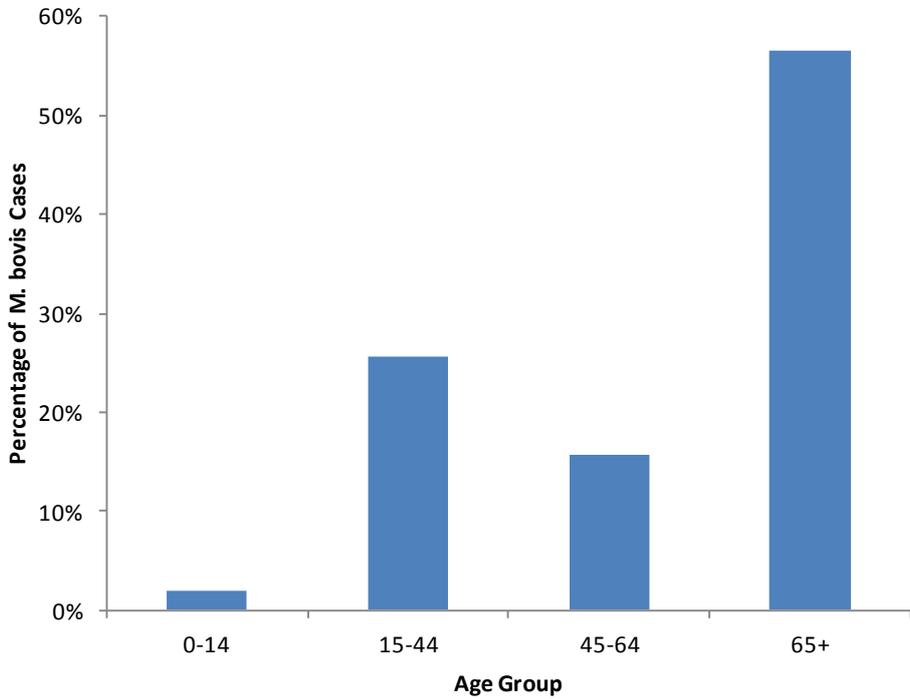
Year	North of England	Midlands	London	South of England	England	Wales	Northern Ireland	Scotland	UK
2000	3	0	2	5	10	1	0	7	18
2001	6	7	2	2	17	1	1	1	20
2002	1	3	2	4	10	1	0	1	12
2003	1	3	7	3	14	0	2	1	17
2004	3	3	3	0	9	1	3	3	16
2005	2	6	0	3	11	4	5	3	23
2006	3	7	5	5	20	0	2	6	28
2007	3	3	6	7	19	1	1	1	22
2008	4	6	2	2	14	2	2	3	21
2009	1	6	1	3	11	4	1	7	23
2010	3	9	6	7	25	1	1	6	33
2011	4	10	7	6	27	0	2	7	36
2012	7	7	6	6	26	3	0	6	35

**Source:** Enhanced Tuberculosis Surveillance (ETS), Public Health England, and Enhanced Surveillance for Mycobacterial Infection (ESMI), Health Protection Scotland.

Surveillance data show that between 2000 and 2012, those aged 65 years and over continued to account for the largest proportion (57%) of human *M. bovis* cases (Figure 3), with the majority (79%) of cases in this age group born in the UK (Figure 4). The age group 15 to 44 years accounted for the second highest proportion (26%) of cases, and the majority (56%) of these were born outside the UK. The proportion of *M. bovis* cases in this age group remains considerably lower than the proportion of TB due to *M. tuberculosis*, where 61% of cases occurred in those aged 15 to 44 years old (9). The proportion of *M. bovis* cases in those aged 0 to 14 years continues to be very low (2%).

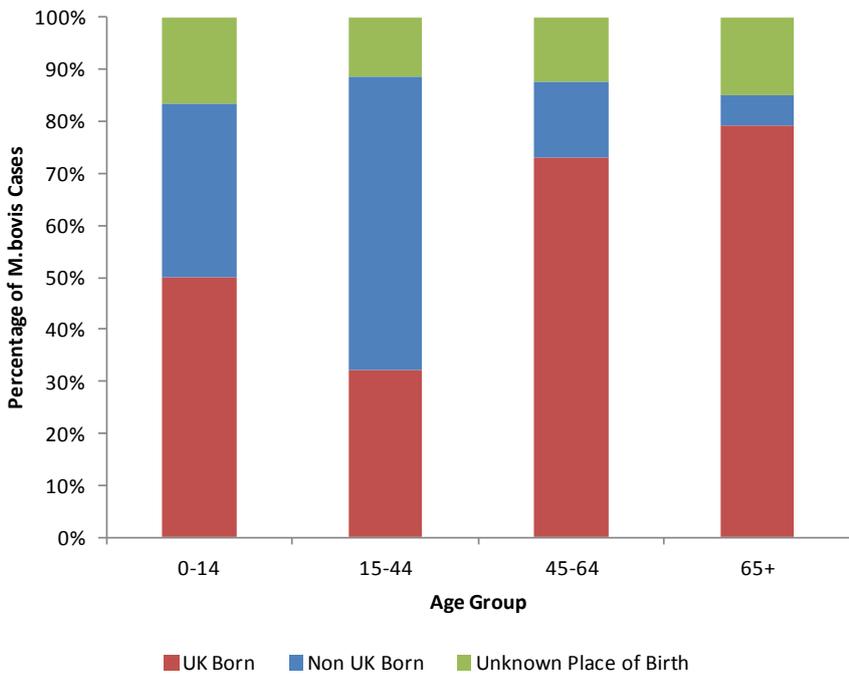
These data support the view that most cases of human TB caused by *M. bovis* are likely due to reactivation of latent infection acquired prior to widespread milk pasteurisation and implementation of compulsory TB control programmes in cattle, or are due to infection acquired abroad.

