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Preface

This Annual Report on Zoonoses in the United Kingdom (UK) presents a summary of reported cases of zoonotic infection in humans and animals during 2010 and their trends and sources. The data have been compiled from statutory notifiable or reportable disease reports, national scanning surveillance systems, control programmes, research programmes and from data submitted to the European Community via the Trends and Sources Report, under the Zoonoses Directive 2003/99 by agencies contributing to the Report.

This report is a collaborative publication produced by:

- Health Protection Agency (HPA): lead organisation for the production of this year's report
- Department for Environment, Food and Rural Affairs (Defra)
- Department of Agriculture and Rural Development Northern Ireland (DARDNI)
- Scottish Government (SG)
- Welsh Government (WG)
- Food Standards Agency (FSA)
- Animal Health and Veterinary Laboratories Agency (AHVLA)
- Public Health Agency (PHA), Northern Ireland
- Health Protection Scotland (HPS)
- Public Health Wales (PHW)

Occasional corrections and amendments to the data, many of which are derived from dynamic databases, may occur following publication; these will result in minor changes to subsequent annual reports. Where this is the case for 2009 figures, they have been marked with an [a] symbol.

Executive Summary

Overall, there were fewer noteworthy incidents during 2010 compared to 2009 although our feature articles continue to highlight human and animal incidents of public health significance. However, there were significant trends in the number of human and animal infections, which will continue to be monitored, and some of which are reported below. These emphasise the need for continued surveillance and collaboration between veterinary and human health practitioners.

Anthrax

Human infection with anthrax is rarely reported in the UK. However in 2009, a large outbreak of anthrax with 11 cases and five deaths amongst heroin users in Scotland was recognised. In 2010, a further 34 cases, including seven deaths were reported before the outbreak was finally declared over in December 2010. All cases were in heroin users, and there is no known zoonotic association with animals in the UK.

Campylobacter

The number of laboratory confirmed cases of *Campylobacter* in humans continued to increase during 2010 and reached the record level of 70,298 cases. This represented an overall 8% increase compared with 2009, and increases were seen in England and Wales, Scotland and Northern Ireland.

In 2010, *Campylobacter* displaced *Salmonella* as the most frequently implicated causative agent in reported outbreaks of foodborne illness. There was a significant increase in the number of *Campylobacter* outbreaks, with 18 outbreaks being reported compared to 13 in 2009. The majority of these were associated with the consumption of poultry liver pâté/parfait at food service premises.

The reduction of foodborne disease caused by *Campylobacter* is a key aim of the new FSA strategic plan 2010-15. This is focussed on the reduction of *Campylobacter* in chicken, as 60-80% of cases of campylobacteriosis can be attributed to chicken. A *Campylobacter* Risk Management Programme has been implemented with the FSA working in partnership with industry, the National Farmers Union and Defra to deliver on a Joint Action Plan for *Campylobacter*. The programme encompasses a range of projects targeted at different points across the food chain, from farm to fork. To measure progress on the effectiveness of the Programme, a new target for the reduction in levels of *Campylobacter* in raw chicken has been agreed. The target focuses on decreasing the proportion of the most contaminated chickens, i.e. those with *Campylobacter* levels of >1,000 cfu/g, from a baseline of 27% in 2008 to 10% by 2015.

Echinococcus

Hydatid disease (*Echinococcus granulosus*)

The number of indigenously acquired human cases in the UK is usually very low, with an average of one new case identified approximately every five years. In 2010, two cases of indigenously acquired infection were reported - one in a retired farmer in Wales and the other in Scotland in a female who worked with sheep.

Alveolar echinococcosis (*Echinococcus multilocularis*)

In 2010, an imported beaver was diagnosed with *Echinococcus multilocularis* (EM) during a post-mortem examination. The beaver had been wild caught in Bavaria, Germany in late 2006 and, after quarantine, had been kept in captivity in England. Since the animal had been held in captivity since arrival, it was considered to pose negligible risk to animal and public health.

Although there would appear to be a very low risk that an imported Bavarian beaver would be infected with *E. multilocularis,* it is important that beavers destined for release in the UK are not sourced from EM endemic areas.

Salmonella

Overall, within the UK, *Salmonella* cases continue to fall. In 2010, 9,685 cases of laboratory confirmed human cases were reported which represents a fall of almost 8% from 2009. There were some differences within the UK, however, with the numbers falling in England and Wales, and increasing in Scotland and Northern Ireland. *S.* Enteritidis remains the most commonly reported serovar, accounting for almost 30% of cases, but this serovar showed the most significant reduction. *S*. Typhimurium was the second most commonly reported serovar and the number of cases increased slightly from 2009. However, other serovars showed a significant rise (16%) from 2009 to 2010.

Only nine foodborne outbreaks of *Salmonella* were reported in 2010, compared to 30 in 2009 (but 17 of these were *S.* Enteritidis PT14b from a single non-UK source). Although this represented a large drop in the number of outbreaks, there were substantial outbreaks associated with the consumption of fresh vegetables e.g. bean sprouts (241 cases in UK) and mixed leaf salad (130 cases).

In GB, there was a significant rise in the number of reported *Salmonella* incidents in cattle (16%) and sheep (36%) compared to 2009. There was little change in the number of incidents reported in pigs. Northern Ireland saw an increase in *Salmonella* isolates from all three species. The prevalence results for the National Control Programmes for *Salmonella* for 2010 indicate that the levels of the regulated *Salmonella* serovars in chickens and turkeys are very low - well below the EU designated targets. Substantial progress continues to be made in controlling *Salmonella* in the UK poultry sectors.

The isolation of *Salmonella* from animal feedstuffs and feedstuff ingredients in GB remained stable with around 1% of samples being positive for *Salmonella*. Of the serovars involved, fewer than 5% are considered to be of greatest public health significance.

Introduction

Zoonoses are defined by the World Health Organisation as “diseases and infections which are transmitted naturally between vertebrate animals and man”. Transmission may occur by a number of routes, from indirect contact through food or drink to direct contact through occupational exposure on farms, and from pets or through leisure pursuits. Data on zoonotic diseases in the human and animal populations is sourced from national surveillance schemes for outbreaks of infectious disease and laboratory-confirmed infections, enhanced surveillance schemes for specific zoonoses and notification of infectious diseases.

Notification and Reporting of Zoonotic Diseases

Some (but not all) zoonotic infections are statutorily notifiable or reportable under veterinary and/or human health legislation. A list of these can be seen in Appendices 1 and 2. Relevant animal legislation includes: the Animal Health Act 1981 and its subsequent amendments; the Zoonoses Order 1989; the Specified Animal Pathogens (Amendment) (England) Order 2008; the European Communities Act 1972 and the Transmissible Spongiform Encephalopathies (England) Regulations 2010, and the Devolved Administrations have equivalent legislation. The relevant human legislation includes the Public Health (Control of Disease) Act 1984 and the Public Health (Infectious Diseases) Regulations 1988. The Public Health (Control of Disease) Act 1984 was amended in 2010 to include a revised list of notifiable diseases, and for the first time a list of notifiable organisms. The new Regulations for clinical notifications came into force on 6 April 2010, and for laboratory notifications on 1 October 2010 (this revised list of notifiable diseases and organisms does not apply to Northern Ireland). In addition to the public health legislation, employers and the self-employed are required to report work-related incidents and diseases (including specified infections) to the Health and Safety Executive (HSE) under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations (RIDDOR), 1995 (http://www.hse.gov.uk/riddor/). Further relevant legislation is listed in Appendix 3.

The significance of notification differs in human and veterinary contexts. In animals, there is an obligation for any person having in their possession, or under their charge, an animal affected or suspected of having a notifiable disease (as listed in the Specified Diseases (Notification and Slaughter) Order 1992, the Specified Diseases (Notification) Order 1996 or the Transmissible Spongiform Encephalopathies (England) Regulations 2010) to immediately notify the local Animal Health Office in England, Wales and Scotland (http://www.defra.gov.uk/animalhealth/) or the local Divisional Veterinary Office in Northern Ireland. Procedures for notification and control of specified diseases are outlined in the legislation detailed above. Since the formation of the Animal Health and Veterinary Laboratories Agency (AHVLA) on 1st April 2011 notification of diseases in Great Britain is now to the local AHVLA office.

For human cases, registered medical practitioners in England and Wales have a statutory duty to notify the proper officer of the local authority (usually the Consultant in Communicable Disease Control (CCDC) of the Health Protection Agency (HPA) in England or Public Health Wales) immediately on suspected clinical diagnosis of a notifiable disease. The list of notifiable diseases varies slightly between Scotland, Northern Ireland, England and Wales. For more detail of the specified notifiable diseases and causative organisms see:

Scotland: http://www.legislation.gov.uk/asp/2008/5/contents
Wales: http://www.legislation.gov.uk/wsi/2010/1546/contents/made
England: http://www.legislation.gov.uk/uksi/2010/659/contents/made

Northern Ireland: http://www.legislation.gov.uk/apni/1967/36/contents

Surveillance and Recording of Zoonotic Diseases

Humans

In addition to notification of specified infectious diseases, voluntary laboratory reporting and outbreak surveillance are conducted for each of the constituent countries of the UK (Appendix 4). Due to under-diagnosis and under-reporting, the cases recorded in national surveillance databases tend to be biased towards more clinically severe cases in high-risk groups, or outbreak related cases. New legislation outlined above in parts of the UK will place a statutory obligation on clinical microbiological laboratories to report the diagnosis of specified organisms.

The national surveillance centres also receive and collate reports of general outbreaks of foodborne gastrointestinal disease from laboratories, health protection units and local authority environmental health (Public Protection) departments as required under article 8 of the EU Zoonoses Directive 2003/99/EC[1]. The minimum dataset on each outbreak is then collected from the appropriate health authority/board through a standardised questionnaire. Surveillance provides information on specific risk factors associated with different pathogens and on trends in the importance of these factors. Enhanced surveillance schemes are also established, either nationally or locally, to provide information on specific aspects of a zoonosis.

Data from the surveillance schemes are reported on national surveillance centre websites and for England and Wales quarterly in the Health Protection Report available at http://www.hpa.org.uk/hpr/archives/Infections/2010/zoonoses_10.htm.

Animals

In GB, diseases in livestock are monitored for the appearance of notifiable or novel diseases or changing trends in endemic diseases, including actual and potential zoonoses. This is done by the following: the Veterinary Laboratories Agency (VLA); Animal Health (AH) (in 2011 AH merged with VLA to form AHVLA); the Scottish Agricultural College (Veterinary Sciences Division) (SAC); and Meat Hygiene Service (MHS) (from April 2010 this became Food Standards Agency Operations). A similar function is performed by the Agri-Food and Biosciences Institute (AFBI) and the Department of Agriculture and Rural Development (DARD) in Northern Ireland. In addition, information may be available from universities, veterinary research organisations and other private veterinary laboratories.

The VLA and SAC undertake scanning surveillance on behalf of the Department for Environment, Food and Rural Affairs (Defra), Welsh Government (WG) and the Scottish Government (SG), through the collection, collation and analysis of disease data. This is performed by analysis of clinical diagnostic samples submitted to the VLA Regional Laboratories and to the SAC Disease Surveillance Centres. The results are entered onto the Veterinary Investigation Diagnostic Analysis (VIDA) database, and collated into reports covering GB which are published monthly, quarterly and annually. These reports (appendix 5), including

[1] OJ L 325, 12.12.2003, p. 31. Directive 2003/99/EC of the European Parliament and of the Council of 17 November 2003 on the monitoring of zoonoses and Zoonotic agents, amending Council Decision 90/424/EEC and repealing Council Directive 92/11/EEC.

those specifically relating to non-statutory zoonoses and infections shared between man and animals, are available on the internet: http://www.defra.gov.uk/vla/reports/rep_surv.htm.

SAC reports can be found at:
http://www.sac.ac.uk/consulting/services/s-z/veterinary/publications/gbdiseasereports/

Risk assessment and control advice for zoonoses

The UK Zoonoses, Animal Diseases and Infections (UKZADI) group provides a high-level strategic overview and a means of ensuring overall coordination of public health action on zoonoses across the UK. The multi-agency, cross disciplinary Human Animal Infections and Risk Surveillance (HAIRS) group acts as a forum to identify and discuss infections with potential for interspecies transfer, (particularly zoonoses). The group has developed a system of horizon scanning and risk assessment processes to detect and assess potential risks to the UK population. More details are available at:
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/EmergingInfections/HAIRS/

Control policies have been introduced to reduce the prevalence of pathogens in the food chain and other areas. These include the implementation of legislation relating to the production of drinking water and food. The UK Food Standards Agency (FSA), the Health Protection Agency (HPA) and Local Government Regulation (LGR) operate national microbiological food sampling programmes and carry out studies focusing on particular foods, food processes and the production environment. This work enables potential food safety issues to be identified, as well as establishing current levels of microbial contamination. Local authorities also carry out food sampling activities.

Under the auspices of the FSA, the Epidemiology of Foodborne Infections Group (EFIG) and the Advisory Committee on the Microbiological Safety of Food (ACMSF) bring together UK surveillance data on humans, animals, and food relating to foodborne risks.

Disease profiles

Details on the clinical signs and symptoms of each disease have been omitted from this year's Zoonoses report. This information is available in many other places including previous years' Zoonoses reports (especially the Zoonoses report 2009), available here:
http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/zoonoses/reports.htm

Further information on the human aspects of infection is available from the HPA webpages:
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/

Information on the animal aspects of infection is available from the Defra webpages:
http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/zoonoses/common.htm

Feature Article 1: Q fever – recent developments in animals in the UK

Author: Rebecca Mearns, AHVLA

Introduction

Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii*. It has worldwide distribution and can infect most vertebrate species including humans, ruminants, rodents, cats and reptiles. Interest in Q fever in livestock in Great Britain continues following several outbreaks in the UK in recent years and the epidemic in The Netherlands.[1] The latter has resulted in over 3500 notified cases of human disease since 2007 and the source of infection has been identified as dairy goats and dairy sheep that aborted due to Q fever.

Figure 1: normal parturition in a goat

Although the causative agent is endemic and 60 human cases were confirmed in 2010, there has never been an outbreak in the UK of the magnitude seen in the Netherlands. Recent Q fever outbreaks in the UK include one with 138 human cases linked to an abattoir in central Scotland in 2006, and in 2007 30 human cases occurred in Cheltenham, tentatively linked to sheep farms in the area.[2] Q fever has been identified in military personnel returning from conflict in Afghanistan, where it is one of several causes of so-called "Helmand fever".[3] In humans infection is asymptomatic in 50 – 60% of cases.[4] Acute cases typically have a flu-like illness, atypical pneumonia or hepatitis. Chronic Q fever can be serious and endocarditis, particularly in patients with pre-existing valvular disease, is the main presentation.

Development of an RT-PCR and validation of the ELISA serological assay for ruminants began at VLA in 2008. Tests employed by Animal Health and Veterinary Laboratories Agency (AHVLA) and used in England, Scotland and Wales are consistent with the approach recommended in a 2010 European Food Safety Authority (EFSA) Report [5], which included guidelines on the diagnostic tests of choice.

Abortion material is received from farmers via their vets on a voluntary basis for investigation of the cause of abortion. There is no statutory testing for Q fever in UK. Diagnosis from ruminant abortion material is routinely carried out if a placenta is included, by examination of modified Ziehl-Neelson (MZN) stained smears of placental cotyledon. The organism appears as small red stained (acid fast) coccobacilli and must be differentiated from *Chlamydophila abortus*, another zoonotic cause of abortion most common in sheep. PCR testing is used for confirmation. AHVLA maintain close links with the Health Protection Agency (HPA) and all cases of confirmed Q fever in animals are reported to the local HPU / CCDC, for follow-up public health action as appropriate.

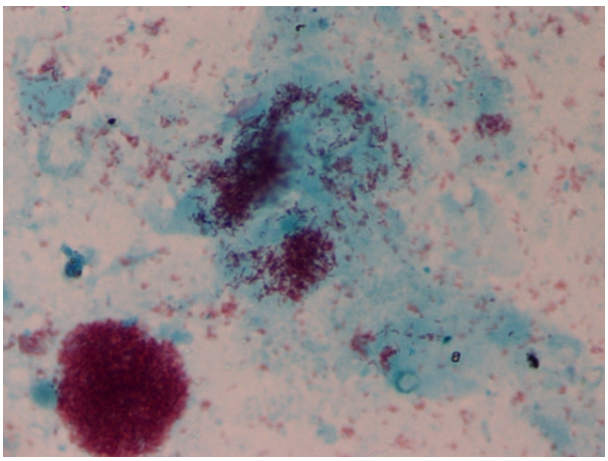

Figure 2: MZN smear of placental cotyledon from a goat that had aborted showing many acid fast organisms typical of *Coxiella burnetii*.

A commercial dairy goat herd with approximately 1,000 adults had a series of abortions in May 2010 and Q fever was diagnosed on materials submitted to the local VLA Regional Laboratory. A total of 95 abortions from 400 pregnant goats were recorded over a period of eight weeks. The herd was visited three times over a seven month period. The seroprevalence 24 days after the last abortion was 79.2%, declining to 45.7% at 207 days from the cessation of abortions. Shedding of the organism was detected by PCR in milk and swabs of vaginal mucus at the first visit only. Environmental samples (dust, water, bedding, faeces) from multiple sites around the farm and within the buildings where aborting goats were housed were positive by PCR. Genotyping by HPA Porton Down by multi-spacer sequence typing (MST) and multi-locus variable number tandem repeat analysis (MLVA) showed the strain isolated from this outbreak had previously been identified in the UK, but was different from those strains recently involved in the Netherlands. There were no human Q fever cases linked to this outbreak.[6]

During 2010 several projects to investigate the presence of *C. burnetii* in animals in GB have been undertaken by AHVLA. A seroprevalence survey was carried out using surplus serum samples collected for the 2008 Brucella survey in sheep and goats. A total of 5,797 sheep (384 flocks) and 522 goats (145 herds) were tested for the presence of *C. burnetii* antibodies by ELISA. Results showed low seroprevalence, with estimates of 1.0% for sheep and 0.9% for goats, between-flock prevalence of 10.2% (sheep) and 2.97% (goats), and within flock prevalence of 10.2% (sheep) and 29.9% (goats).[7] The risk of a sheep testing positive increased with flock size, the number of breeding ewes and nearby goat population density. In comparison, a seroprevalence survey in the Netherlands in 2008 found 7.8% of goats and 17.8% of goat farms positive, while 2.4% of sheep and 14.5% of sheep farms were positive.

In Northern Ireland a survey was undertaken in 2008 to determine seroprevalence in cattle using sera from statutory Brucellosis testing. Of the 5,182 cattle (273 herds) that were tested for antibodies to *C. burnetii* using a commercial ELISA, 45.5% were from dairy herds (121 herds), and 54.5% from beef herds (152 herds). Overall, 6.2% of cattle and 48.4% of herds tested positive[8], with 64.5% of dairy herds positive. Analysis of seroprevalence by herd type and size, breed, age and sex showed that animals from dairy herds were more than twice as likely to test positive as animals from beef herds, and that larger herds had a greater likelihood of testing positive than small herds. Increasing age and cattle of the Friesian breed were also associated with increased odds of infection.

In order to assess the zoonotic hazard for farmers, veterinarians and laboratory workers that have occupational contact with abortion material, foetal fluid and cotyledons were collected from submissions to AHVLA Regional Laboratories in England and Wales during 2010. PCR testing was carried out on 192 ovine and 124 cattle cotyledons, nine from goats, two placental samples from alpacas and four from pigs. In all cases Q fever had not been suspected on routine laboratory investigation (MZN smear on placenta). *C. burnetii* was found in nine (7.3%) of the 124 cattle cotyledons and one (11.1%) of the nine goat samples. *C. burnetii* was not detected in any of the sheep (estimated prevalence <1%), alpaca or pig samples.[9]

Further work is in progress to assess the lower than expected sensitivity of MZN placental smear microscopy in cattle. Any case with a positive MZN smear was fast-tracked for PCR testing for diagnostic purposes, and only samples negative on MZN were included in the survey, yet there were nine submissions where *C. burnetii* was detected by PCR. It is important to note that *C. burnetii* may be shed at normal parturition and in four of the positive bovine cases another cause of abortion was identified. The significance of a positive Q fever PCR in cases that are negative on MZN microscopy has been investigated in a few cases using immunohistochemistry, but further work is needed to determine the test of choice in cattle and how results should be interpreted. The zoonotic hazard remains however, and workers who handle abortion materials should be aware that up to 12% of placentas from bovine abortions could contain *C. burnetii*. [9]

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Feature Article 2: The Godstone farm outbreak of *E. coli* O157 and the Griffin Report

Authors: John Cowden and Susan Brownlie, Health Protection Scotland

On Thursday 20 August 2009 a London Health Protection Unit (HPU) informed Surrey and Sussex HPU of a child with presumptive *E. coli* O157 infection who had visited Godstone Farm on 8 August. Godstone Farm is an open farm used exclusively as a visitor attraction in the village of Godstone, Surrey. It received between 1500 and 2000 visitors a day during the summer holidays.

Surrey and Sussex HPU became aware of another case with links to the farm on 28th August - just before the Bank Holiday weekend. The HPU liaised with the local Environmental Health Department about the importance of contacting the farm. On 1st September, the local Environmental Health Department (EHD) informed the HPU of another case and suggested there may be an outbreak associated with the farm.

By 3 September, eight confirmed and clinically suspected cases of *E. coli* O157 had been reported, six of whom had recently been to the farm. At this time a visit was made to the property by representatives of the HPU and the local EHD where the provision of adequate hand washing facilities and the risks associated with animal contact were discussed with the proprietors.

On the following day (4 September) the HPU recommended a number of infection control measures to the owners of the farm and also suggested that they may want to consider temporary, voluntary closure of the attraction. The farm remained open but a series of measures were put in place to minimise the risk of infection. These included restricting direct contact with animals and the closure of some sandpits. By 12 September, the total number of human confirmed or presumptive cases had reached 36. At this time the farm agreed to close until further notice.

Cases continued to be reported until the outbreak was finally declared over on 15 October. By this time the total number of cases had reached 93 with 91 of these having been microbiologically confirmed with *E. coli* O157, phage type 21/28. This included 65 primary cases who had visited the farm between 8 August and 4 September, 13 secondary cases and 15 asymptomatic carriers. Seventy-six (81.7%) of the 93 cases were aged under 10 years; 27 were admitted to hospital and 17 of them (all children) suffered haemolytic uraemic syndrome (HUS), a debilitating illness affecting the kidney and brain. Eight of the children with HUS required dialysis.

Most (83.0%) of 30 animal samples taken at Godstone Farm by the Veterinary Laboratory Agencies (VLA) on 7 September were subsequently reported as positive for *E.coli* O157, Phage Type 21/28.

Microbiological, epidemiological and environmental investigations identified the main animal petting barn at Godstone Farm as the source of the outbreak.

In June 2010 the HPA published the results of an independent review (The Griffin Report[1]) of the management of the outbreak, and the regulatory framework and control of risks relating to open farms.

This comprehensive review detailed a large number of recommendations relating to open farms, most of which have been undertaken. The top recommendations were:

- Minimising, or preferably eliminating, visitor contact with animal faecal matter
- Raising public awareness of the potential risk of animal contact
- Development of an Approved Code of Practice (ACoP) for the Open Farm industry
- All relevant agencies, both regulatory and non-regulatory should find ways of working together to establish clear roles and responsibilities
- More assistance should be provided to clinicians to aid quicker diagnosis and treatment of *E. coli* O157 in children
- Research ways of minimising the carriage of *E. coli* O157 in animals

The Griffin report is a welcome and useful contribution to the debate on how best to manage open farms suspected of being the source of cases of Verotoxigenic *E. coli* (VTEC) infection. However, there are two specific questions which it addresses but for which it does not provide definitive answers, and which warrant further examination. The two questions are:

- Under what circumstances should an open farm be closed in whole or in part

and

- Under what circumstances should an open farm which has been closed be allowed to re-open.

It may be that there are no definitive answers to these questions. Certainly they cannot be answered solely on the basis of the number of cases associated with an open farm. As the Report acknowledges, risk can never be eliminated completely, and therefore, inevitably it has to be accepted that cases may well occur in even the best regulated of establishments.

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Feature Article 3: *Salmonella* Typhimurium DT8 linked to duck eggs

Article adapted from: **Noble DJ, Lane C, Little CL, Davies R, DePinna E, Larkin L, Morgan D. Revival of an old problem: an increase in *Salmonella enterica* serovar Typhimurium definitive phage type 8 infections in 2010 in England and Northern Ireland linked to duck eggs. *Epidemiol Infect* 2011 Apr 7:1-4**

Salmonella enterica serovar Typhimurium definitive phage type (DT) 8 is uncommon in humans in the UK. In July 2010, the *Salmonella* Reference Unit (SRU) in the HPA Laboratory of Gastrointestinal Pathogens identified an increase in reports of pan-susceptible *S.* Typhimurium DT8 in England and Northern Ireland. Preceding this, a nationwide outbreak of fully sensitive *S.* Typhimurium DT8 had been reported in Ireland in May 2010[1], with all seven cases reporting consumption or contact with duck eggs.

Between January and October 2010, there were 81 laboratory-confirmed human isolates of pan-susceptible *S.* Typhimurium DT8 across all regions of England and Northern Ireland. No cases were identified from Wales or Scotland over a 9 month period. This represents an increase of 26% on 2009 (n=60) and 41% on 2008 (n=48). Sixty-two per cent (50/81) of cases were male. Ages ranged from <1 to 80 years (median 47, inter-quartile range 33–61 years). Five of the cases were hospitalized and one death was reported (although it was not formally attributed to *Salmonella* infection). No cases were associated with travel.

Of 31 cases contacted and consenting to be interviewed after July, 16 (51.6%) ate duck eggs with a further three reporting eating duck meat or duck liver pâté. Eleven of the cases recalled purchasing duck eggs from local small retailers (n=4), farm shops (n=4), market places (n=2) and from a national supermarket chain (n=1). A further two cases consumed duck eggs at restaurants. *S.* Typhimurium DT8 was detected in both shells and contents from seven pooled eggs collected from a patient's home as well as three pooled samples collected from two farms linked back via supply of eggs to cases.

There is no legislation requiring the marking of duck eggshells with 'use by' dates and origin, as there is for hen eggs, and thus rapid trace back down the supply chain was more difficult. However, duck eggs consumed by five *S.* Typhimurium DT8 cases could be linked with several layer duck premises and the breeding flock supplying the commercial stock on these premises. While it is recognized that the number of eggs tested in this investigation is relatively small, the *Salmonella* contamination rate of duck eggs found in this investigation is significantly higher than that found in UK-produced hen eggs (0.3%) ($P<0.0001$).[2]

The same strain of *S.* Typhimurium DT8, characterized by variable number of tandem repeat (VNTR) analysis and pulsed-field gel electrophoresis (PFGE), was identified in human isolates and in duck eggs. PFGE analysis of selected strains including human isolates, isolates from duck eggs and from voluntary surveillance of embryonic mortalities in a UK breeding flock were indistinguishable from each other (designated profile STXMXB.0217). Isolates from patients in England and Northern Ireland were also compared to those in Ireland, who had reported a resurgence of cases of *S.* Typhimurium DT8 in August, again associated with duck eggs.[3] VNTR fragment analysis indicated that they were also indistinguishable (designated profile 2-10-NA-12-212) and supported the PFGE results.

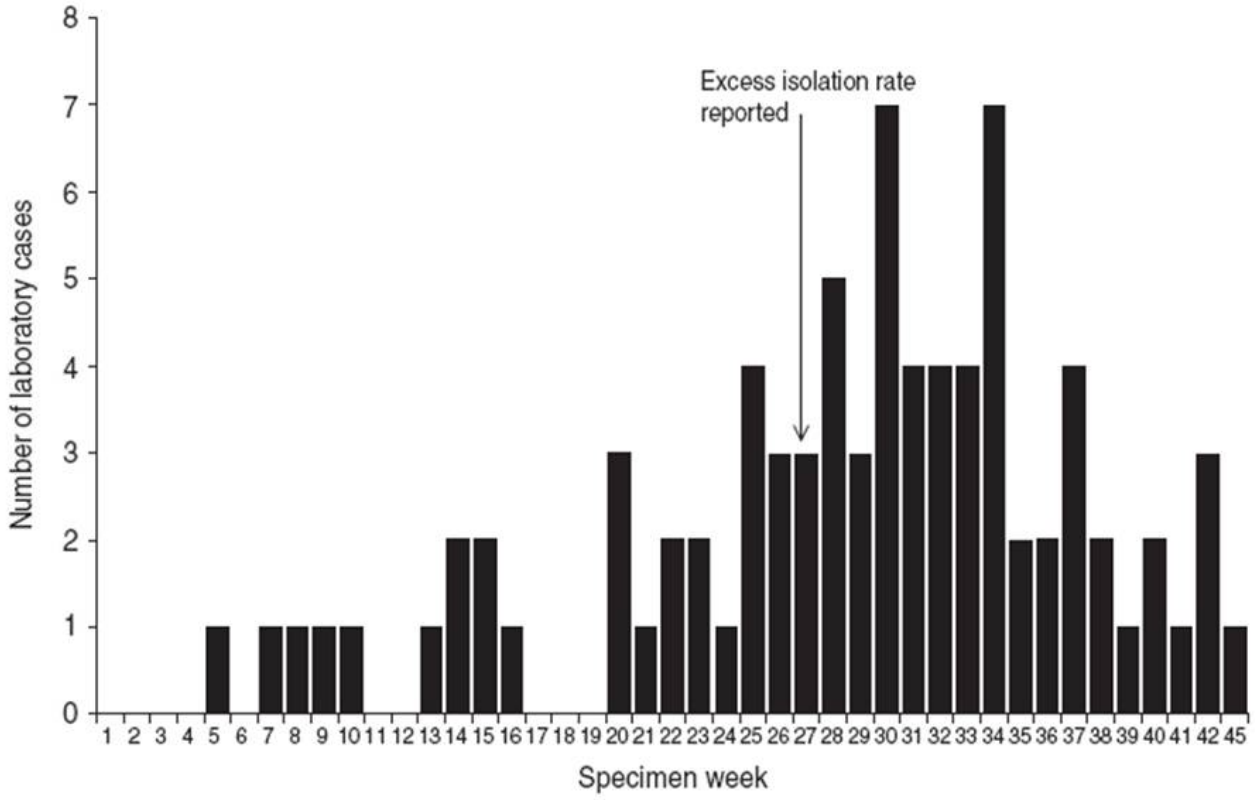
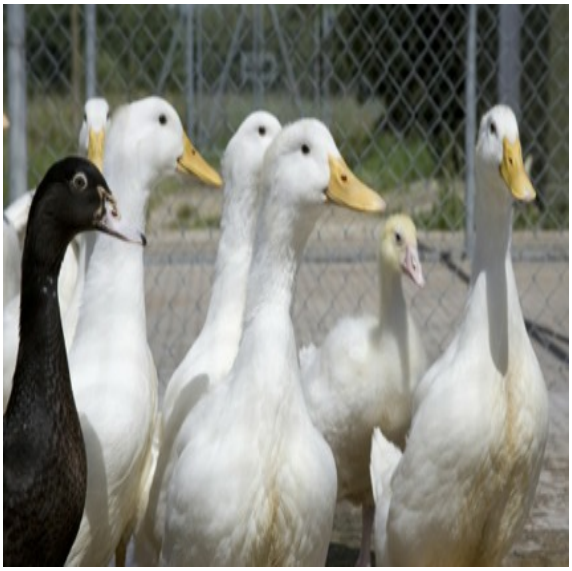


Figure 3: Number of laboratory-confirmed cases of pan-susceptible *Salmonella* Typhimurium DT8 by week of isolation. England and Northern Ireland, January-October 2010 (n=81).

S. Typhimurium DT8 has been associated with farmed ducks in the UK for many years, accounting for 50.0% of all *S.* Typhimurium incidents in ducks.[4] Ducks are often housed in earth-floored, straw-bedded, naturally ventilated buildings with access to open water troughs or to outdoor range areas. This, plus the naturally moist nature of duck faeces and moisture levels in bedding may be conducive to the survival and spread of *Salmonella* to the outside of the egg if it is present in the flock. Surface contamination can be drawn into the egg as it cools, particularly if the protective cuticle is damaged or the surface of the egg is not dry. The cuticle is sometimes removed from hatching eggs or table eggs during a chemical washing stage to

enhance hatchability of eggs or to make table eggs look cleaner, but if the hatching equipment is contaminated this may increase the risk of infection of day-old ducklings.[5]



Targeted disease control measures were taken at the duck producers by Defra that included inspection and provision of advice on effective disease control measures, voluntary movement restrictions and enhanced cleansing and disinfection. The FSA issued advice to consumers and caterers of the importance of good hygiene practice when cooking with and consuming duck eggs in order to reduce the risk of infection.