**Figure 3: Percentage of culture-confirmed human TB cases due to *M. bovis* by age group, UK 2000 to 2012**



**Source:** Enhanced Tuberculosis Surveillance (ETS), Public Health England, and Enhanced Surveillance for Mycobacterial Infection (ESMI), Health Protection Scotland.

**Figure 4: Percentage of culture-confirmed human TB cases due to *M. bovis* by place of birth and age group, UK 2000 to 2012**



**Source:** Enhanced Tuberculosis Surveillance (ETS), Public Health England, and Enhanced Surveillance for Mycobacterial Infection (ESMI), Health Protection Scotland.

## Transmission from cattle to humans

There are three routes of infection with *M. bovis* in human hosts: ingestion, inhalation or direct contact with mucous membranes and skin abrasions (8). The infectious dose is unknown but has been estimated to be in the order of tens to hundreds of organisms by the respiratory route and millions by the oral route (10). Infection via the respiratory route is therefore plausible but requires close contact with the tuberculous animal. Traditionally, the consumption of unpasteurised milk from infected cows has been the main vehicle of *M. bovis* infections in humans.

### Oral Transmission

Oral transmission can occur through consumption of contaminated milk or milk products. In theory, transmission could also occur via consumption of meat/meat products, although there is no evidence that this has happened in the UK or in the published literature.

#### *i) Milk and milk products*

Pasteurisation completely inactivates *M. bovis* and while the sale of unpasteurised cow's milk to the final consumer is still permitted in England, Wales and Northern Ireland under certain conditions, it represents only a very small fraction (estimated 0.01%) of total UK liquid milk sales to the consumer. Herds of cows which supply milk for unpasteurised sale must be officially TB free (Regulation (EC) 853/2004) and undergo tuberculin skin testing each year. The sale of unpasteurised cow's milk is banned in Scotland and there are no known sales in Northern Ireland (11).

The risk to consumers associated with the consumption of unpasteurised milk and milk products was formally assessed by the Advisory Committee on the Microbiological Safety of Food (ACMSF) in 2011 (11). It was acknowledged that there is a risk from consumption of unpasteurised milk if there is infection in the producer herd. However, the risk of infection from consumption of cow's milk or milk products is considered very low. It was estimated that in 20 consumption events of unpasteurised milk, fewer than 1500 organisms would be consumed. This is several orders of magnitude less than the infectious dose which is considered to be in the region of millions of organisms by the oral route. It was estimated that in 20 consumption events of cheese made from unpasteurised milk, an individual would be exposed to less than 20 organisms, a tiny fraction of the infectious dose (11).

The risk from unpasteurised sheep, goat and buffalo milk and milk products was also assessed and considered to be very low, due to smaller production volumes and probable lower TB prevalence in these domestic species compared with dairy cows.

## ii) *Meat and meat products*

There have been no recorded human cases of bovine TB in the UK that have been due to consumption of meat from infected animals. In theory, the consumption of undercooked or raw meat from tuberculous animals could present a risk of transmission of *M. bovis* infection to humans. However, meat is very unlikely to be a vehicle of infection in the UK as animals with evidence of disseminated disease, and any part of a carcass with visible lesions, are removed from the food chain during post-mortem meat inspection. If any organisms remained in the meat due to cross-contamination, these would be killed by normal cooking (12). The ACMSF has considered the risk from meat three times in the last decade, and on each occasion concluded that the risk from consumption of meat sold as fresh meat for human consumption following post-mortem inspection in UK abattoirs is very low (13).

The European Food Safety Authority published a scientific report in June 2013 on meat inspection which concluded that the risk of *M. bovis* infection in humans from meat was negligible as it was not considered to be a meat-borne pathogen (14).

## Respiratory Transmission

Transmission between animals occurs most commonly through aerosolised bacilli excreted from the respiratory tract. This is the most efficient method of transmission and the infectious dose is much lower than that for the oral route (8). A potential risk therefore exists for people who handle animals infected with *M. bovis* or their carcasses. Bovine TB is an occupational zoonosis. Although rare, outbreaks or cases have been described in several occupations including cattle and deer farmers, abattoir workers, zoo keepers, veterinarians, veterinary nurses, meat inspectors and TB laboratory personnel (15-19).

## Cutaneous Transmission

This involves the traumatic inoculation of bovine TB into the skin during manipulation of carcasses or direct contact with infected animals, resulting in localised skin, tendon, mucosal or lymph node lesions. This mode of transmission is now extremely rare in the UK, with only one case documented in the mid 2000s in a veterinary surgeon who treated an infected alpaca before the diagnosis of TB could be reached (20).

## Transmission from humans to cattle

Although infection of cattle by humans with *M. bovis* has been described in a very limited number of case reports (21), the contribution of humans as a source of *M. bovis* infection to cattle in the UK is insignificant compared to the much more prevalent reservoirs of infection in cattle, badgers and other animal populations.

## Transmission from human to human

As with *M. tuberculosis*, human-to-human transmission of *M. bovis* can occur, and outbreaks have been reported (22). However, since human *M. bovis* disease is rare, cases arising from human to human transmission of *M. bovis* are also rare.

### Transmission from non-bovine animals to humans

It had always been assumed that there was a theoretical risk of transmission from non-bovine animals (such as pets) to humans although this risk had not been documented. However, recent incidents involving infected cats (23, 24) have provided evidence that both latent and active TB infections in humans can result from close contact with an infected domestic animal. Nonetheless, a risk assessment has concluded that the transmission risk of *M. bovis* from cats to humans is still very low (25).