Although there has been a long-term association of ducks with *Salmonella*, this is the first reported outbreak of salmonellosis linked to consumption of duck eggs since the current surveillance system for general outbreaks of gastrointestinal infection in the UK began in 1992. The last known outbreak in the UK occurred in 1949.[6] Consumption of duck eggs in the UK plummeted in the 1950s when large-scale hen egg production methods took control of the market. However, promotion on use of duck eggs in recent years has seen sales significantly increase. The commercial hen egg sector, unlike the duck sector, has had industry assurance schemes in place and has used vaccination of layer hen flocks against *Salmonella* for over a decade.[2] To improve public health, i.e. by reducing the number of infections from egg borne *Salmonella*, the duck industry is planning to implement a similar assurance scheme, including mandatory vaccination of flocks.

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Feature article 4: *Salmonella* Control Programmes in Poultry

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Following several 'food-scares' in the 1980s and 1990s which included the dioxin crisis, BSE and outbreaks of salmonellosis, new legislation was drafted which laid out a risk-based 'farm to fork' approach to food safety policy.[1] Consistent with this, in 2003, two specific pieces of legislation were adopted, laying down enhanced risk assessment and risk management options to reduce the incidence of zoonotic disease in the EU. Directive 2003/99/EC, which replaced the old Zoonoses Directive 92/117/EC, established a system for monitoring zoonotic agents and antimicrobial resistance throughout the human food and animal feed chain Regulation (EC) No. 2160/2003 set up a framework for harmonised risk management of zoonotic agents across the food chain, starting at primary production and complementing existing food hygiene legislation. At the time, *Salmonella* was considered a priority for control.

The legislation requires each EU Member State to carry out a standardised baseline survey to determine the prevalence of *Salmonella* within their industry sectors, after which agreed reduction targets are set. In order to achieve this, each country is required to set up *Salmonella* National Control Programmes (NCPs), with the overall aim of controlling the spread of *Salmonella* and limiting the risk to public health. The primary emphasis of the NCPs is on reducing the prevalence of the specific serovars which account for the majority of human salmonellosis cases - *Salmonella* Enteritidis and *Salmonella* Typhimurium. Monophasic strains of *S.* Typhimurium have now also been included in the legislation as regulated serovars[2] and, from the start of 2010 onwards, these strains will be included in UK annual prevalence results. NCPs are required in breeding chickens, laying chickens producing eggs for human consumption, chickens reared for meat (broilers), turkeys and pigs as these sectors are considered of the highest priority in terms of the impact of foodborne salmonellosis on public health in the EU.

Farmers are required to take samples during rearing and production from all their commercial poultry flocks to test for the presence of *Salmonella.* Further official sampling is carried out by the Competent Authority to verify the progress with the reduction target or so that appropriate risk mitigation measures can be implemented. Responsibility for the implementation of each NCP is shared between Government and industry, and industry operated control programmes have been approved in the laying chicken and turkey sectors. Farmers are also required to have effective biosecurity measures in place on their farms and, in the event of a problem being detected, to review their control measures and take action. Vaccination against *S*. Enteritidis and *S*. Typhimurium with an authorised vaccine is allowed and vaccination is widely used in the UK on a voluntary basis, especially in the laying chicken and broiler breeder chicken sectors. Use of antibiotics to control subclinical *Salmonella* infection is not permitted and the NCPs also include a harmonised antimicrobial resistance monitoring programme.

The results of NCP testing are used to inform farm management measures and monitor the efficacy of on-farm biosecurity procedures. In the event of detection of *Salmonella* in a chicken or turkey flock, official control measures vary depending on the specific NCP requirements and the *Salmonella* serovar detected. If *S*. Enteritidis or *S*. Typhimurium is confirmed to be present in a breeding chicken or turkey flock, the flock is slaughtered and the hatching eggs are destroyed. The aim of this is to prevent the vertical transmission of these serovars from the breeding birds through the hatching egg to the day old chick/ turkey poult. For laying hen flocks

that have tested positive for *S.* Enteritidis or *S.* Typhimurium, the eggs cannot be sold as fresh table eggs at retail and must be heat treated to eliminate any potential *Salmonella* contamination before they are used for human consumption. For the broiler and fattening turkey NCPs, if the target serovars are detected, enhanced on-farm hygiene measures must be taken. If persistent infection is found, restrictions are placed on re-stocking of the affected house(s) until the results of further sampling verify that there is no *Salmonella* present in the house(s).

The results of NCP testing must be declared in the Food Chain Information documentation[3] that accompanies the poultry to slaughter so that risk management measures for hygienic slaughter can be implemented at the slaughterhouse to minimise the risk of *Salmonella* contamination of the meat. In addition, there are currently food safety criteria in place for poultry meat preparations and products[4] and, from autumn 2011, a food safety criterion for fresh poultry meat will be introduced, requiring the 'absence of *Salmonella* in 25g' of fresh meat. Compliance with the food safety criteria is used to assess the acceptability for the placing of the foodstuff on the market.

Discussions are due to commence on the development and implementation of a *Salmonella* NCP in breeding and fattening pigs (expected to be implemented in 2013). To date, four NCPs for *Salmonella* in the poultry sector have been implemented in the UK:

(i) The National Control Programme for breeding chickens

The new NCP was implemented in 2007, with a reduction target of not more than 1% of adult breeding flocks to remain infected with the specified five regulated serovars: *S.* Enteritidis, *S.* Typhimurium, *S.* Hadar, *S.* Infantis and *S.* Virchow by the end of 2009. This target was based on the results of a previous statutory control programme so no baseline survey was carried out in the breeding chicken sector. The 1% target was subsequently adopted as the definitive annual target from 2010 onwards. Producers with 250 or more breeding chickens are required to sample their flocks for *Salmonella* three times during the rearing period and adult flocks must be sampled at least every three weeks during production of hatching eggs. Routine official control samples are collected twice annually from every flock.

The breeding chicken *Salmonella* NCP has now completed the fourth year of implementation of the programme and the UK results have been significantly below the EU target of 1% every year. For 2010, the prevalence for the target serovars was 0.06%, with only 1/1,550 flocks testing positive during the year. This is a reduction on the 0.12% in 2009 and 0.49% in 2008 and the same as the 0.06% prevalence recorded in 2007.

(ii) The National Control Programme for commercial laying chickens

An EU-wide baseline survey of commercial laying chicken flock holdings was carried out in 2004-05. The UK prevalence for *S.* Enteritidis and *S.* Typhimurium was among the lowest of the major egg producing countries (7.9% of holdings cf 20.4% across the EU).[5] The UK target was to reduce the prevalence of flocks remaining positive by 10% each year to a definitive target of 2% or less by the end of 2010. The NCP was implemented in 2008. All farmers have to take samples twice during the rearing phase and every 15 weeks during the egg-laying phase. A routine annual official control sample is collected from one flock on all farms with more than 1,000 egg laying hens.

In 2010, a total of six flocks tested positive for *S*. Enteritidis and five flocks positive for *S*. Typhimurium or monophasic strains out of a total 4,368 flocks. Overall, prevalence results for *S*. Enteritidis and *S*. Typhimurium for 2008 (1%), 2009 (0.36%) and 2010 (0.25%, including the monophasic strains) were all well below the EU target set for the UK to be achieved by the end of 2010 and also well below the definitive target of 2%.

(iii) The National Control Programme for broilers

The broiler chicken baseline survey was carried out in 2005-06 and the results showed a very low UK prevalence of *S.* Enteritidis and *S.* Typhimurium of 0.2% (cf the EU prevalence of 11.0%).[6] The reduction target was set at not more than 1% of flocks remaining infected with *S.* Enteritidis and *S.* Typhimurium by the end of 2011. The NCP commenced at the beginning of 2009 in the UK. Farmers are required to test their flocks for *Salmonella* within the 3 weeks prior to slaughter. Routine official control samples are collected once annually from 10% of UK farm premises with more than 5,000 birds.

The prevalence of *Salmonella* is very low within the UK broiler sector – especially for *S.* Enteritidis and *S.* Typhimurium. In 2010, the prevalence of the target serovars was 0.03%, with only 10/33,611 flocks tested positive for *S.* Typhimurium or the monophasic *S.* Typhimurium strains. No flocks were detected positive for *S.* Enteritidis during the year. The 2010 figure was a reduction on the 2009 prevalence figure of 0.04% for the target serovars. These very low prevalence results are also supported by the results of a baseline survey of broilers at slaughter in 2008, which showed that the UK prevalence for *S.* Typhimurium and *S.* Enteritidis on broiler carcasses was among the lowest of the 26 participating Member States at 0.0% compared to the EU average prevalence of 3.6%.[7]

(iv) The National Control Programme for turkeys

The baseline survey for *Salmonella* in turkey breeding and fattening flocks was carried out from 2006-07. The results for *S.* Enteritidis and *S.* Typhimurium indicated very low UK breeding turkey results (0.5%) but the fattening turkey flock prevalence result was higher than the EU average at 4.6%[8] (the weighted average prevalence for the EU as a whole for breeding turkeys was 1.8%, and 3.7% for fatteners). A reduction target was agreed of no more than 1% of breeding flocks and 1% of fattening flocks remaining positive by the end of 2012. The NCP, covering both breeding and fattening turkeys, was implemented at the start of 2010. Fatteners are sampled 3 weeks before slaughter and breeding birds are sampled on three occasions during rear and then every 3 weeks while producing hatching eggs. Routine official control samples must be taken from all elite and grandparent breeding turkey flocks and from 10% of all other eligible UK turkey farm premises.

For the first year of implementation of the programme, the prevalence of positive flocks for the regulated serovars was 0% in breeding turkeys (0/249 flocks tested) and 0.13% in fattening birds. For fattening flocks, only four flocks were detected positive for *S.* Typhimurium during the year, out of 3,078 flocks tested. The level of regulated serovars is therefore already below the target set to be achieved by the end of 2012.

Conclusions

Overall, prevalence results for the NCPs for *Salmonella* in poultry from 2007-10 indicate that the levels of the regulated *Salmonella* serovars are well below the EU designated targets in all the UK sectors. There have been considerable reductions in *Salmonella* prevalence since the EU baseline surveys were carried out. A reducing contribution of *Salmonella* to the overall burden of foodborne zoonoses has been observed in the UK, especially for *S.* Enteritidis, where a significant decreasing trend in laboratory reports of infection in humans has been reported in recent years. A reduction in reported human salmonellosis cases has also been observed across the EU (on average 12% per year between 2005-09). The Commission and EFSA are attributing this, at least in part, to successful control of *Salmonella* in broiler, laying and breeding hen flocks and eggs.[9, 10]

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Zoonoses A-Z

Anthrax (*Bacillus anthracis*)

Anthrax is caused by the bacterium *Bacillus anthracis (B. anthracis)*. Under certain environmental conditions *B. anthracis* can convert into a spore, which may survive in the environment for many decades in an inert state. In this form the organism shows great resistance to the effects of heat, drying, UV light and many disinfectants.

Anthrax can occur in all mammalian species, and has also been reported in some birds. The clinical presentation in animals varies between species with three forms of anthrax recognised; peracute/apoplectic, acute and chronic. Anthrax infection in humans classically causes one of three types of disease which affect either the lungs (inhalation/ pulmonary), the digestive tract (intestinal) or the skin (cutaneous). In 95% of naturally-acquired human cases, the infection is cutaneous.

In recent years sporadic anthrax cases have occurred in cattle in the UK, presumably from exposure to anthrax spores present in soil and originating from cases that occurred decades earlier. Recent human cases of anthrax in the UK have been associated with animal hide drums that use imported animal hides, or with contaminated heroin.

Infection in humans

Cases: Between 2001 and 2008, four human cases were confirmed; two cutaneous cases and two cases associated with animal hide drums. In December 2009, an outbreak of anthrax amongst heroin users started in Scotland, believed to be due to the circulation of a batch of heroin contaminated with anthrax spores. In 2009, there were 13 confirmed cases in drug users with six deaths, all in Scotland.

In 2010, a further 34 cases including seven deaths were confirmed in Scotland, and five cases were reported in England and Wales with four deaths. All of these cases occurred in heroin users. No cases occurred in Northern Ireland.

Infection in animals

Frequency: The last case of anthrax in animals in GB was in cattle in 2006, affecting six cows (two confirmed) on one farm in Wales. In Northern Ireland the last case of anthrax was in 1990, affecting one cow on a farm in County Antrim.

There were no cases of anthrax detected in animals in the UK in 2010.

Avian influenza

Influenza is a respiratory infection caused by viruses of the orthomyxoviridae family. Animal adapted influenza viruses do not readily infect people. However, spontaneous mutation or reassortment of influenza virus genes between human and animal strains can occur. Some of these strains have the potential to be readily transmitted between people and can lead to pandemic spread in humans, as in the case of the 1918 Spanish flu pandemic.

Avian influenza, also referred to as 'Fowl Plague' or 'Bird Flu', is a disease of birds caused by type A influenza viruses. It is one of the most important poultry diseases as it is highly infectious, can produce significant mortality and can affect many species of birds. Avian influenza viruses are classified according to the severity of disease (pathogenicity) they cause in kept birds; they are either highly pathogenic or of low pathogenicity. Highly pathogenic avian influenza (HPAI) can cause severe disease in poultry, with a high flock death rate (up to 100%) in affected flocks. HPAI disease can develop so rapidly that birds may die without showing any previous signs of disease. Viruses of low pathogenicity result in milder, less significant disease. However, these strains, known as low pathogenicity avian influenza (LPAI) viruses, can mutate into highly pathogenic strains.

The highly publicised H5N1 HPAI strain has been responsible for considerable poultry losses across Asia and, in recent years, Europe and other parts of the world as well. The UK has maintained a high vigilance for avian influenza due to the westward spread of H5N1 from Asia and occasional incursion of other influenza viruses to European poultry. The last case of HPAI in the UK was in Oxfordshire in June 2008 when H7N7 infected a single laying hen flock.

Avian influenza in humans

Cases: Human cases of avian influenza in the UK are very rare. In 2006, there was one confirmed case of H7N3 in a farm worker. In 2007, there were four cases in owners who kept birds, associated with a H7N2 poultry outbreak. All viruses were of low pathogenicity for poultry. No cases were reported in 2010.

There have been no deaths reported as a result of avian influenza in the UK, however, a number of people worldwide have died after infection with certain strains of avian influenza, notably H5N1. Between 2003 and the end of 2010, 516 human cases of H5N1 had been reported worldwide, resulting in 306 deaths[2]. Almost all of these people had close contact with birds infected with H5N1.

Avian influenza in animals

Frequency: During 2010, there were no notified cases of disease in birds in the UK as a result of infection with HPAI.

Active surveillance of UK poultry stocks for viruses of H5 and H7 subtypes has been undertaken annually since 2003. Infrequently, antibodies to H5 or H7 infection subtypes have been detected in a small number of sampled birds, which is most likely indicative of prior exposure to H5 or H7

[2] http://www.who.int/csr/disease/avian_influenza/country/cases_table_2011_06_3/en/index.html

LPAI virus strains, and in ducks these were most likely to indicate non-specific reactions which are recognised to occur. During 2010, four of 453 holdings sampled in the UK had birds with antibodies to avian influenza viruses of subtypes H5 or H7. This compared with two detections from 453 holdings sampled in 2009.

During 2010, a total of 2,480 wild birds were sampled in the UK. The majority of birds (74%) were sampled by live trapping, while the remainder were birds that were found dead by the public or warden patrols of wetlands and reserves. Most of the birds sampled (82%) were of the order *Anseriformes* (ducks and geese). H5N1 HPAI (notifiable in wild birds since 2003) was not detected but other influenza A viruses of several subtypes (consistent with continual maintenance in these reservoir populations) were found in 17 positive birds (0.7%) over the course of the year. This comprised thirteen wild birds that were sampled as part of wildfowl trapping activities (0.5%), and four that were found dead (0.2%).

Further information:

Great Britain AI Wild Bird Surveillance data for 2010:
http://vla.defra.gov.uk/reports/docs/rep_survrep_qtlyw0410.pdf

Bovine tuberculosis (*Mycobacterium bovis*)

The *Mycobacterium tuberculosis* complex includes *M. tuberculosis, M. bovis and M. africanum* and other mycobacteria that cause TB in mammals. Bovine tuberculosis (bTB) is caused by *M. bovis*, a zoonotic organism that can give rise to a form of tuberculosis that is indistinguishable from the disease caused by *M. tuberculosis* (the human TB bacterium).

Infection with *M. bovis* most often occurs when airborne droplets of moisture (aerosols) containing the organism are inhaled, but can also occur by eating or drinking contaminated foodstuffs and, more rarely, through contamination of skin wounds. The consumption of unpasteurised milk or dairy products from infected cows was an important cause of childhood tuberculosis in the UK until pasteurisation became widespread in the mid-20th century.