There are concerns about the potential for transmission from other animals, particularly camelids, which have rapidly progressive and extensive disease and a tendency to spit (a mixture of gastric contents and saliva). There have been two confirmed cases in the UK of human disease acquired from infected alpacas (20, 26).

### Other zoonotic mycobacterial infections in humans

Human cases of *M. tuberculosis* acquired from animals, including elephants, have occasionally been described (4).

Human infections due to *M. microti* are also rare (5), and occur in both immunosuppressed and immunocompetent patients. A zoonotic source of infection may not always be identified.

*M. avium* complex infections are increasingly reported in humans (27), but are still uncommon compared to *M. tuberculosis*. They are generally thought to be environmentally rather than zoonotically acquired (14).

# Liaison between veterinary, medical and local authority agencies

## TB in cattle

### Cattle testing for bovine TB

Bovine TB is identified in cattle in several different ways:

- by tuberculin skin testing (reactor animals)
- by blood testing (primarily the interferon gamma release assay – a supplementary test used in conjunction with the primary skin test to enhance the detection of infected animals in some cattle herds)
- by post-mortem inspection or examination (for example at a slaughterhouse, veterinary laboratory, knacker's yard or hunt kennels)
- by identification of clinical cases (typically tuberculous mastitis), which are extremely rare nowadays

A movement restriction legal notice (TB2) suspending or withdrawing the Officially TB Free (OTF) status of the herd is issued to the owner or keeper of infected animals in all of the above situations. It is also issued if:

- a scheduled TB test is not completed on time; or
- a skin test detects inconclusive reactors in a herd that had experienced a bovine TB breakdown in the previous 3 years; or
- a suspected case of TB is detected in the carcass of an animal (eg during meat inspection) and pending the laboratory culture results

Once the required testing and removal of animals has been completed, a de-restriction notice (TB10) is issued by AHVLA restoring the OTF status of the herd. This indicates the end of the disease incident. Further details on these processes are available from AHVLA (28).

### Notification of results

A new system was instituted in November 2013. An electronic report is issued by AHVLA to the relevant Public Health England Centre (PHEC), via secure email (@NHS.net) in all instances where the OTF status of a cattle herd is first withdrawn (ie the first time a herd is positive) due to the detection of:

- at least one tuberculin test reactor animal with visible lesions of TB at post-mortem examination AND/OR an *M. bovis*-positive culture result, OR
- at least one non-reactor with visible lesions of TB at post-mortem examination AND with an *M. bovis*-positive culture result, OR

- an untested animal with visible lesions of TB at post-mortem examination and with an *M. bovis*-positive culture result

The electronic report from AHVLA will provide information to assist public health authorities in deciding what further public health actions may be required (see also **direct notifications** below). Further reports will be issued when the incident has been resolved and a TB10 notice issued. These electronic reports are supplied to PHE on a monthly basis. AHVLA issues similar reports to environmental health practitioners (to enable monitoring of farmers' compliance with milk hygiene regulations) and the Food Standards Agency.

See Appendix 5 for content of the electronic report.

A **direct notification** or further update (by phone or post, possibly in advance of the electronic report) will be made in any bovine TB incident in which there are aspects with possible public health significance. These might include:

- clinical cases of TB in the herd
- dairy cows with tuberculous mastitis
- evidence of milk-borne spread within a herd
- supply of raw milk to visitors/guests, production of unpasteurised cheese, or sale of unpasteurised milk
- cattle with pulmonary lesions
- unusually large numbers of test reactors with visible lesions
- partial or complete depopulations of infected premises due to severe TB breakdowns

## TB in other animals

AHVLA will notify the PHEC about all bacteriologically confirmed diagnoses of *M. bovis* infections in non-bovine domestic animals or captive wild animals, such as camelids, goats, cats, dogs, exotic animals in zoos, etc. This will be done by telephone or by post.

Diagnostic laboratories in GB must, by law, notify AHVLA of the identification of *M. bovis* in any animal sample without delay. Although not mandatory, it is recommended that such laboratories share *M. bovis* isolates from animals with AHVLA for comparative genotyping.

## Human *M. bovis* infection

The public health and clinical management of *M. bovis* cases is detailed in NICE guidance (29). The principles are very similar to the investigation, treatment and contact follow up of *M. tuberculosis* cases.

- as for *M. tuberculosis*, all human cases of *M. bovis* should be notified to the web-based Enhanced TB Surveillance (ETS) system by the Registered Medical Practitioner
- infection control and contact tracing activities are as for any other case of human tuberculosis, as detailed in NICE guidance (29)
- the PHE Centre health protection team should also be informed so that further public health actions may be undertaken
- an *M. bovis* enhanced questionnaire (revised 2014) should be completed for every human case by the health protection team or clinical care provider, preferably on ETS. If completed in paper form, please return to the PHE TB team
- any possible zoonotic source indicated by this screening questionnaire should be discussed with the TB or Emerging Infections & Zoonoses teams at PHE Colindale

Additional details should be collected if an animal is implicated in transmission. While specific questions should be tailored to the situation (ie livestock or pet), this information might include:-

- the type, proximity and length of contact with the animal (eg intermittent contact of short duration [livestock], or prolonged contact, such as with a domestic pet)
- the nature of the close contact with the animal
- was contact in an enclosed environment or open air?
- if a pet, did the animal sit on laps or shoulders? or sleep on an occupied bed?
- if the animal was diseased, was there contact with wounds or abscesses?
- was the contact animal known to be positive for *M. bovis*?
- if yes, what was the site of TB in this animal - cutaneous TB, pulmonary TB, TB mastitis or other?
- duration of disease in the animal? was the animal coughing or spitting?
- are there strain typing results for comparison with the human isolate?