Bovine TB is one of the most serious animal health problems for the cattle industry in the UK, costing the taxpayer around £133m in 2010/11 in England and Wales (including research). *M. bovis* infection has also been found in many mammal species, including other livestock, wildlife, domestic cats and dogs, but only badgers are considered maintenance hosts to the bacterium in addition to cattle. A compulsory eradication campaign for bovine TB began in GB and Northern Ireland in 1950 and 1959 respectively. This was underpinned by routine screening of herds using the comparative tuberculin skin test and slaughter of all test reactors. This programme gradually reduced the incidence infection in cattle herds to a very low level by the early 1980s. However, since then, the number and geographical distribution of new incidents of TB in cattle herds ('breakdowns'[3]) have steadily increased in England and Wales. This trend accelerated after the foot and mouth disease outbreak in 2001, during which the routine TB testing and slaughter programme was suspended for several months.

[3] TB incidents are also known as 'breakdowns', i.e. herds in which at least one animal was a reactor to the tuberculin skin test or where *M. bovis* culture-positive tuberculous lesions were detected during commercial slaughter of a non-reactor animal.

M. bovis is currently endemic in cattle and badgers in most of Northern Ireland and large tracts of the west of England and south and mid-Wales. Scotland was declared an officially TB free region of the UK by the European Commission in 2009 (Decision 2009/761/EC) and as such implements strict controls regarding the movement of cattle from the rest of the UK.

Infection in humans

Cases: M. bovis accounts for approximately 0.5% of all culture-confirmed M. tuberculosis complex diagnoses in humans in the UK annually. In 2010, there were 28 culture-confirmed cases of human TB caused by M. bovis in the UK, an increase of 12% over 2009 (Table 1).

The distribution of human cases of *M. bovis* in the UK has remained consistent in recent years. In 2010, a country of birth was given for 22 cases in England & Wales, of whom 63.6% were of white ethnicity with 68.2% UK-born (15/22). Thirteen of these UK-born cases were over 65 years old (86.7%) and likely to be due to reactivation. The seven non-UK-born cases were from Eritrea, Kuwait, Morocco (2), Nigeria and Poland with one not stated. All had been in the UK for more than five years at diagnosis. This suggests that a majority of the cases seen in the UK are attributable to reactivation of latent infection, probably acquired prior to widespread implementation of disease controls.

Table 1: Patients with culture-confirmed tuberculosis in the UK, 2010

	England & Wales	Scotland	NI	UK Total
M. bovis	23	4	1	28
M. tuberculosis	4,329	358	48	4,735
M. africanum	15	4	1	20
M. tuberculosis complex	167			167
Total	4,534	366	50	4,950

Infection in animals

Frequency:

There were 83,636 cattle herds registered in GB at the end of 2010. A total of 4,703 new bTB incidents were recorded in GB in 2010, a 2.2% increase on the 4,602 new bTB incidents recorded in 2009. More than 99% of the new bovine TB incidents that occurred in GB during 2010 occurred in England and Wales. Post-mortem evidence of lesions characteristic of bTB and/or culture evidence of *M. bovis* infection was detected in 2,464 (52.2%) of the new bTB incidents for GB. In Scotland, the total number of new (n=45) bovine TB incidents was lower than in 2009 (n=49). Of the 2010 new incidents 15 were post-mortem and/or culture-confirmed compared to 12 in 2009. The majority of these bovine TB incidents in Scotland were due to inward movements of cattle from high risk areas elsewhere in the UK and Ireland.

In GB, a total of 31,679 cattle were slaughtered as tuberculin skin or interferon-gamma (blood) test reactors in 2010, a drop of 8.8% on 2009 (n=34,769).

In Northern Ireland there were 25,933 cattle herds with 1.6 million cattle registered during 2010. There were 1,160 new TB reactor herds and 6,404 reactor animals, and at the end of the year 986 herds (3.8%) were still under bTB restriction.

134 incidents of *M. bovis* infection in non-bovine domestic animals and wild deer in GB were confirmed by laboratory culture during 2010 (this data does not cover badgers). This compares to 144 incidents during 2009.

Further information

For historical annual bTB incidence and charts (1998-2008):
http://www.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/tb/stats/county.htm

The GB data provided above on animal incidents was accessed on 17th July 2011 from the link below (aall TB data in this Defra TB database are provisional and subject to change as more data becomes available):
http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/cattletb/regional/

Brucellosis (*Brucella* spp.)

The livestock (cattle) population of GB has been Officially Brucellosis Free (OBF) since 1985; Northern Ireland has not yet achieved this status. As a result, brucellosis in humans is generally acquired abroad (usually *B. melitensis*) although cases of *B. abortus* are occasionally acquired in Northern Ireland where infection remains in cattle. Most human cases of brucellosis are acquired through the consumption of unpasteurised milk and dairy products.

Bovine brucellosis was largely eradicated from Northern Ireland during the 1980s and only sporadic outbreaks occurred during 1990 to 1996. In 1997, three primary outbreaks resulted in secondary and tertiary spread to more than 60 farms. The presence of *B. abortus* in cattle in Northern Ireland continues to constitute a risk to public health but its prevalence has fallen since the peak of infection in 2002, which coincided with the peak of reported human cases of *B. abortus*.

Infections with *B. ovis*, *B. melitensis*, *B. suis* and *B. microti* have never been detected in the animal population in the UK. The marine species *Brucella ceti* and *Brucella pinipedalis* have occasionally been isolated from marine mammals washed up on the coast around the UK.

Infection in humans

Cases: Between 2000 and 2009 an average of 21 cases of acute brucellosis were identified in humans each year. This level of infection has remained relatively stable, with a slight decline in recent years.

In 2010, there were a total of 12 cases of brucellosis in humans identified in the UK (Table 2), six of whom had infection with *B. melitensis* (all in England and Wales). Eleven cases of

brucellosis were reported in England and Wales, with one case in Scotland and no cases in Northern Ireland. Whilst the sources or countries of infection were not consistently reported, all of the English and Welsh cases are believed to have been acquired overseas.

Table 2: Reports of *Brucella* infection in humans in the UK, 2010

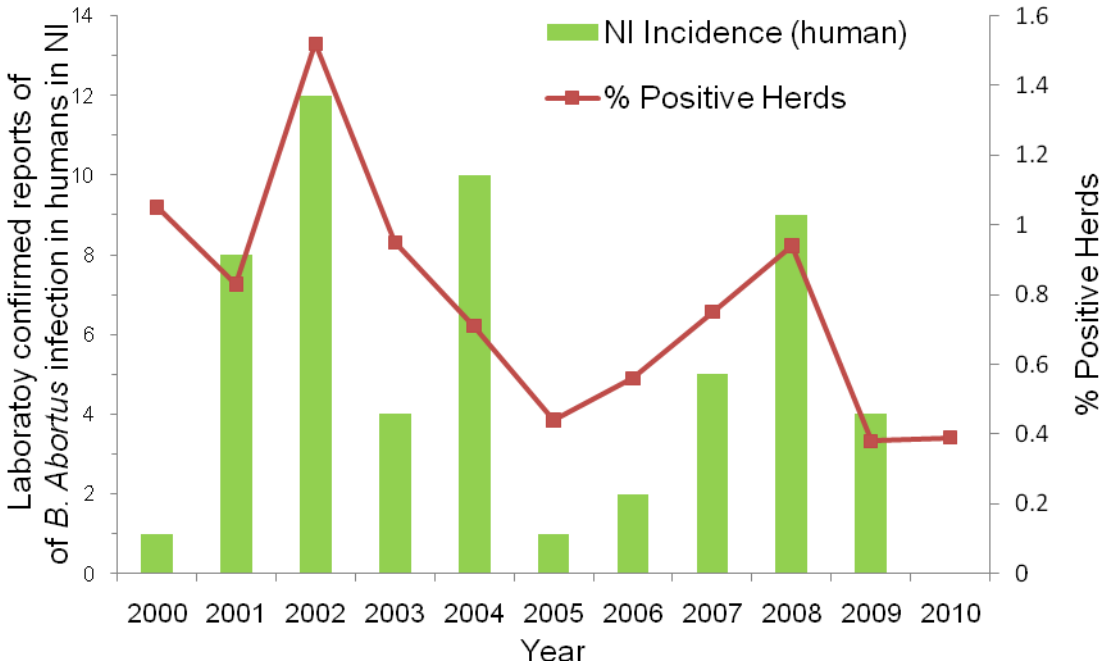
	England & Wales	Scotland	NI	UK Total
B. abortus	**0**	**0**	**0**	**0**
B. melitensis	**6**	**0**	**0**	**6**
Other Brucella spp.	**5**	**1**	**0**	**6**
Total	**11**	**1**	**0**	**12**

Infection in animals

Frequency: **In Northern Ireland in 2010, 19,598 herds with eligible cattle were tested for B. abortus. Seventy-seven herds (0.4%) were positive (consistent with 0.4% of herds in 2009), of these, 74 new herds were positive. There were 867,402 animals tested and 184 were positive (0.02%), with 23 confirmed by bacteriological culture.**

The incidence of brucellosis in humans closely corresponds to trends in the percentage of positive herds in Northern Ireland during the period 2000-2010 (see Figure 4) and has shown an overall decrease since 2000. No human cases were identified in Northern Ireland during 2010.

Figure 4: Incidence of *Brucella abortus* in humans and percentage of positive herds in NI, 2000-2010



A programme of surveillance is carried out to ensure that GB's OBF status is not compromised, in order to underpin trade. Cattle surveillance includes monthly testing of bulk milk samples from all dairy herds, risk-based investigations of cattle abortions and premature calvings and post-import testing of breeding cattle. An annual survey is also conducted in the UK to demonstrate the absence of *B. melitensis* in sheep and goats as a requirement of EU regulations. Evidence of absence of *B. melitensis* is supported by submissions of abortion samples from sheep and goats.

No cases of brucellosis were detected in animals in GB during 2010. Tests were carried out on 155,837 bulk milk samples, 6,691 cattle abortions and premature calvings, 2,893 post importation tests of breeding cattle and 3,255 tests of imported cows at their first calving following importation. The sheep and goat survey found no evidence of *B. melitensis*.

Campylobacteriosis (*Campylobacter* spp.)

Campylobacter is the most commonly reported bacterial gastrointestinal pathogen in humans in the UK. The species of greatest public health importance for humans are *C. jejuni* and *C. coli*, with approximately 90% of campylobacteriosis being caused by *C. jejuni*[4]. However, most laboratories do not routinely speciate strains isolated from human clinical specimens so changes in relative prevalence may not be detected.

The role of *C. jejuni* in human enteric illness was first clearly demonstrated in 1972. By 1986, *Campylobacter* had replaced non-typhoidal *Salmonella* as the most commonly reported gastrointestinal pathogen in the UK. Transmission to humans is through the "faecal-oral" route, usually by the consumption of contaminated foods or water.

C. jejuni and *C. coli* can be found in a wide range of livestock and wildlife species, but do not generally cause disease in animals. *C. fetus* is a common cause of abortion in sheep and may occasionally cause serious systemic disease in humans. Other species, such as *C. sputorum*, *C. hyointestinalis* and *C. lari*, are present in mammals and birds in the UK but are not generally considered of public health importance.

Infection in humans

Cases: The incidence of infection has been recorded since 1982, and the number of laboratory confirmed cases in humans in the UK increased steadily to 65,720 by 2000. Following a decline in case numbers between 2000 and 2004, apart from a slight drop in 2008, cases have again increased steadily. The number of cases recorded in 2010 was the highest to date. In Northern Ireland, annual numbers have had an upward trend since 2004.

In 2010, 70,298 cases were reported across the UK, an 8.2% increase from the 65,000 cases reported in 2009 (Table 3). In England and Wales, 62,683 cases were reported in 2010, an increase of 8.8% from 2009. In Scotland there were 6,575 cases, an increase of 2.5% from 2009, and 1,040 cases were reported in Northern Ireland in 2010, representing an increase of 6.4%.

[4] A report of the Study of infectious intestinal disease in England. 2000. FSA.
http://www.food.gov.uk/science/research/foodborneillness/microfunders/intestinal

Table 3: Number of *Campylobacter* reports in humans 2001-2010

Year	England & Wales	Scotland	Northern Ireland	UK
2001	55,081	5,435	888	61,404
2002	48,133	5,121	821	54,075
2003	46,285	4,445	743	51,473
2004	44,544	4,365	849	49,758
2005	46,724	4,581	891	52,196
2006	46,868	4,857	937	52,662
2007	51,975	5,194	885	58,054
2008	49,883	4,878	848	55,609
2009	57,608	6,415	977	65,000
2010*	62,683	6,575	1,040	70,298

**These figures are provisional and may be subject to change due to delayed reporting*

Within the UK, epidemiological studies have indicated that the ratio of unreported human infection in the community to reports to national surveillance is approximately 9.3 to 1[5]. This suggests that, in 2010, there could have been as many as 724,000 *Campylobacte*r cases in the UK.

A further increase in foodborne *Campylobacter* outbreaks in England and Wales was reported in 2010 compared to 2009 (18 vs 13). The majority of outbreaks were associated with consumption of poultry liver pâté/parfait at food service premises[6]. Evidence gained from outbreaks during 2010 revealed that, as in 2009, livers used to make the parfait or pâté by caterers were deliberately undercooked allowing the liver dish to remain pink in the centre, despite specific food safety advice tailored for caterers. A summary of foodborne outbreaks by zoonotic pathogen, broken down by food vehicle category, is given in appendix 6.

Campylobacter in food

A key target within the FSA's renewed Foodborne Diseases Strategy for 2005-2010 was a 50% reduction in the prevalence of *Campylobacter* in chicken at retail sale by 2010, measured against a baseline of 70%. The most recent FSA commissioned survey on the prevalence of *Campylobacter* in chicken at retail sale published in October 2009 suggests that the 50% target has not been met. The survey**,** carried out between May 2007 and September 2008, reported that *Campylobacter* was present in 65% of fresh chicken samples tested[7].

As past efforts do not appear to have been effective in achieving a sustained reduction in human campylobacteriosis in the UK, the reduction of foodborne disease caused by *Campylobacter* is a key aim of the new FSA strategic plan for 2010-15. This is focussed on the reduction of *Campylobacter* in chicken, as 60-80% of cases of campylobacteriosis can be attributed to chicken. Current efforts to achieve this strategic aim centres on development and implementation of a *Campylobacter* Risk Management Programme, working in partnership with

[5] Tam CC, *et al.* Longitudinal study of infectious intestinal disease in the UK (IID2 study): incidence in the community and presenting to general practice. *Gut* 2011 [Epub ahead of print]
[6] HPA. Campylobacter now the leading cause of general foodborne outbreaks in England and Wales. *HPR* 5(19) (13 May 2011). http://www.hpa.org.uk/hpr/archives/2011/hpr1911.pdf
[7] http://www.foodbase.org.uk/admintools/reportdocuments/351-1-676_B18025.pdf

the British Poultry Council, the National Farmers Union, the British Retail Consortium, and Defra to deliver on a Joint Action Plan for *Campylobacter*. The programme encompasses a range of projects targeted at different points across the food chain, from farm to fork.

To measure progress on the effectiveness of the *Campylobacter* Risk Management Programme a new target for the reduction in levels of *Campylobacter* in raw chicken has been agreed jointly with industry, to be achieved by April 2015[8]. The target focuses on decreasing the proportion of the most contaminated chickens, i.e. those with *Campylobacter* levels of >1,000 cfu/g, from a baseline of 27% in 2008 to 10% by 2015.

Infection in animals

Frequency: There were a total of 117 recorded cases of thermophilic Campylobacter spp. detected in the UK in 2010: 83 in sheep, 27 in cattle and seven in pigs. Most isolations of Campylobacter in animals other than poultry are due to abortion investigations. In 2010, there were 278 Campylobacter spp. isolates from cattle and sheep abortions, an increase of 28% from 2009 (n=217). Of these, 49 isolates were C. jejuni or C. coli, 197 were C. fetus, and 32 were other species. The significant rise in the number of cases of Campylobacter associated abortions in 2010 was mainly due to non-thermophilic strains in sheep.

Chlamydiosis and Psittacosis

Ovine chlamydiosis *(Chlamydophila abortus)*

Ovine chlamydiosis caused by infection with *Chlamydophila abortus* causes enzootic abortion in ewes (EAE), goats and occasionally cattle. The main route of transmission is through the inhalation of aerosols and contaminated dusts. This infection can cause serious zoonotic disease in pregnant women, resulting in stillbirth or abortion. However, infections appear to be rare, with very few reports of *C. abortus* in the UK each year.

Infection in humans

Cases: It is generally accepted that there are only one or two cases of C. abortus each year in pregnant women in the UK, however the number of human cases of C. abortus occurring annually is uncertain as routine serological testing does not distinguish between *C. abortus* and other *Chlamydophila* species. Diagnosis of C. abortus is dependent primarily on clinical suspicion in a person with positive serology for chlamydial infection and relevant exposure to sheep/lambing.

There were no reports in the UK in 2010.

[8] http://www.food.gov.uk/multimedia/pdfs/campytarget.pdf

Infection in animals

Frequency: In 2010, C. abortus was identified as the cause of abortion in 344 (35.8%) of 960 sheep and goat submissions to VLA and SAC laboratories in GB where a diagnosis was reached (Table 4). The equivalent figures for 2009 were 370 (40.9%) of 904 diagnosed sheep and goat submissions. C. abortus continues to be the most commonly diagnosed infectious cause of abortion in sheep. C. abortus was also confirmed in abortion material from three cattle, compared to two cases diagnosed in Great Britain in 2009.

In Northern Ireland, 54 cases of *C. abortus* were identified in 2010, all diagnosed in sheep, compared to 40 cases in 2009.

Table 4: Laboratory confirmed reports of *C. abortus* in animals in the UK, 2010

	GB	NI	UK Total
Sheep and goat abortions submissions to VLA and SAC in GB, and AFBI in NI, where a diagnosis is reached	**960**	**317**	**1277**
***C. abortus* confirmed as the cause of abortion in sheep and goat submissions**	**344**	**54**	**398**
Isolation of *C. abortus* in goat abortion material	**5**	**0**	**5**
Isolation of *C. abortus* in sheep abortion material	**339**	**54**	**393**

Psittacosis; Ornithosis (*Chlamydophila psittaci*)

Psittacosis is an infection caused by *Chlamydophila psittaci*. It has been described in over 130 species of birds but is most common in psittacines (parrots and parakeets). Other birds commonly affected include pigeons and doves, whilst turkeys, ducks and geese can also be infected. *C. psittaci* can also be carried by asymptomatic birds. Transmission of *C. psittaci* from birds to humans results in an infection known as psittacosis, ornithosis or ‘parrot fever’.

Infection occurs most often via infectious aerosols, and the presence of strong air currents may be a factor in its spread. It is likely that most, if not all, cases of psittacosis are attributable to exposure to birds or bird products.

Infection in humans

Cases: In 2010, there were 55 laboratory reports of human infection with C. psittaci in the UK; 50 cases in England and Wales and five in Scotland (no cases were diagnosed in Northern Ireland). This is similar to the 60 cases reported in 2009 in the UK. However, a lack of specific serological testing means that reported cases could have been caused by Chlamydophila species other than C. psittaci

Infection in animals

Frequency: In recent years the popularity of keeping birds, in particular psittacines, and the sale of birds and other pet animals by large store chains has increased. Tests used on animal samples do not differentiate between different strains of *Chlamydophila*, so it is not possible to report the number of *C. psittaci* infections in animals in 2010. However, eight cases of Chlamydiosis were diagnosed by government laboratories following testing of isolates from birds during 2010 in GB, an increase on the three cases diagnosed in 2009.

Cryptosporidiosis (*Cryptosporidium* spp.)

Cryptosporidiosis is a disease caused by protozoan parasites of the genus *Cryptosporidium*. Of those species with the greatest public health impact, *C*. *hominis* is normally only recovered from humans and *C*. *parvum* is found in both animals and humans. Together, these *Cryptosporidium* species are responsible for up to 96% of cases in the UK and have different risk exposures, seasonal and geographical distributions[9].

Young calves (particularly those aged between 10-20 days) are considered to be the major animal reservoir for *C*. *parvum*, but infection can also be readily acquired from other species, particularly lambs and goat kids. *C. parvum* is considered to be endemic on the majority of cattle holdings in the UK, and is also common in sheep flocks and deer.

Cryptosporidiosis in humans can occur as the result of foodborne or waterborne infection arising from faecal contamination of drinking water sources, foodstuffs and recreational waters. Direct contact with animals and their environments can also result in infection.

Infection in humans

Cases: In 2010, there were 4,589 cases reported in the UK, 17.9% lower than in 2009 (n=5,587). In England and Wales, 3,902 cases of cryptosporidiosis were reported, which was 19.2% lower than the 4,831 cases reported in 2009. There were no major outbreaks identified, but several small outbreaks and clusters occurred. In Scotland in 2010, there were 568 positive laboratory confirmations of cryptosporidiosis and 119 in Northern Ireland; these figures are similar to the number of laboratory confirmations in 2009.

Within the UK, epidemiological studies, using routine diagnostic tests, have indicated that the ratio of unreported human cryptosporidiosis in the community to reports to national surveillance is approximately 8.2 to 1.[10] This suggests that, in 2010, there may have been as many as 42,200 cases of cryptosporidiosis in the UK.

Confirmed reports of cryptosporidiosis in humans in the UK follow a bimodal seasonal pattern, with higher incidence occurring in spring and early autumn. The spring peak consists

[9] Chalmers RM, *et al.* Epidemiology of anthroponotic and zoonotic human cryptosporidiosis in England and Wales, 2004 to 2006. *Epidemiology and Infection* 2011; 139(5): 700-712.
[10] Tam CC, *et al.* Longitudinal study of infectious intestinal disease in the UK (IID2 study): incidence in the community and presenting to general practice. *Gut* 2011 [Epub ahead of print]

predominantly of *C. parvum* cases, which are most likely acquired from animal sources[11]. In contrast, the larger, early autumn peak has a greater rise in *C. hominis* cases many of which are associated with travel outside the UK[11].

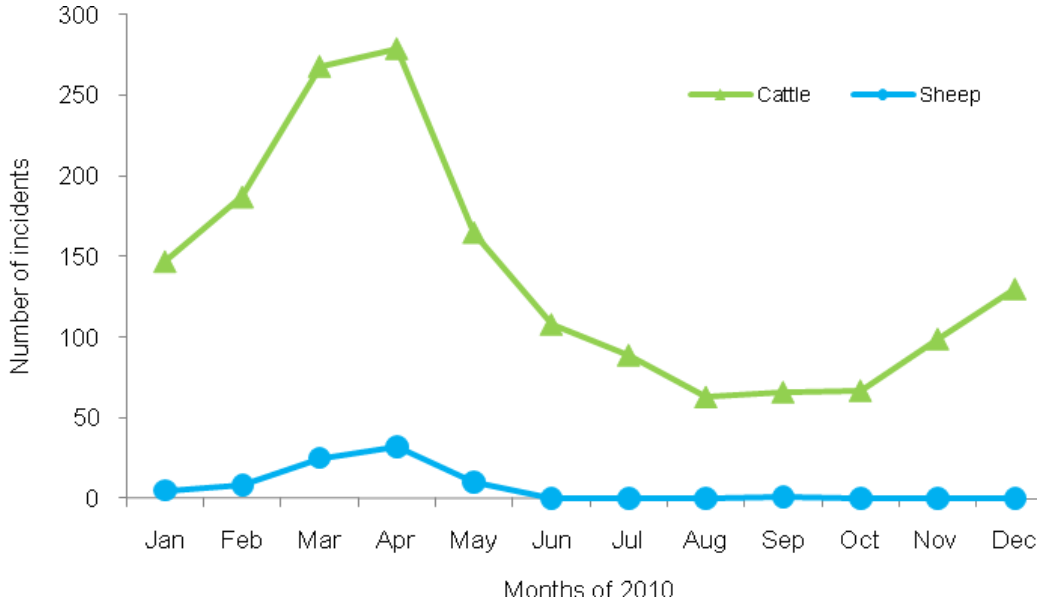
In 2010, there were seven outbreaks of *Cryptosporidium* reported in England and Wales, a similar number to that reported in 2009 (n=9). The most common outbreak settings in 2010 were swimming pools (4/7, 57.1%) and petting/open farms (2/7, 28.6%).

Infection in animals

Frequency: Clinical cryptosporidiosis is common in animals in GB. Examination of VIDA data indicates that of clinical material examined by government diagnostic laboratories in GB, clinical infection with Cryptosporidium spp. was diagnosed in 22.6% of cattle submissions tested, and 2.4% of sheep submissions which underwent testing.

There were 1,674 diagnoses of animal infection with cryptosporidium recorded in GB (1,577 in cattle, 78 in sheep, seven in goats and 12 in other animals), and 94 in Northern Ireland in 2010 (91 in cattle and three in sheep). Recorded incidents in cattle and sheep show a distinct seasonal distribution, with a peak in the spring (Figure 5). Cryptosporidiosis in calves showed a further increase compared with previous years, and is a common cause of enteritis in calves less than three weeks of age.

Figure 5: Recorded diagnosis of cryptosporidiosis in cattle and sheep in UK, 2010



Echinococcus

Cystic hydatidosis (*Echinococcus granulosus*)

Echinococcus granulosus is a tapeworm which inhabits the small intestine of canines. Nine *E. granulosus* strain genotypes are now recognised worldwide, of which two are present in GB in

[11] Chalmers RM, *et al.* Epidemiology of anthroponotic and zoonotic human cryptosporidiosis in England and Wales, 2004 to 2006. *Epidemiology and Infection* 2011; 139(5): 700-712.

indigenous animals: a sheep adapted strain involving a dog to sheep life-cycle, and a horse adapted strain involving a dog to horse life-cycle.

The main cycle of infection in GB is between farm dogs and sheep, the main intermediate host in the UK. Sheep acquire hydatidosis by grazing on pastures contaminated with dog faeces containing the cestode eggs or by ingesting other contaminated feed. Cattle can also be infected with the sheep strain, but resultant cysts are usually sterile. Dogs are infected by ingesting animal viscera containing viable cysts.

Humans can act as an accidental intermediate host. The main route of transmission to humans is through direct contact with infected dogs or their faeces. Developing cysts may grow for 20 or more years before becoming large enough to cause a range of symptoms depending on the affected organ and the location of the cyst.

Infection in humans

Cases: During 2010, seven confirmed cases of hydatid disease in humans were reported in the UK; six in England and Wales (four males and two females) and one in Scotland. Five cases in England were thought to have contracted disease outside the UK, whilst one case in Wales was indigenously acquired in a retired farmer resident outside the pilot control area discussed later in this section. The case in Scotland was also believed to have been indigenously acquired, occurring in a female who worked with sheep. The number of indigenously acquired human cases in the UK is usually very low, with an average of one new case identified approximately every five years.

Infection in animals

Frequency: The following figures are reported findings of hydatid disease at post mortem inspection of sheep and cattle for human consumption at licensed abattoirs in GB. During 2010, there was a throughput of 13,759,548 sheep, of which 74,491 (0.5%) were recorded as being affected with hydatid cysts; there was a throughput of 2,257,165 cattle, of which 1,422 (0.06%) were recorded as affected with hydatid cysts. In 2009, 0.5% of sheep and 0.1% of cattle in GB licensed abattoirs were recorded as affected with hydatid cysts.

In Northern Ireland there was a throughput of 368,034 sheep and 473,885 cows during 2010. There were no post mortem detections of hydatidosis in any species slaughtered throughout 2010. The last recorded detection in Northern Ireland was in June 2006.

Since the cessation of a dog worming campaign in the eighties, there is evidence[12] to suggest a rising trend in dog infestation in South Powys, Wales, although there is no current indication that transmission to the human population has increased. In 2008, the Welsh Government launched a Wales-wide hydatid disease awareness campaign and a South Powys pilot eradication scheme, which continued throughout 2009 and finished in 2010.

[12] Buishi I, *et al*. (2005) Re-emergence of canine Echinococcus granulosus infection, Wales. *Emerg Infect Dis. 11*(4):568-71

Data from the South Wales pilot eradication scheme[13], indicated an initial prevalence of 9%[a] of farm dogs sampled. However, one or more dogs on 20% of farms tested positive, and this represents a potential human health risk at one in five farms in South Powys. Preliminary data indicates that worming dogs regularly remains highly effective and a key personal health protection measure.

During 2010 the VLA diagnosed *Echinococcus ortleppi* in an imported Philippine Spotted Deer that had been kept at a zoo. *E. ortleppi* has been classed as a cattle adapted strain G5 of *E. granulosus* (the only strain that readily infects cattle) but has been named *E. ortleppi* as it is genetically distinct from the sheep and horse strains of *E. granulosus*. Cattle are the intermediate host but in this case a deer was found to be the intermediate host. There appears to be only a low infectivity to humans although a human case has been identified in one survey in the Netherlands and also one case (2010) in Brazil. There are no pre-import testing requirements for *Echinococcus*, but as this finding was in a zoo-kept animal there is no scope for definitive hosts in the United Kingdom to have become infected.

Alveolar echinococcosis (*Echinococcus multilocularis*)

E. multilocularis causes alveolar hydatid disease, which has a wide geographical distribution across the Northern hemisphere throughout North America, Asia and Europe. Alveolar hydatid disease is a much more invasive disease in man than cystic hydatidosis. The life-cycle normally involves foxes and raccoon dogs as definitive hosts and small rodents, particularly voles as intermediate hosts. Dogs, cats and wolves may also act as definitive hosts to a lesser extent.

There is evidence that the distribution of *E. multilocularis* is spreading in northern Europe[14,15,16]. Particular concern has been expressed in relation to the increase in the number of urban foxes. In Sweden (previously thought to be *E. multilocularis*-free) a fox was found to be positive for *E. multilocularis* in December 2010.[17] Dogs and cats entering the UK from mainland Europe are currently required to receive treatment for *E. multilocularis* under the 'Pets Travel Scheme', detailed in the Rabies section.

E. multilocularis is not known to be present in indigenous animals in the UK. An imported case was identified by the VLA in 2010 during the post-mortem examination of the liver from an imported female beaver that had been kept in captivity since arrival. She had been wild caught in Bavaria, initially quarantined in GB in early 2007 for six months, and was then kept in captivity until being found dead. Liver lesions identified at post mortem examination were found to be positive for *E. multilocularis* at subsequent PCR testing. Beavers are not considered to be natural intermediate hosts but may be considered aberrant hosts.

[13] http://wales.gov.uk/topics/environmentcountryside/ahw/disease/hydatiddisease/hydatiddiseasecampaign/;jsessionid=JWtnMQ2CT70WCXMnXl2mWLLKPVHgpLM95Z0nDnqTC4bbG9J3fY1b!-25131489?lang=en

[14] Takumi K, *et al.* Evidence for an increasing presence of *Echinococcus multilocularis* in foxes in The Netherlands. *Intl J for Parasitology* 2008; 38(5):571-578.

[15] Berke O, *et al.* Emergence of *Echinococcus multilocularis* among red foxes in northern Germany 1991-2005. *Veterinary Parasitology* 2008; 155(3-4):319-322.

[16] Vervaeke M, *et al.* Spatial spreading of *Echinococcus multilocularis* in red foxes across nation borders in Western Europe. *Preventive Veterinary Med.* 2006; 76(3-4):137-150.

[17] http://web.oie.int/wahis/public.php?page=single_report&pop=1&reportid=10700

At least 49 beavers have been imported into captivity in Great Britain from Northern Bavaria since 2001. These beavers have gone, following appropriate rabies quarantine, to private and public collections in Scotland and England. There would appear to be a very low risk that an imported Bavarian beaver would be infected with *E. multilocularis*. As they are in captivity, there is a negligible risk of predation by foxes or dogs of any of these potential aberrant hosts. Therefore the UK's disease free status for *E. multilocularis* will not have been compromised outside these captive collections. Ongoing surveillance in the UK has demonstrated that the UK fox population remains free of *E. multilocularis.*

Leptospirosis (*Leptospira interrogans* serovars)

Leptospirosis is a zoonotic disease caused by the bacterium *Leptospira interrogans* of which only some strains are pathogenic. *L.* Icterohaemorrhagiae is the main serovar causing human disease. Leptospires are widespread amongst feral and domesticated mammals, which are maintenance hosts for over 250 known serovars[18].

The serovars encountered most frequently in farm livestock in the UK are *L.* Hardjo (cattle), *L*. Bratislava (pigs) and *L*. Icterohaemorrhagiae (which affects a wide range of wild and domestic species). Leptospirosis is a major cause of economic loss to the intensive cattle and pig industries of the developed world[19], and is still an important occupational disease risk for people working in agriculture. Clinical disease in animals in GB is less common than in the past although it is still a significant problem in Northern Ireland.

Humans mainly acquire infection by direct contact with infected urine through mucous membranes, eyes, or cuts and abrasions. Infection can also occur indirectly through contact with water, soil or foods contaminated with urine from infected animals. Recent *L.* Icterohaemorrhagiae infections have been linked to pet rats.