The relevant health protection team should advise the regional AHVLA office as quickly as practicable whenever sputum smear-positive or culture-positive *M. bovis* TB is diagnosed in a person with an agricultural connection or working in the livestock sector. This will enable AHVLA to investigate the possibility of an undisclosed animal infection in the patient's environment, either as a potential consequence or as the source of the human infection.

## Actions to be taken by public health

This requires good and prompt liaison between local veterinarians, AHVLA, local authority environmental health practitioners, the responsible officer at the PHEC, and the local chest clinic.

### *M. bovis* in cattle

- disease in both dairy and beef cattle will be notified to PHE
- see algorithm (Appendix 1) for a summary of actions
- NICE guidance (see Box 1) should be followed unless there are extenuating circumstances relating to the animal incident such as intense or unusual transmission between animals, or the exposed person is known to be in a risk group as defined by NICE (see Box 2). The precautionary principle should be applied

#### **Box 1. NICE guidance regarding follow-up of cattle TB incidents**

The risk assessment, contact tracing and management of persons in contact with bovine TB should be informed by the current Tuberculosis guideline from the National Institute of Care and Clinical Excellence (NICE). (29)

The NICE guideline development group (GDG) considered the evidence from the national *M. bovis* surveillance system and from investigations of human contacts of infected herds. There has been no increase in reported human cases of *M. bovis* despite a greater than five-fold increase in animal disease (PHE data). Based on this evidence, the NICE GDG concluded that the risk to human health from bovine TB in cattle is very low.

Since there is little evidence of cattle–human or human–human transmission<sup>e</sup> of *M. bovis* from national epidemiology or the limited UK data, NICE considers that tuberculin skin testing and interferon-gamma testing should be limited to previously unvaccinated children and adolescents (age <16) who have regularly drunk unpasteurised milk from animals with udder lesions, with treatment for latent TB infection being offered to those with a positive result.

“Inform and advise” information should be given to people in contact with TB-diseased animals. Symptomatic individuals identified during follow-up should be referred to the TB Clinic for further investigations.

- an “Inform and advise” letter is required even if no formal screening is arranged. A sample letter for local adaptation is given in Appendix 4. This can be accompanied by the joint PHE/AHVLA information leaflet for farmers (30)
- follow-up should be limited to close contacts who are likely to have had significant exposure. In practice, this usually means those who may have consumed raw milk or unpasteurised dairy products from a cow with mammary

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<sup>e</sup> Evans JT et al. Cluster of human tuberculosis caused by *Mycobacterium bovis*: evidence for person-to-person transmission in the UK. *Lancet* 2007; 369: 1270–76

gland lesions, or from cows in a herd with strong evidence of milk-borne spread of *M. bovis* infection, or highly infectious disease. If unvaccinated and under the age of 16 years, or in a risk group defined by NICE (Box 2), such contacts should be referred for assessment and screening. Close contacts 16 years and over should be provided with information as above.

- the optimum time for screening to take place is 8 weeks after the last exposure (31)

**Box 2. NICE guidance: groups of people at increased risk of developing active TB**

This includes people who:

- are HIV positive
- have had solid organ transplantation
- have a haematological malignancy
- have chronic renal failure or receive haemodialysis
- are receiving anti-tumour necrosis factor (TNF)-alpha treatment
- are injecting drug users
- have had an jejunioileal bypass
- have had a gastrectomy
- have silicosis

## Other considerations

### ***Abattoir workers and meat inspectors***

Abattoir workers and meat inspectors, especially those working in premises regularly receiving cattle from infected areas or slaughtering TB reactor cattle from infected herds, may repeatedly handle infected carcasses and potentially be exposed to aerosolised *M. bovis*.

The Health and Safety Executive (HSE) are the regulatory authority for such premises in relation to workplace health and safety. There is a legal duty under the Control of Substances Hazardous to Health Regulations 2002 (as amended) for employers to assess risks to employees and others and implement measures to prevent exposure to *M. bovis* as far as is reasonably practicable. Dependent upon the risk this may include, in addition to good occupational hygiene practices and disinfection, additional control measures such as respiratory protective equipment as well as provision of adequate health surveillance to ensure compliance with health and safety legislation.

Further advice on how to achieve compliance with health and safety law is available on the [HSE website](#) and in the Advisory Committee on Dangerous Pathogens guidance document '[Infections at work: Controlling the risks](#)'. A review of evidence to support future guidance from the Advisory Committee for Dangerous Pathogens for people working with animal carcasses in abattoirs is underway.

Veterinary surgeons and staff such as abattoir workers who handle animal species known to be susceptible to TB or those who handle animals that are strongly suspected of being infected with *M. bovis*, are recommended to receive BCG if they are previously unvaccinated tuberculin-negative, or interferon-gamma test negative individuals, aged under 35 years.(32)

### **Dairy herds and food safety**

**Regulation (EC) 853/2004** requires raw cow's milk to come from animals in a herd that is officially tuberculosis free. Where the TB free status of a herd is officially suspended or withdrawn, milk from the herd may no longer be used to produce raw drinking milk or raw milk-based products. Milk from the herd (other than those animals testing positive for TB or displaying signs of the disease) may still be used for human consumption but must be pasteurised or subject to higher heat treatment (eg UHT). Milk from TB reactor cows cannot enter the human food chain.

The herd owner must notify the first purchaser(s) of the loss of OTF herd status and the need to heat treat the milk. The responsibility for monitoring compliance by dairy producers in relation to milk from a dairy herd that has lost its OTF status lies with the local food authority (environmental health department). Guidance for food authorities in England, Scotland, Northern Ireland and Wales on OTF status and dairy hygiene legislation is set out in the FSA's Food Law Code of Practice Guidance (33). The local food authority will consider the public health implications for raw milk or milk products made prior to the suspension of OTF status. They will decide on need to carry out a full risk assessment on the risks to human health from these products, in consultation with AHVLA, FSA Dairy Hygiene Inspectors and Public Health England (or equivalent organisations in Scotland, Wales and Northern Ireland).