Infection in humans

Cases: During 2010, 42 cases of leptospirosis were reported in the UK (Table 5): Serovars were determined by the *Leptospira* Reference Unit: L. Icterohaemorrhagiae (n=15); L. Autumnalis (n=4); L. Hardjo (n=2); L. Saxkoebing (n=2); L. Australis (n=1); other serovar (n=3); and for 15 the infecting serovar was not determined.

Twenty-two of the cases were acquired indigenously, and 20 were acquired through travel. Of the indigenously acquired infections, 21 were male and one was female. There was one fatality. Ten of the indigenous infections were likely to have been acquired through occupational activities: four were in farmers; two in abattoir workers; a gamekeeper; a carpenter repairing a river bank; a building worker exposed to stagnant water; and a rowing instructor who died following immersion in the river Thames. Ten further cases were likely to have been acquired

[18] Higgins, R (2004) Emerging or re-emerging bacterial zoonotic diseases: bartonellosis, leptospirosis, Lyme borreliosis, plague. In: Emerging zoonoses and pathogens of public health concern. Rev. sci. Off. int.Epiz.23 (2), 569-581

[19] Ellis, W.A (1998). Leptospirosis. In: Zoonoses Eds S R Palmer, Lord Soulsby and D.I.H. Simpson Oxford, Oxford University Press, p115-126.

through recreational or non-occupational exposures to rodent-infested environments. There was no risk factor information available for the remaining two cases.

Twenty people acquired leptospirosis whilst overseas in 2010, mostly from South-East Asia. Many of these were associated with water-related activities.

Table 5: Laboratory confirmed reports of leptospirosis in UK residents, 2001-2010

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
England & Wales	48	54	28	29	41	44	74	62	52	39
Scotland	0	3	0	2	4	3	6	13	2	3
NI	0	1	0	1	1	3	1	1	0	0
UK	48	58	28	32	46	50	81	76	54	42

Infection in animals

Frequency: The constituent countries within the UK use different diagnostic methods, and the diagnostic criteria required for disease confirmation have also changed in recent years, so it is difficult to make comparisons between countries and time periods.

In 2010, a total of 508 specimens from a range of mammalian species (mainly cattle and pig foetal kidneys) in England and Wales were examined by real-time PCR for pathogenic leptospires. Of the 432 samples suitable for testing, four were positive.

There were also 8,681 serum samples from a range of species examined by the VLA for disease diagnosis, monitoring and export (mainly dogs) purposes. A summary of the positive samples is given in Table 6. The data are further biased because only a few samples were examined for the full range of serovars. Note that these data only indicate serological evidence of exposure and/or vaccination (which is widely practiced) and not clinical disease.

Table 6: Detection of antibody to pathogenic leptospires in serum samples submitted to VLA for testing using the Microscopic Agglutination Test, 2010

	Dogs	Cattle	Pigs	Horses
Total samples	3,407	4,715	559	0
Positive *L.* Canicola	1,199*	0	0	0
Positive *L.* Icterohaemorrhagiae	528*	0	0	5
Positive *L.* Hardjo	0	1,047*	0	0
Positive *L.* Bratislava	5	0	158	0
Positive *L.* Zanoni	0	0	0	0
Positive *L.* Copenhageni	4	0	0	0

It should be noted that results only reflect the serological tests requested for each submission, and therefore significant titres to other *Leptospira* serovars could be missed.
* Leptospires for which a vaccine is available in this species.

Serological testing of dairy herds in England and Wales in 2010 to monitor *L.* Hardjo status continued to show evidence of potentially active infection and/or extensive vaccination in about 57% of herds.[20]

In Northern Ireland, of 897 suitable samples (including cattle samples) examined by the fluorescent antibody test and there were 105 confirmed cases (11.7%).

Listeriosis (*Listeria monocytogenes*)

Listeria monocytogenes is widely distributed in the environment, including soil, decaying vegetation and fodder such as silage in which the bacteria can multiply.

In humans the disease most commonly occurs in pregnant women, neonates and people over the age of 60 years with a range of underlying medical conditions including cancer and diabetes. Consumption of foods contaminated with *L. monocytogenes* is the main route of transmission to humans. Zoonotic infection acquired directly from animals is also possible, although cases reporting animal contact are rare.

In animals, listeriosis is chiefly a disease of farmed ruminants, with cattle and sheep considered the most important species. Infection occurs due to direct ingestion of soil, or through soil-contaminated feed, notably spoilt silage.

Infection in humans

Cases: There were 176 cases in the UK in 2010, of which 18 were pregnancy-associated cases (Table 7). This is a decrease of 25.1% compared to the 235 cases reported in 2009, with the greatest decrease (26.6%) in England and Wales[21].

Given the long incubation period for infection and the population at risk of infection, outbreaks of listeriosis are difficult to detect. Nevertheless, in 2010, two outbreaks of listeriosis were reported in England; one was linked to consumption of retail sliced meats distributed by a single manufacturer and the other to sandwiches served at a hospital in the North East. The outbreak linked to sandwiches served to patients in hospital highlights the potential for sandwiches contaminated with *L. monocytogenes* to cause severe infection in vulnerable people[22,23]. A summary of foodborne outbreaks by zoonotic pathogen, broken down by food vehicle category is given in appendix 6.

[20] FZ2100 report: http://vla.defra.gov.uk/reports/docs/rep_zoo0410.pdf
[21] Decrease in listeriosis incidence in England and Wales in 2010. http://www.hpa.org.uk/hpr/archives/2011/news1311.htm#list
[22] HPA. Human listeriosis linked to hospital sandwiches: implications for procurement and storage. *HPR* 2(35) (29 Aug 2008). http://www.hpa.org.uk/hpr/archives/2008/news3508.htm
[23] Little C, *et al.* Outbreaks of infection associated with ready-to-eat food. ACMSP, Jan 2011, ACM/1014. http://www.food.gov.uk/multimedia/pdfs/committee/acm1014hpa.pdf

Table 7: Laboratory reports of listeriosis in humans in the UK, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
England and Wales										
Total cases	145	139	233	211	189	185	227	182	214	157
Pregnancy associated cases	18	10	34	21	25	25	28	20	34	17
Others	127	129	199	190	164	160	199	162	180	140
Scotland										
Total cases	12	19	11	15	28	17	23	15	17	17
Pregnancy associated cases	0	0	1	1	2	1	2	0	1	1
Others	12	19	10	14	26	16	21	15	16	16
NI										
Total cases	5	2	3	4	3	6	5	11	4	2
Total	162	160	247	230	220	208	255	208	235	176

Listeria in food

Two surveys in 2009 investigated food as a source of *Listeria* spp. One hundred and thirty-three samples were taken as part of a curtailed EU harmonised survey of *Listeria* spp. in ready to eat (RTE) foods. Forty-seven samples of meat product, 45 samples of soft cheese and 41 samples of smoked fish were tested for the presence of *Listeria monocytogenes*. *L. monocytogenes* was found in two samples of smoked fish (both at less than 20 cfu/g. As the legal limit for these types of product is 100 cfu/g, no action was taken on the positive results). There were no positive results for the meat products or for the cheeses, although one cheese sample was positive for *Listeria seeligeri* and one for *Listeria welshimeri*. A new EU harmonised survey of Listeria in RTE foods began in 2010, with UK sampling starting on 1st November 2010.

In 2009, the FSA also conducted an imported foods survey which sampled 115 fresh chickens and 32 cooked shellfish products. One chicken sample and one shellfish sample were found to be positive for *L. monocytogenes*.

Infection in animals

Frequency: In the UK the majority of cases occur between January and April when animals are housed. This peak in cases is linked to the feeding of poorly fermented soil-contaminated silage. During 2010, 237 diagnoses of listeriosis in animals were made in the UK (Table 8). Of these, 215 occurred in GB compared to 177 in 2009, an increase of 21.5%. The reason for the increase is uncertain; the incidence of disease varies over successive years, the most likely contributory factor probably being the weather at times of the year when forage is collected, as poorer quality silage is likely when grass is cut when it is wet.

Table 8: Confirmed *Listeria* cases in animals in the UK, 2010

Year	*Listeria* (all species)
Birds (at farm)	2
Cattle	58
Sheep and goats	174
Other	3
Total	237

Lyme Borreliosis (*Borrelia burgdorferi*)

Lyme borreliosis (also known as Lyme disease) is a spirochaetal infection caused by the bacterium *Borrelia burgdorferi* which is transmitted to humans and animals through the bite of an infected tick (*Ixodes* species). It is the most common tick-borne infection in the temperate northern hemisphere and has shown a steady increase within the UK since 2003. The majority of cases are indigenously acquired in the UK, often through recreational activities including walking, trekking and mountain-biking[24].

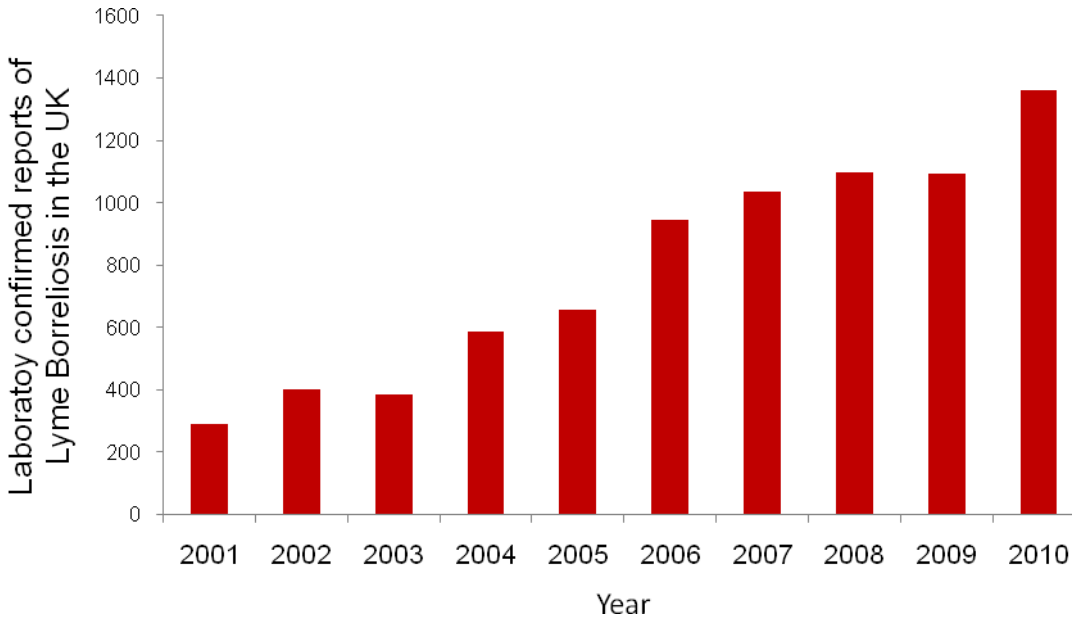
Well known regional foci of Lyme borreliosis include the New Forest, Salisbury Plain, Exmoor, the South Downs, parts of Wiltshire and Berkshire and Thetford Forest. Similar foci are known on the West coast and islands of Scotland.

Infection in humans

Cases: The number of reported cases of Lyme disease has risen in recent years. There were 1,361 serologically confirmed cases of B. burgdorferi infection in humans in the UK in 2010 (data are provisional). This is a 24.4% increase on 2009 (n=1,094) (Figure 6).

[24] http://www.hpa.org.uk/NewsCentre/NationalPressReleases/2010PressReleases/100505Betickaware/

Figure 6: Number of laboratory confirmed human cases of Lyme borreliosis in the UK, 2001-2010



There were no laboratory-confirmed cases of Lyme borreliosis in Northern Ireland in 2010, compared to two in 2009. In Scotland there were 308 laboratory confirmations in 2010; a 35.1% increase on the 228 Scottish cases reported in 2009. Information on at least three cases suggests that their infection was acquired abroad.

In England and Wales, there were 1,053 cases of Lyme borreliosis in 2010. Of these, 90 (8.5%) cases are known to have been acquired overseas, giving a UK acquired total population incidence of 1.6/100,000 population (Table 9). The seasonal pattern in 2010 was consistent with previous years; infections were reported throughout the year but with a peak in infection in the second quarter of the year. This is consistent with the major tick feeding period which occurs in the late spring and early summer months.

Table 9: Source of infection with Lyme borreliosis of cases resident in England and Wales, 2001-2010

Year	UK acquired	Overseas acquired	% overseas	Total
2001	215	53	19.8	268
2002	269	71	20.9	340
2003	234	31	11.7	265
2004	425	75	15.0	500
2005	488	107	18.0	595
2006	677	91	11.8	768
2007	705	92	11.5	797
2008	722	91	11.2	813
2009	674	190	22.0	864
2010*	963	90	8.5	1,053

*These figures are provisional. The total number of cases is likely to reduce as in previous years, and the proportion acquired overseas is likely to increase.

Reports were received from all regions of England and Wales with the South East and South West contributing 40% and 29% of the total reports (population-specific rates of 5.2/100,000 and 6.0/100,000 respectively). The regional distribution of human cases reflects a similar regional pattern to that of the infected tick population.

Further information

British Infection Association Position Statement on Lyme disease in the UK:
http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1309968694565

Pasteurellosis (*Pasteurella* spp.)

Pasteurellosis is a zoonotic bacterial disease that occurs sporadically worldwide. In humans *Pasteurella multocida* is the most commonly reported species. The most common mode of transmission to humans is via dog or cat bites, scratches or licks. These frequently lead to a cutaneous infection which may be severe. The organism is also found in the upper respiratory tract of many animal species including chickens, turkeys, cattle, rabbits and rodents.

Infection in humans

Cases: There were 586 laboratory-confirmed reports of human pasteurellosis in the UK in 2010, a 4.8% increase on the 559 cases reported in 2009 (Table 10).

In 2010, 466 cases were reported in England and Wales (344 of which were *P. multocida)* compared to 455 (including 333 *P. multocida*) in 2009. There were 120 cases reported in Scotland in 2010 (76 of which were *P. multocida)* compared to 97 (including 62 *P. multocida)* in 2009, an increase of 23.7%. No cases were reported in Northern Ireland in 2010 compared to seven cases (five of which were *P. multocida*) in 2009.

Table 10: Laboratory confirmed reports of pasteurellosis in humans in the UK, 2010

Serovar	England and Wales	Scotland	NI	UK total
P. multocida	344	76	0	420
P. pneumotropica	14	4	0	18
P. haemolytica	2	0	0	2
P. other named	8	7	0	15
Pasteurella spp	98	33	0	131
Total	466	120	0	586

Infection in animals

Frequency: There were 510 cases of pasteurellosis (*P. multocida*) diagnosed in animals in the UK during 2010. Of these, 368 occurred in GB, an increase on the 319 cases reported in 2009. In Northern Ireland numbers increased by 55.6%.Table 11 shows the number of reports per species in 2010 and 2009. The change in the number of laboratory diagnoses is unlikely to reflect any real change in the prevalence of animal infection, but is more likely a consequence of differing submission levels in the two years.

Table 11: Laboratory confirmed reports of *P. multocida* in animals in the UK, 2009-2010

Year	2009 GB	2009 NI	2009 UK	2010 GB	2010 NI	2010 UK
Cattle	175	145	320	199	99	298
Sheep	91	6	97	96	2	98
Pigs	42	46	88	51	28	79
Birds	6	22	28	19	9	28
Miscellaneous/ wildlife	3	2	5	2	4	6
Goats	2	0	2	1	0	1
Total	319	221	540	368	142	510

Q Fever (*Coxiella burnetii*)

Q fever is caused by the bacterium *Coxiella burnetii*. In its spore-like form the organism is very robust and resistant to desiccation and common disinfectants. It can therefore survive for long periods in the environment and be transmitted in aerosols or by fomites, including dust particles.

C. burnetii infection is seen mainly in domesticated ruminants (cattle, sheep and goats), where it can cause abortion. However, infection is also present in a wide range of wildlife species and other animals including arthropod vectors (mainly ticks).

Transmission to humans mostly occurs through exposure to aerosols containing *C. burnetii*. This may arise via bacterial shedding in products of abortion or normal parturition, or result from contaminated dust particles or bedding. Most human infections are asymptomatic, but cases may present as acute or chronic disease, and relapses may occur. Since 1999, HPA data shows that an average of 16% of cases diagnosed annually are chronic.

Infection in humans

Cases: In 2010, routine laboratory surveillance identified 23 cases in England and Wales, while three cases were reported in Scotland and none in Northern Ireland (Table 12). Enhanced surveillance data based on diagnoses from the two HPA reference laboratories in Bristol and Porton identified 57 cases, compared to 27 in 2009.

Table 12: Laboratory confirmed reports of Q fever in humans in the UK, 2008-2010

Year	Scotland	NI	England & Wales (Enhanced Surveillance**)	UK total*	England & Wales (Routine Surveillance)
2008	1	11	55	67	37
2009	2	2	27	31	15
2010	3	0	57	60	23

*The UK total includes the enhanced surveillance data but not routine surveillance data for England and Wales, as cases reported routinely may also be reported to enhanced surveillance.
**Acute and chronic cases from the Enhanced surveillance database in England and Wales.

Infection in animals

Frequency: In 2010, two goats, one cow and one sheep were clinically diagnosed with Q fever from abortion specimens submitted to VLA and SAC laboratories in GB.

Most cases of abortion due to Q fever in livestock are sporadic, although larger outbreaks are occasionally seen. Such an outbreak occurred in May 2010. No human cases were associated with this outbreak (see the feature article on Q fever).

Further information

Information on Q fever infection risks during the lambing season are available at:
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/QFever/GeneralInformation/qfevQFeverRisksLambingSeason/

Q fever information for farmers is available at:
http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1210834106356

Rabies (*Rhabdoviridae*)

Rabies is an acute viral infection of the central nervous system, caused by a lyssavirus in the family *Rhabdoviridae*. It affects all mammals, including humans, cats, dogs, wildlife and farm animals. In animals, three forms are classically described; prodromal, excitement (furious) and paralytic (dumb). The disease is absent from land mammals in the UK. The last case of rabies in an animal outside of quarantine in GB was a dog in Camberley in 1970. In Northern Ireland the last case was reported in 1923. The last case of rabies in quarantine was reported in 2008 in England.

The virus is present in the saliva of affected animals, and the most frequent method of transmission to humans is by bites, scratches or licks to broken skin or mucous membranes. In

humans, death is almost inevitable with very few documented survivors[25]. The last case of human terrestrial rabies acquired in the UK was in 1902; however occasional travel-related cases do occur. In the last 10 years there have been four cases of imported human rabies in the UK. The most recent case was in December 2008 and resulted from a dog bite in South Africa two years earlier[26].

In 2002, it was recognised that UK bats carry European Bat Lyssavirus 2 (EBLV-2), a genetically-similar strain of rabies virus. Further information can be found in the European Bat Lyssavirus (bat rabies) section.

Infection in humans

Cases: There were no human cases of rabies infection in the UK in 2010.

Infection in animals

Frequency: In 2010, 18 dogs, 16 cats and two foxes were submitted to the VLA for laboratory testing. None of the samples were positive.

The Pet Travel Scheme (PETS) was launched in 2000 to allow people to bring in or travel with their pets (dogs, cats and ferrets), while ensuring the UK remains free from rabies and certain other exotic diseases. During 2010, 82,512 dogs, 7,870 cats, and 64 ferrets entered the UK under this scheme. In total, 752,945 pet animals have entered the UK under PETS since 2000 (ferrets have only been able to enter under the scheme since July 2004), and there have been no cases of rabies in any of these animals.

Further information

Further information on PETS and the conditions of the scheme can be found at:
http://www.defra.gov.uk/wildlife-pets/pets/travel/pets/index.htm

Bat rabies (European Bat Lyssavirus)

European Bat Lyssaviruses (EBLVs) 1 and 2, commonly referred to as ‘bat rabies’, are found in bats in Europe. EBLVs have been known to infect other animals and humans, presumably through a bite or scratch from an infected bat. Since 1977, there have been five human deaths in Europe (three confirmed, two possible) from EBLVs. In all cases the person had been bitten or scratched by bats and had not received rabies vaccination either before or after the incident[27].

[25] Jackson AC. Why does the prognosis remain so poor in human rabies? *Expert Rev. Anti Infect. Ther.* 2010; 8(6): 623-625

[26] Hunter M, *et al*. Immunovirological correlates in human rabies treated with therapeutic coma. *Journal of Medical Virology* 2010; 82: 1255-1265.

[27] Note that bats are a protected species and should only be handled by licensed persons. It is advised that any member of the public finding a bat behaving abnormally, found in an unusual place or under unusual circumstances, should not attempt to handle or move the animal, but should contact their local bat conservation group or the Bat Conservation Trust.

Infection in humans

Cases: The only case of EBLV-2 in a human in the UK was in 2002 when a bat handler was infected following a bite from a Daubenton's bat (*Myotis daubentonii*) in Scotland[28].

Infection in animals

Frequency: Overall results from surveillance conducted in England between 2003 and 2006 indicated a low seroprevalence estimate of EBLV-2 of about 2.2% in the 363 Daubenton's bats tested over 17 sites during these years, and antibodies against EBLV-1 were found in only one of 273 Serotine bats surveyed[29].

No seropositive bats were identified during surveillance undertaken in Scotland during 2010. However this may not indicate a statistically significant decline from a high of 15% in 2005. Six hundred and nine dead bats from the UK were submitted to the VLA in 2010 as part of an ongoing passive lyssavirus surveillance scheme. None tested positive for EBLV-2. Nine bats have tested positive through this scheme in the past (Table 13).

Table 13: Isolations of EBLV-2 in bats in the UK (all were *M. daubentonii*)

Date	No. isolations	Location	Sex
1996	1	Newhaven, East Sussex	Adult female (Pregnant)
2002	1	Carnforth, Lancashire	Juvenile, Female
2004	2	Staines, Surrey Blackburn Lancashire	Juvenile, Female Adult male
2006	1	Abingdon, Oxon	Juvenile Female
2007	1	Stokesay Castle, Shropshire	Adult Female
2008	2	Teddington, Surrey Stokesay Castle, Shropshire	Adult Female Juvenile, Male
2009	1[30]	Linlithgow, West Lothian	Adult Female

Further information

General information including guidance on post exposure prophylaxis is available from the HPA: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Rabies/

Advice for bat workers and their GPs can be found at: http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947347180

[28] Crowcroft N. Rabies-like infection in Scotland. *Euro Surveill*. 2002;6(50):pii=1984. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=1984

[29] Harris SL, *et al.* Targeted surveillance for European bat lyssaviruses in English bats (2003-06). *J Wildlife Disease* 2009; 45(4):1030-41.

[30] Horton DL, *et al.* European bat lyssavirus in a Daubenton's bat from Scotland. *The Veterinary Record* 2009; 165(13); 383-4.

Information on bats is available online from the Bat Conservation Trust at: http://www.bats.org.uk

Results of the Scottish Natural Heritage bat lyssavirus monitoring programme: www.snh.org.uk/press/detail.asp?id=2104

Salmonellosis *(Salmonella* species*)*

Salmonellosis in humans and animals is largely caused by the subspecies *Salmonella enterica enterica,* which is divided up into over 1,500 serovars of the 2,600 serovars of all *Salmonella* species*.* Although all animals can carry *Salmonella*, certain serovars such as *S.* Typhi and *S*. Paratyphi A are host-specific or highly host adapted. As these serovars are human host adapted they are not associated with zoonotic transmission. Illness in humans associated with other *Salmonella* serovars is known as non-typhoidal salmonellosis. Two of these serovars, *S.* Enteritidis and *S.* Typhimurium, account for 60 – 80% of all human salmonellosis. The sections below summarise the salient features of these non-typhoidal infections.

In domestic animal species, clinical cases of salmonellosis are most common in cattle. Subclinical carriage is most common in pigs, poultry and reptiles. Most human salmonellosis is acquired via the foodborne route, including by cross-contamination from raw products during preparation of other foods.

Infection in humans

Cases: In 2010, 9,685 cases of laboratory confirmed salmonellosis were reported in the UK. This represents a fall of 7.6% from 2009 (n=10,479). For England and Wales the total fell by 9.6%, whereas in Scotland and Northern Ireland numbers rose by 11.2% and 13.9% respectively. However, for every laboratory-confirmed report of disease caused by Salmonella made to the national surveillance scheme, there are estimated to be 4.7 unreported cases in the community[31]. This means the total number of cases in the UK in 2010 could be as high as 55,200.

S. Enteritidis remained the most commonly reported serovar in 2010, accounting for 28.9% of cases, although *S*. Enteritidis PT4 reports fell by over a third between 2009 and 2010, to 459 cases (Figure 7, Table 14). *S*. Typhimurium was the second most commonly reported serovar and increased by 4.6% from 2009. Reporting shows a consistent seasonal pattern with a distinct peak of infection observed in the third quarter of the year.

Other serovars also reported a rise from 4,025 in 2009 to 4,683 in 2010 (16.3%).

[31] Tam *et al.* Longitudinal study of infectious intestinal disease in the UK (IID2 study): incidence in the community and presenting to general practice. *Gut* 2011 [Epub ahead of print]

Figure 7: Laboratory reports of human *Salmonella* cases in the UK, 1984-2010

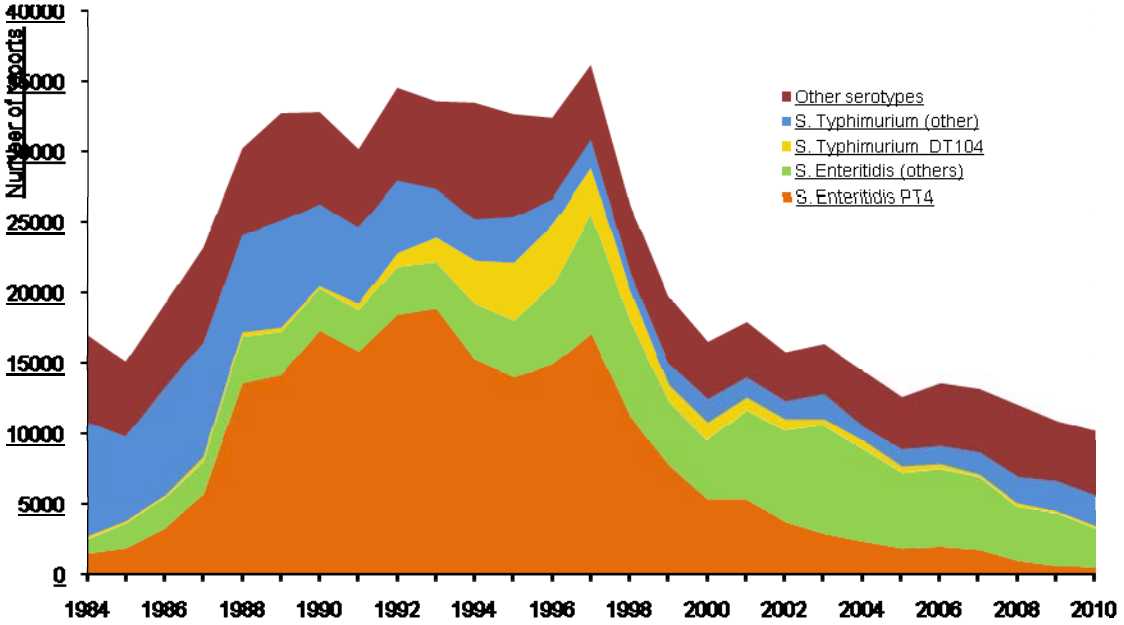


Table 14: The number, rates per 100,000 population and change since 2009 of the most common laboratory confirmed *Salmonella* serovars isolated from people in UK in 2010

Serotype	England & Wales		Scotland		NI		UK	
***S.* Enteritidis (TOTAL)**	**2,444**		**303**		**48**		**2,795**	**-35.6**
***S.* Enteritidis PT4**	**415**		**39**		**5**		**459**	**-32.3**
***S.* Typhimurium**	**1,959**		**195**		**53**		**2,207**	**4.6**
Other serovars	**4,161**		**443**		**79**		**4,683**	**16.4**
All	**8,564**		**941**		**180**		**9,685**	**-7.6**

Only nine foodborne outbreaks of *Salmonella* were reported in the UK in 2010 compared with 30 in 2009, continuing a decade-long declining trend, particularly in those caused by *S.* Enteritidis. Notably, the most common food types associated with *Salmonella* outbreaks in 2010 were fresh vegetables (*S.* Bareilly linked to bean sprouts[32], *S.* Paratyphi B var. Java PT 3 var 9 linked to mixed leaf salad[33]) and *S.* Typhimurium DT8 associated with duck eggs[34]. A summary of foodborne outbreaks by zoonotic pathogen, broken down by food vehicle category is given in appendix 6.

[32] Cleary P, *et al.* A foodborne outbreak of *Salmonella* Bareilly in the United Kingdom, 2010. *Eurosurveillance* 15(48):pii=19732

[33] HPA. Salmonella Java. *HPR* (serial online) 2010; 4(40); news. http://www.hpa.org.uk/hpr/archives/2010/hpr4010.pdf

[34] Noble DJ, *et al*. Revival of an old problem: an increase in *Salmonella enteric* serovar Typhimurium definitive phage type 8 infections in 2010 in England and Northern Ireland linked to duck eggs. *Epidemiol Infect.* (2011) [Epub prior to publication]

Salmonella in food

In 2010 an 11 month long, UK-wide, joint Local Government Regulation and HPA study took place investigating hygiene practices at large scale events in preparation for the Olympics in 2012. No *Salmonella* was detected during the study from samples of ready-to-eat food. Samples were collected from vendors serving food at large scale indoor and outdoor events (e.g. music festivals and sporting events) and smaller local events, e.g. fêtes and fairs.

As part of the *S.* Bareilly outbreak investigations, samples of bean sprouts (100 g) were collected from two suppliers. They were examined using HPA standard methods for the detection of *Salmonella* spp. *S.* Bareilly of a PFGE type indistinguishable from the outbreak cases was identified in a packet of bean sprouts collected from one supplier. They received mung bean seeds from upstream suppliers who sourced them from China or Myanmar[35].

Infection in animals

Frequency: The majority of incidents of *Salmonella* in farm livestock in the UK are detected as a result of testing diagnostic samples from clinical disease in cattle or statutory surveillance under legislative programmes to control *Salmonella* in flocks of domestic fowl (see feature article 4). There is currently no statutory *Salmonella* control programme in the UK pig sector, however, approximately 90% of pigs are produced under an assurance scheme that includes a programme to reduce the level of *Salmonella* in pigs - the Zoonosis National Control Programme for *Salmonella* in pigs (ZNCP).

Animal data for *Salmonella* are usually reported as “incidents” rather than the total number of isolates, since multiple isolates may be obtained from a number of samples taken simultaneously from a premises, group or animal environment. An incident is defined as the first isolation and all subsequent isolations of the same serovar (or serovar and phage type combination) of a particular *Salmonella* from an animal or epidemiologically distinct group of animals occurring on a single premises, usually within a 30 day period. Changes in the number of incidents therefore need to be treated with caution in view of the inherent biases associated with data collection.

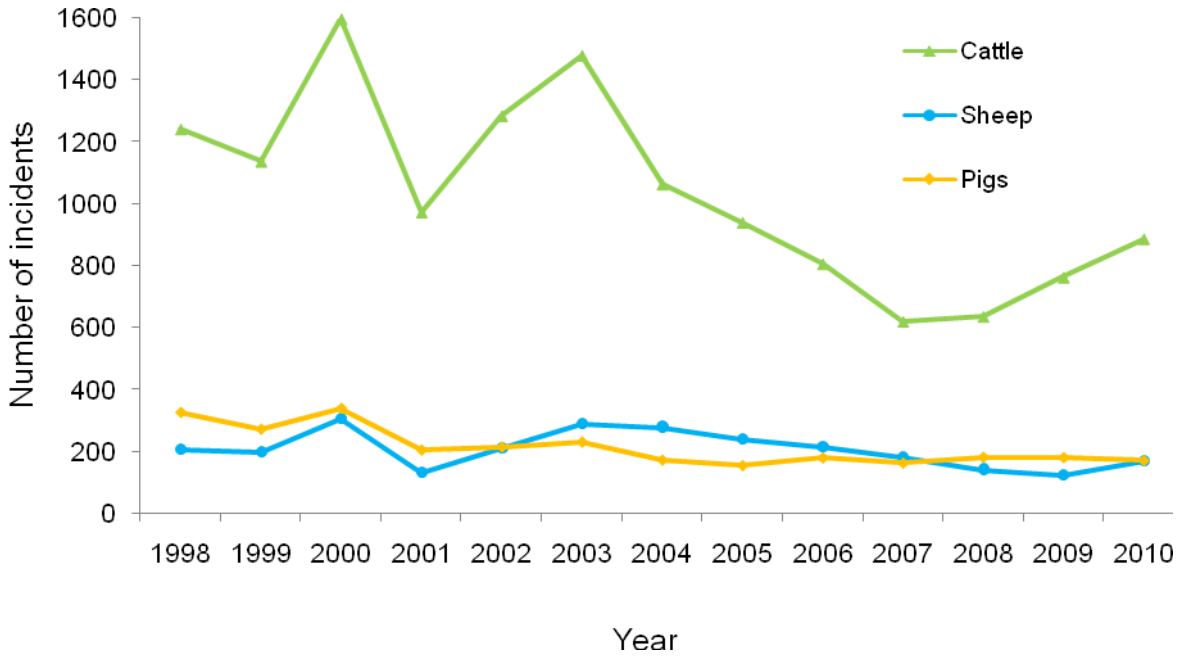
Cattle, sheep and pigs

In GB in 2010, there was a 16.3% increase in the number of reported *Salmonella* incidents in cattle to 887 compared to 2009 (n=763) (Figure 8). There was also a 36.0% increase in the number of reported incidents in sheep (170 from 125 in 2009), but no significant change in the number of incidents in pigs (172 from 182 in 2009).