Where the local food authority becomes aware of raw drinking milk or unpasteurised dairy products marketed after a herd's OTF status has been suspended, the incident will be reported to the FSA and appropriate action taken by the local food authority in liaison with the FSA.

## **Infection in a non-bovine animal**

### **Camelids**

Alpacas and llamas appear to be very susceptible to infection with *M. bovis* with clinically overt disease which may progress rapidly. Emaciation, intermittent cough, respiratory signs and sudden death are variably reported. Lesions at post mortem examination can be extensive, and mostly involve the lungs and associated lymph nodes (34). Two recent human infections are known to have been acquired in England from tuberculous camelids (20, 26). Although farm animals, they may have more

intense human contact than other farm species, including contact with children or other vulnerable groups, in indoor locations and at public events.

If *M. bovis* is confirmed in a camelid:

- see algorithm (Appendix 2) for a summary of actions
- for animals considered to be infectious, contact tracing should include those with regular close contact ie the animal keeper, farm workers, and household members if it was regarded as a pet. Others with regular close contact with the animal while it was sick (eg veterinarian) might also need to be assessed
- any possible zoonotic exposures should be discussed with the TB or Emerging Infections & Zoonoses teams at PHE Colindale
- while specific questions should be tailored to the situation, risk assessment of exposed persons should include the following questions:
  - how long was the animal unwell?
  - is it still alive?
  - what is/was the nature of its illness?
  - if it had respiratory symptoms, how long for?
  - was the animal spitting/coughing?
  - is it considered livestock, or a pet, or does it have contact with the public? (eg open farm)
  - has anyone had close, prolonged and frequent contact with it?
  - has anyone had regular face to face contact (eg within 25cm)
  - how many other infected animals have been identified or are potentially infected on the same premises?
  - is anyone in a risk group defined by NICE? (see Box 2)
  - is anyone in close contact <16 years old?

All persons assessed at risk of transmission (as indicated on the algorithm) should be considered for screening. If indicated, screening procedures should follow NICE guidance. The optimum time for screening to take place is 8 weeks after the last exposure (31).

An “Inform and advise” letter is required even if no formal screening is arranged. A sample letter for local adaptation is given in Appendix 4. This advice should include information on handling of infected animals and appropriate personal hygiene measures, as exposure may continue while animals are unwell and continue to shed organisms, or if the environment has been contaminated.

### **Other livestock species**

The processes outlined above should also apply when *M. bovis* is isolated in other non-bovine livestock species.

## Household companion animals

If *M. bovis* is confirmed in a companion animal:

- see algorithm (Appendix 3) for a summary of actions
- contact tracing should include the household, and anyone else who has had close contact with the animal while it was sick (eg frequent visitors, veterinarian)
- any possible zoonotic exposures should be discussed with the Emerging Infections & Zoonoses team at PHE Colindale
- while specific questions should be tailored to the situation, risk assessment of these persons should include the following questions:
  - how long has the animal been unwell?
  - is it still alive (eg pets undergoing veterinary treatment at the owners' expense and risk)?
  - what is/was the nature of TB in affected animal - cutaneous TB, pulmonary TB or other?
  - if cutaneous lesions, how long for?
  - were the lesions discharging?
  - if respiratory disease, how long for?
  - was the animal coughing?
  - how many other infected animals have been identified or are potentially infected in the same household?
  - how close was the contact with the animal?
  - does anyone have contact with wounds or abscesses?
  - did it regularly sleep on an occupied bed?
  - did it sit on anyone's lap or shoulder?
  - was there regular face to face contact with the pet? (eg within 25cm)
  - is anyone in a risk group defined by NICE (see Box 2)?
  - is anyone in the household < 16 years old?

All persons assessed at risk of transmission (as indicated on the algorithm) should be considered for screening. If indicated, screening procedures should follow NICE guidance. The optimum time for screening to take place is 8 weeks after the last exposure (31).

An "Inform and advise" letter is required even if no formal screening is arranged. A sample letter for local adaptation is given in Appendix 4. While the risk has been assessed as very low (25), the advice should include information on handling of infected animals and appropriate personal hygiene measures, as exposure may continue, even if the animal is being treated, while it is unwell and/or continues to shed organisms (35).

## Other mycobacterial infections in an animal

While *M. tuberculosis* is rarely confirmed in animals in England, it has been reported to occur in captive elephants and non-human primates, and occasionally in dogs (4). If *M. tuberculosis* is identified in an animal, human contacts should be followed up as for *M. bovis*, to determine exposure and for the possible source of infection.

*M. microti* can cause TB in cats in GB, and is thought to be acquired by them from contact with wild rodents. Human cases of tuberculosis caused by *M. microti* appear to be very rare worldwide.

Animals can also be infected with other tuberculosis-complex mycobacteria such as *M. caprae*, and other non-tuberculous species including *M. avium*. *M. caprae* is present elsewhere in Europe (36), but has not yet been recognised in animals in Great Britain. It can affect humans. *M. avium* is a complex of subspecies and animal isolates are not routinely subtyped. The role of animals in the epidemiology of human *M. avium* infection is unclear as the organisms are often environmental, but it is considered unlikely to be zoonotic from companion animals.

In the case of an animal diagnosis of a mycobacterium other than *M. tuberculosis* or *M. bovis*, the private veterinarian or AHVLA may inform the owner of a possible zoonotic risk and suggest that they seek further advice. If this occurs, they may be reassured that while there is a theoretical risk of transmission to humans, the risk appears to be very low. No routine actions are indicated.

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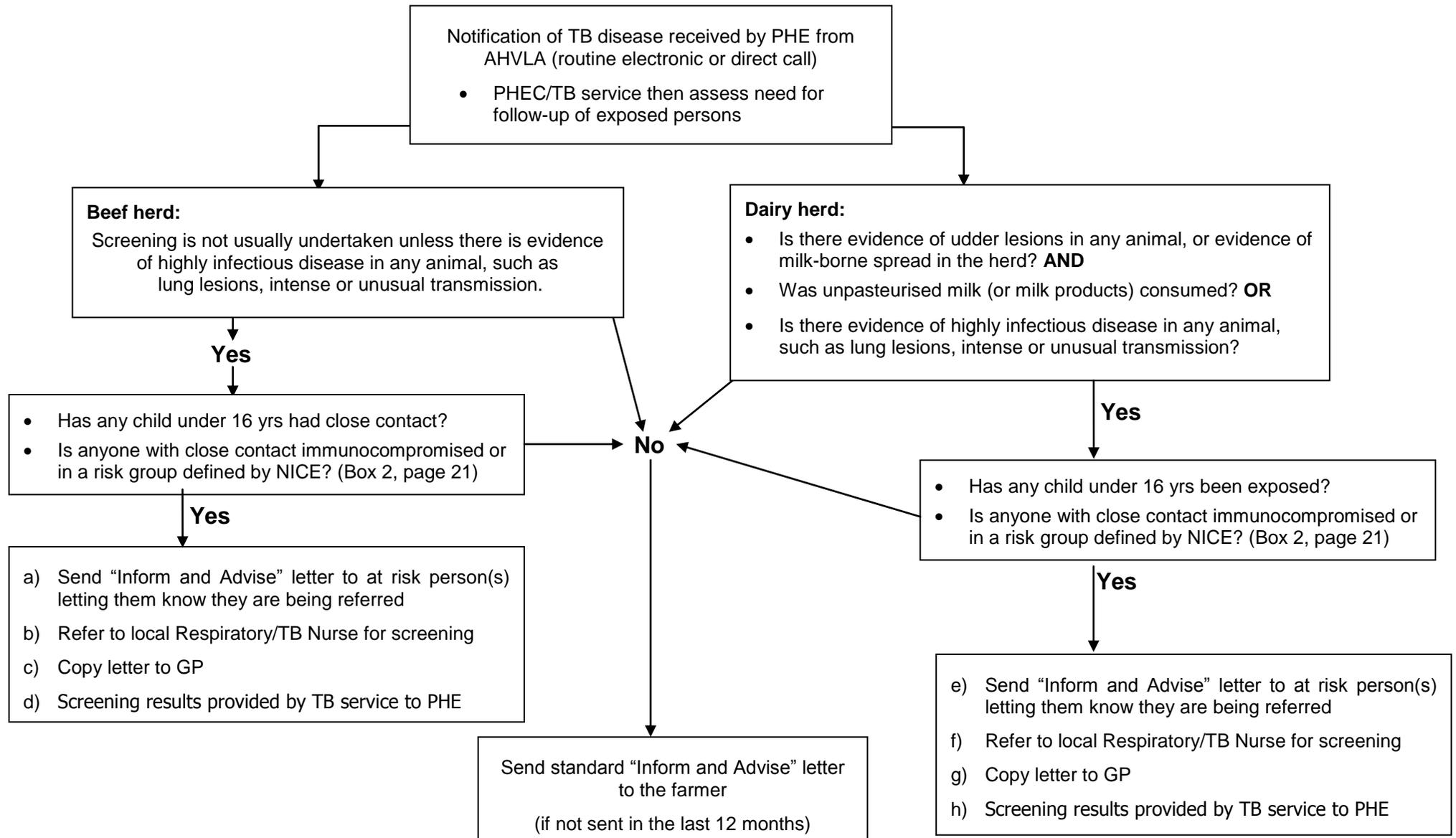
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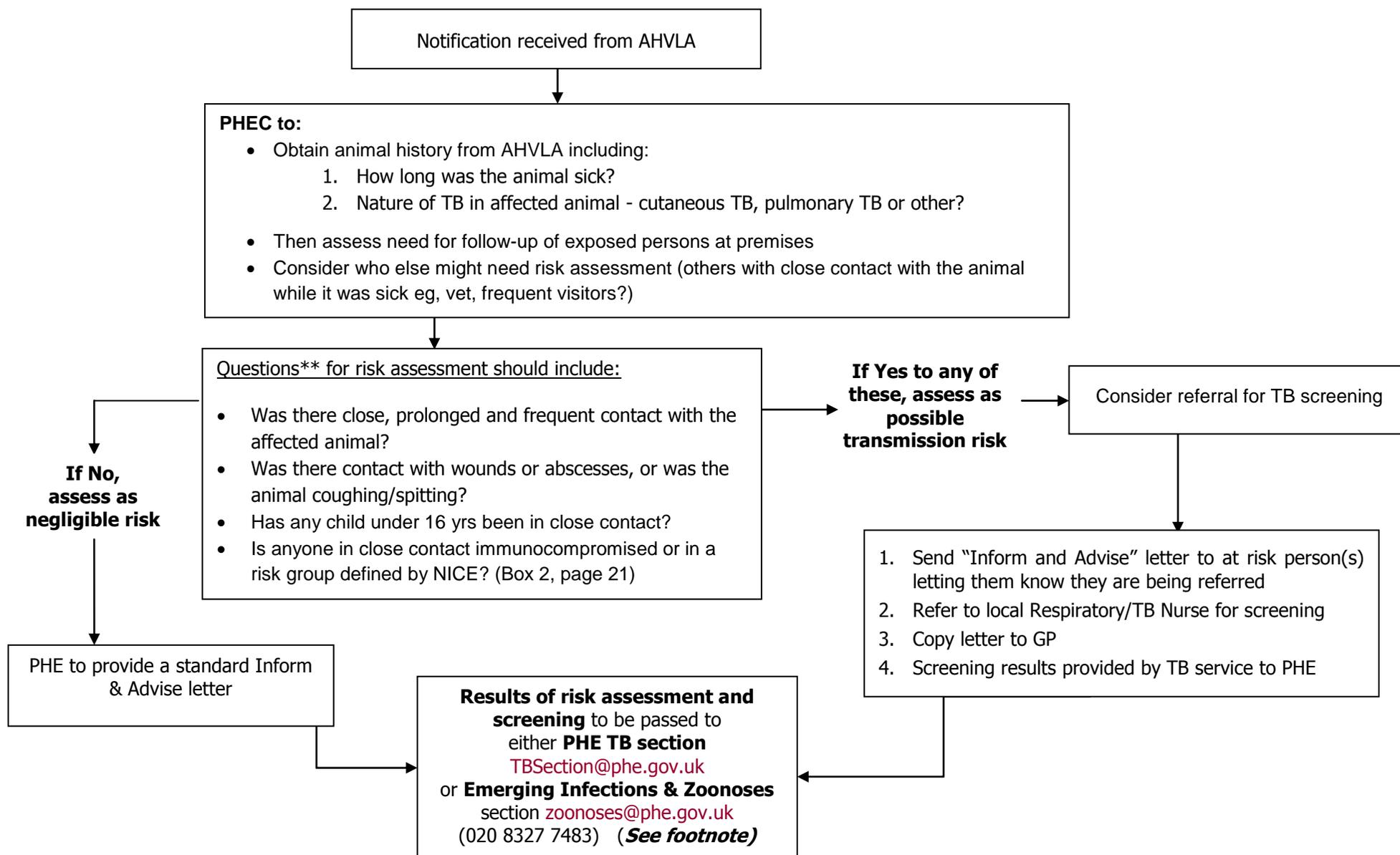
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# Appendix 1: Algorithm for TB in cattle

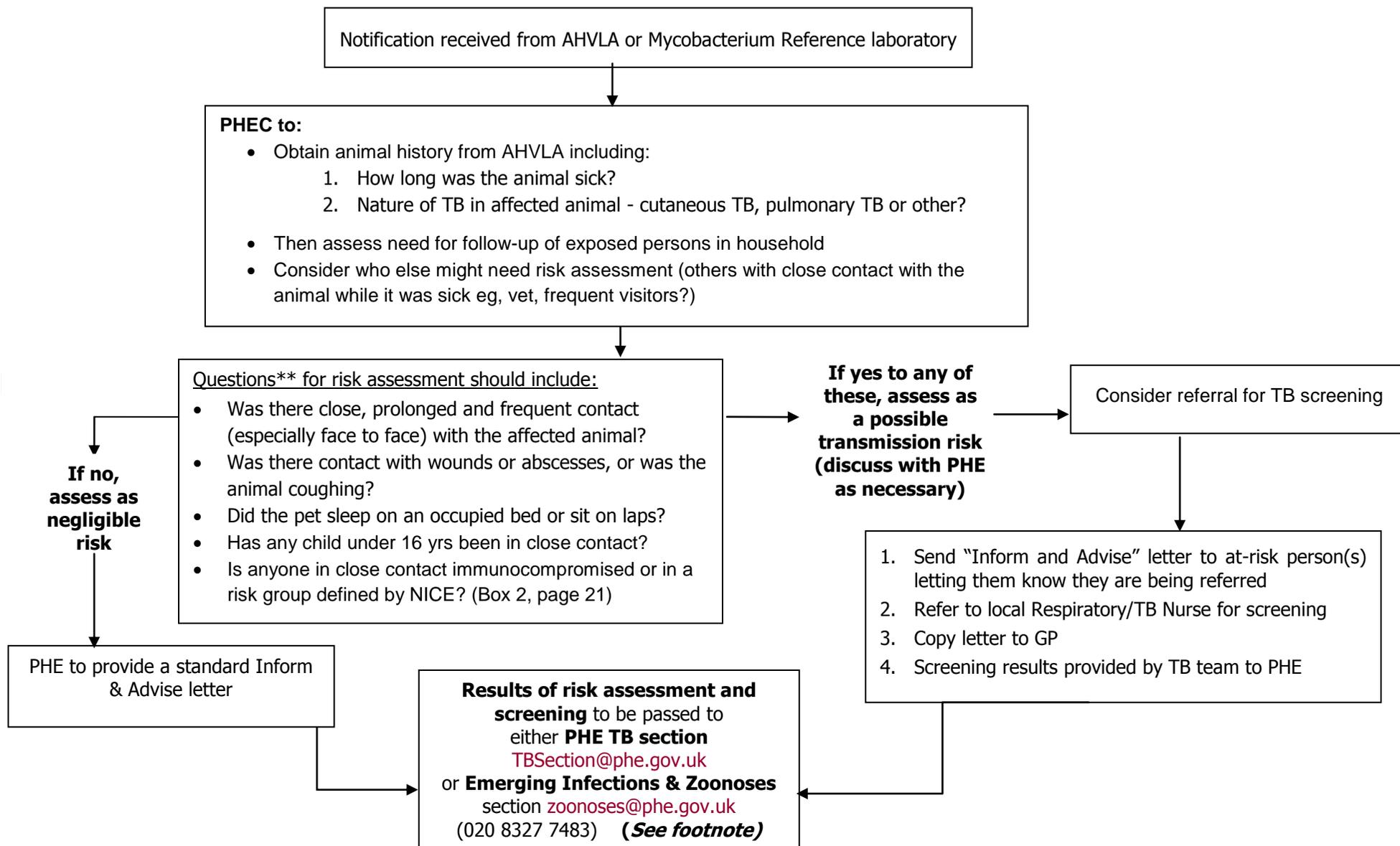


## Appendix 2: Algorithm for TB in camelids



\*\* detailed questions in Guidance

## Appendix 3: Algorithm for TB in companion animals



\*\* detailed questions in Guidance

## Appendix 4: Sample letters

### Sample 'inform and advise' letter for TB in cattle

Dear

**Re: Address of Farm**

I am writing to you as I understand that your farm was found to have cattle with TB. AHVLA always informs the Health Protection Team of such instances because of the potential public health implications.

The Health Protection Team will be contacting you to find out if there is anyone who has been in contact with the animals who is under the age of 16, or who may be unusually susceptible to infection.

Tuberculosis in cattle is very rarely passed on to humans, even when they are working very closely with the animals. The risk is therefore very low. However, it is important that you and others who may have been in close proximity with the affected animals are aware of the possible symptoms of tuberculosis which may be any of the following:

- Persistent cough (more than three weeks)
- Coughing up blood at any time
- Fever
- Night sweats
- Unexplained weight loss
- Loss of appetite
- Swelling of one or more glands in the neck
- Extreme fatigue and tiredness

If you have any immediate concerns about your health, or that of your family or colleagues, then you should consult your GP in the usual way.

You are welcome to discuss any of this with me or one of my colleagues here in the Health Protection Team.

Yours sincerely

## Sample 'inform and advise' letter for TB in camelids

Dear

### **Re: Address of Premises/Farm**

I am writing to you as I understand that your premises has been found to have alpacas/llamas (delete as appropriate) with TB. AHVLA always informs the Health Protection Team of such instances because of the potential public health implications.

The Health Protection Team will be contacting you to find out if there is anyone who has been in contact with the animals who is under the age of 16 years or who may be unusually susceptible to infection, and also to discuss what kind of contact there has been with the infected animals.

Tuberculosis in camelids is extremely rarely passed on to humans, even when they are working very closely with the animals. The risk is therefore very low. However, it is important that you and others who may have been in close proximity with the affected animals are aware of the possible symptoms of tuberculosis which may be any of the following:

- Persistent cough (more than three weeks)
- Coughing up blood at any time
- Fever
- Night sweats
- Unexplained weight loss
- Loss of appetite
- Swelling of one or more glands in the neck
- Extreme fatigue and tiredness

If you have any immediate concerns about your health, or that of your family or colleagues, then you should consult your GP in the usual way.

To minimise your exposure to the TB, we advise that you adopt strict personal hygiene procedures when handling the infected animals and their environment as they are likely to continue shedding TB organisms.

You are welcome to discuss any of this with me or one of my colleagues here in the Health Protection Team.

Yours sincerely

## Sample 'inform and advise' letter for TB in companion animals

Dear

**Re: Name of pet**

I am writing to you as I understand that your pet was found to have TB. AHVLA always informs the Health Protection Team of such instances because of the potential public health implications.

The Health Protection Team will be contacting you to find out if there is anyone who has been in contact with the animals who is under the age of 16 or who may be unusually susceptible to infection, and also to discuss what kind of contact you have had with the pet since it has been unwell.

Tuberculosis in pets is extremely rarely passed on to humans, even when they have very close contact. The risk is therefore very low. However, it is important that you and others who may have been in close contact with your pet are aware of the possible symptoms of tuberculosis which may be any of the following:

- Persistent cough (more than three weeks)
- Coughing up blood at any time
- Fever
- Night sweats
- Unexplained weight loss
- Loss of appetite
- Swelling of one or more glands in the neck
- Extreme fatigue and tiredness

If you or your family have any of these symptoms, then you should consult your GP in the usual way, mentioning TB in your pet.

To minimise your exposure to the TB, we advise that you adopt strict personal hygiene procedures when handling your infected pet and their environment as there is likely to be continued shedding of TB organisms even if treatment is attempted.

You are welcome to discuss any of this with me or one of my colleagues here in the Health Protection Team.

Yours sincerely

## Appendix 5: AHVLA notification content

The electronic notification from AHVLA to PHE includes the following:

- PHE Centre
- contact details of AHVLA Regional Office
- CPHH (county/parish/holding/herd number) (Farm identification number)
- herd type (dairy/beef/mixed)
- TB2 (restriction notice) date
- OTF Withdrawn (confirmation) date – usually when visible lesions or culture positive results are received
- map reference of holding
- farm occupier/organisation name and phone number
- farm address and postcode
- number of reactors (test positive animals)
- number of animals with visible lesions typical of TB at post mortem examination
- number of animals with typical lesions of TB mastitis
- number of animals with visible lesions of TB in the lungs
- number of animals with other visible lesions of TB
- number of animals with a positive *M. bovis* culture result
- AHVLA incident reference number

## Other sources of information

PHE information on *Mycobacterium bovis*

[http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb\\_C/1296683154769](http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1296683154769)

Reducing the risk of human *M.bovis* infection: Information for farmers

[http://www.hpa.org.uk/webc/HPAwebFile/HPAweb\\_C/1259151943662](http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1259151943662)

Bovine TB in domestic pets

<http://www.defra.gov.uk/ahvla-en/files/AG-TBYP-01.pdf>

HSE information data sheet on bovine TB

<http://www.hse.gov.uk/agriculture/zoonoses-data-sheets/bovine-tuberculosis.pdf>

FSA Manual for Official Controls. Chapter 6. Notifiable Diseases

<http://food.gov.uk/enforcement/monitoring/meat/manual/>