In Northern Ireland there were 186 confirmed *Salmonella* isolates from cattle, 62 from pigs and 19 from sheep in 2010. This compares to the 2009 figures of 122 isolates from cattle, 10 from sheep and 18 from pigs.

[35] Cleary P, *et al.* A foodborne outbreak of *Salmonella* Bareilly in the United Kingdom, 2010. *Eurosurveillance* 15(48):pii=19732

Figure 8: Number of laboratory-confirmed incidents of *Salmonella* in animals in GB, 1998-2010



S. Dublin, which is seldom associated with human foodborne infection, continued to account for nearly three quarters of the incidents in cattle, whilst 3.1% of incidents were caused by monophasic *S.* Typhimurium; *S.* 4,5,12:i:- (Table 15). There were also increases in *S.* Mbandaka and *S.* Montevideo, which are thought to originate from contamination of oilseed residue proteins included in total mixed rations for dairy cows. *S. enterica* subspecies *diarizonae* 61:k:1,5,(7), a host-adapted serovar which is also not common in humans, was, as usual, the most frequently reported serovar in sheep. In pigs, *S.* Typhimurium was the most commonly recorded serovar, accounting for 52.1% of incidents (less than in 2009 when it amounted to 71%), whilst the monophasic *S.* Typhimurium variant, *S.* 4,5,12:i:-, represented 16.2% of incidents and the *S.* 4,12:i-, variant accounted for 5.6% of cases, continuing the shift from fully typeable to monophasic *S.* Typhimurium in pigs.

Table 15: Proportion of cattle, sheep and pig incidents by *Salmonella* serovar in the UK, 2010

Species	Cattle	Sheep	Pigs
Serotypes			
***S.* Dublin**	**71.5**	**13.4**	
***S.* Typhimurium**	**5.5**	**3.9**	**52.1**
***S.* Mbandaka**	**9.5**		
***S.* Montevideo**	**3.6**	**12.8**	
***S. enterica* subsp enterica 4,5,12:i:-**	**3.1**		**16.2**
***S.* Anatum**	**1.2**		

S. Newport	0.9		
S. Agama	0.6	2.2	
S. enterica subsp enterica 4,12:i:-	0.5		5.6
S. Kottbus	0.3		1.3
S. Infantis	0.1		1.3
S. enterica subsp diarizonae 61:k:1,5,7		43.6	
S. enterica subsp diarizonae 61:-:1,5,7		12.3	
Unspecified arizonae		3.4	
S. Derby		1.7	8.1
S. London			2.6
S. Kedougou			1.7
S. Rissen			1.3
S. Reading			1.3
S. Bovismorbificans			1.3
Other	3.2	6.7	8.5
Total number of incidents			

Poultry

Chickens and turkeys

For chickens and turkeys, the NCP results for 2010 are provided in feature article 4.

Ducks/geese

There was a 72% decrease in reports of Salmonella from ducks compared to 2009, to 83. There were 18 incidents of S. Typhimurium, but S. Enteritidis was not reported. There were 4 reports of Salmonella in geese of which 2 were S. Typhimurium.

Animal feed surveillance for *Salmonella*

Feedstuff contaminated with *Salmonella* may be a source of infection for animals. In order to reduce this risk, *Salmonella* is monitored and controlled, according to guidelines described in Codes of Practice, at a number of points in the feed production process.

The isolation rate of *Salmonella* from animal feedstuffs and feedstuff ingredients in GB has continued to remain stable. In GB in 2010, 0.9% of samples were positive (407 *Salmonella* isolates from 44,982 samples). Approximately 4.7% of these isolates were of *Salmonella* serovars considered to be of greatest public health significance (i.e. *S.* Typhimurium, *S.* Enteritidis, *S.* Hadar, *S.* Virchow, *and S.* Infantis). *Salmonella* was isolated from 0.4% of processed animal protein for feedingstuffs use. The isolation rates in oilseed meals and mineral (and other) ingredients were 1.5% and 1.4% respectively.

Further information

A description of *Salmonella* data collection and reporting in animals is included in the *Salmonella* in Livestock Report:
http://www.defra.gov.uk/vla/reports/rep_salm_rep09.htm

Further background to the pig ZNCP initiative is available at the British Pig Executive's website: http://www.bpex-zap.org.uk

Toxoplasmosis *(Toxoplasma gondii)*

Toxoplasmosis is caused by the protozoan parasite *Toxoplasma gondii*. The organism is carried by cats and can infect virtually all warm-blooded animals. The resistant oocysts are excreted by cats in their faeces, and can survive in the environment for many months.

Humans are infected with *T. gondii* by four major routes:

- Ingesting sporulated oocysts from water, food or soil contaminated with the faeces of infected cats
- Ingesting or handling undercooked or raw meat (mainly pork or lamb) that contains tissue cysts
- Transmission from a newly infected mother to the foetus
- Receiving organ transplants or blood products from donors with toxoplasmosis, although this is rare

Infection in humans

Cases: A total of 187 laboratory-confirmed cases of toxoplasmosis were reported in the UK by routine surveillance during 2010 (Table 16).

Under-reporting is known to occur within the laboratory reporting system and an enhanced surveillance system was introduced by the HPA in England and Wales in 2008 in collaboration with the national Toxoplasma Reference Laboratory in Swansea. In 2010, 348 cases of toxoplasmosis were reported through this scheme; 142 (40.8%) of these cases were male and 203 (58.3%) were female (three were reported with unknown gender), and 263 cases had acute infection (76%).

Table 16: UK confirmed human cases of toxoplasmosis, 2001-2010

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
England & Wales Laboratory reporting	106	94	75	79	102	94	106	75	86	114
Scotland	16	32	17	20	11	33	40	48	69	71
NI	7	12	7	1	2	0	2	4	3	2
Total	129	138	99	100	115	127	148	127	158	187
England & Wales Enhanced surveillance*	NR	NR	NR	NR	NR	NR	NR	407	422	348

* Figures for enhanced surveillance are not included in the total

Infection in animals

Frequency: In 2010, exposure to Toxoplasma was confirmed in 53% of diagnostic sheep sera sampled in the UK (Table 17). This compares with 49% in 2009. This testing does not distinguish between vaccinal antibody and that produced by natural infection, so these figures could be influenced by vaccination. However as these diagnostic samples were collected from sheep in flocks with a recent abortion problem it is likely that the majority of positives were associated with infection. In a separate VLA project, the seroprevalence of T. gondii in breeding animals in Great Britain was measured during 2010 using sera collected in 2009 for the Brucella melitensis survey. Of the 3,539 blood samples collected from 227 flocks, 2,619 (74.0%) were found to be positive for antibody to toxoplasma. Details of vaccination status were returned for 3,049 (86.1%) of animals sampled. The results show that 6.2% of the animals included in the survey were vaccinated, 57.2% were unvaccinated and the remaining 36.5% were of unknown vaccination status. Animal seroprevalence was estimated at 68.6%, flock seroprevalence at 100% and within flock seroprevalence at 68.6%[36].

Table 17: Sera testing of Toxoplasmosis in animals in the UK, 2010

Sera testing	GB	NI**	UK
No. sheep samples sera tested	781	502	1,283
No. separate submissions*	171	192	363
No. positives *T. gondii*	340	342	682
No. goat samples sera tested	20	0	20
No. separate submissions	8	0	8
No positives *T. gondii*	7	0	7
No. alpaca samples sera tested	3	0	3
No. separate submissions	3	0	3
No. positives *T. gondii*	0	0	0
No. pig samples sera tested	97	16	113
No. separate submissions	2	9	11
No. positives *T. gondii*	26	0	26

*Each submission may contain a number of samples
** Positive is a titre >1/32

In 2010, toxoplasmosis remained the second most commonly diagnosed cause of abortion in sheep and goats in GB, accounting for 22.0% (n=216) of all incidents of fetopathy investigated by government veterinary laboratories. This compares to 23.0% in 2009 (n=205).

36 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=4329&FromSearch=Y&Publisher=1&SearchText=toxopla&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

Trichinellosis (*Trichinella* spp.)

Trichinellosis is caused by a small parasitic worm (*Trichinella* spp.) 'the muscle worm', which can infect many species of mammals and some birds. It is a foodborne parasitic disease that is spread primarily by the consumption of raw or undercooked meat products from horses and pigs containing trichinae, the infective, immature (larval) stage of the worm.

There are eight zoonotic species of *Trichinella*, of which *T*. spiralis is the most common in Europe[37]. Whilst GB appears to be free from the parasite in animals, *Trichinella spiralis* was found in two foxes in Northern Ireland in 2007 and 2009. In humans, European outbreaks of trichinellosis are regularly reported, whilst in contrast there have been no human cases acquired from meat produced in GB for over 30 years.

Nine cases of trichinellosis were diagnosed in England and Wales between 2000 and 2009, which included an outbreak of eight cases in 2000 associated with the consumption of imported meat products. The remaining case was travel-related.

Infection in humans

Cases: One human case of trichinellosis was reported in the UK in 2010. This was reported by Scotland in a person who had eaten partially cooked meat in France.

Infection in animals

Frequency: All evidence indicates the absence of Trichinella in Great Britain, and in domesticated animals in Northern Ireland. Pigs and horses are routinely monitored for the presence of Trichinella. In 2010, 220,674 breeding sows and boars and 1,628,367 fattening pigs (including an estimated 111,571 outdoor reared pigs) in the UK, and 9,018 horses, 952 farmed wild boar and 202 feral wild boar in GB were tested. All samples examined were negative.

An ongoing survey of *Trichinella* in foxes is being carried out by the FSA in the UK, and from 2006 other wildlife have also been tested. In 2010, 502 foxes in GB and 146 in Northern Ireland were tested and none were positive for *Trichinella*. Thirty-three badgers in Northern Ireland were also tested, and all samples were negative.

Further information

European outbreaks are reported at:
http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=590

[37] Pozio E. World distribution of Trichinella spp. Infections in animals and humans. *Vet Parasitol.* 2007; 149(1-2) p3-21

Variant Creutzfeldt-Jakob disease (vCJD) in humans and Bovine Spongiform Encephalopathy (BSE) in animals

Variant Creutzfeldt-Jakob disease (vCJD) in humans

Creutzfeldt-Jakob disease (CJD) is a rare and fatal transmissible spongiform encephalopathy (TSE) of humans. Sporadic CJD is the most common form and was initially described in 1921. In 1996, a new variant, vCJD, was recognised and was strongly linked to Bovine Spongiform Encephalopathy (BSE) in cattle.

There have been no vCJD cases in those born after the 1980s. The government introduced leukodepletion of blood in 1999, and in 2004 implemented a policy that people who had received a blood transfusion in the UK since 1980 would no longer be able to give blood. There have been four probable secondary infections associated with blood transfusion in the UK.

Cases: There were three deaths from definite or probable vCJD in the UK in 2010 bringing the total number recorded since 1995 to 171. The number of deaths per year peaked at 28 in 2000.

Further information

The Department of Health:
http://www.dh.gov.uk/en/Aboutus/MinistersandDepartmentLeaders/ChiefMedicalOfficer/CMOtopics/FeaturesBrowsableDocument/DH_4102718

The National Creutzfeldt-Jakob Disease Surveillance Unit:
http://www.cjd.ed.ac.uk/

Report on the incidence of variant Creutzfeldt-Jakob disease diagnoses and deaths in the UK, January 1994 – December 2010:
http://www.cjd.ed.ac.uk/cjdq68.pdf

Bovine Spongiform Encephalopathy (BSE) in animals

BSE is a transmissible spongiform encephalopathy (TSE) disease of domestic cattle. BSE has caused a major epizootic in cattle and smaller epizootics in exotic ruminants and domestic and exotic felines. Worldwide there have been two naturally occurring cases of BSE in goats: one in France and one in the UK. The transmissible agent in TSEs is widely suspected to be an abnormal form of a host-encoded protein called the 'prion protein', although some research[38,39] suggests that in some TSEs, infectivity may be associated with low levels of detectable abnormal prions, or that abnormal prion protein may not always be infectious.

Frequency: The UK BSE epidemic peaked in 1992 with over 37,000 cases and has since declined steadily, with just 11 cases in 2010. The annual incidence of BSE cases in the EU has declined since targeted surveillance started in 2001. There have been a small number of cases in North America, the Middle East, and Asia.

[38] Barron RM, et al. High titres of TSE infectivity associated with extremely low levels of PrPSc in vivo. (2007) *J. Biol. Chem*. 282:35878-35886
[39] Piccardo P, et al. Accumulation of abnormal prion protein that is not infectious. (2007) *PNAS* 104: 4712-4717

Vero cytotoxin-producing *Escherichia coli* (VTEC)

Escherichia coli (E. coli) is a bacterium which normally inhabits the guts of animals, including humans. Many strains are considered to be harmless. However there are a number of subgroups that are associated with human disease. Verocytotoxin-producing *E. coli* (VTEC) O157 is the most common zoonotic serogroup affecting people in the UK, but other serogroups such as O26 and O111 may be important in some countries. VTEC O157 can be transmitted to people in several ways. These include:

- Consumption of contaminated food or water
- Direct or indirect contact with animals, their faeces or contaminated environments
- Person–to-person spread

Many animals can carry VTEC O157 bacteria, even when they appear healthy. Cattle are the main reservoir of VTEC O157 in the UK, but the organism may also be found in other ruminant species, particularly sheep, and it has been isolated from a wide range of other livestock and wildlife species. Whilst VTEC O157 causes illness in humans, it does not normally cause illness in other animal species.

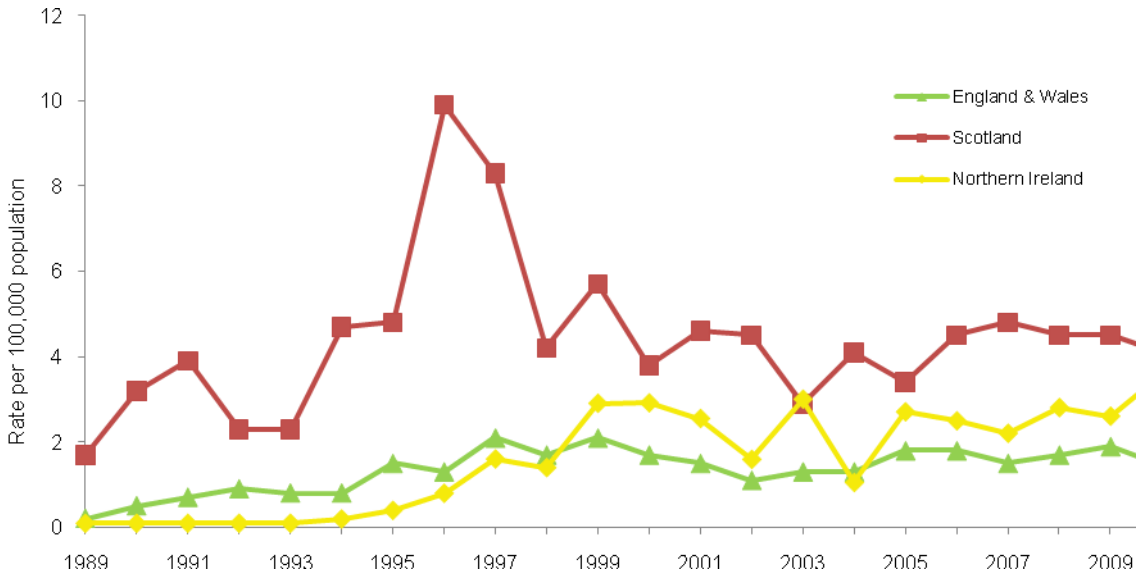
Infection in humans

Cases: In 2010, there were 1,069 laboratory-confirmed cases of VTEC O157 reported in humans in the UK (793 in England and Wales, 212 in Scotland and 64 in NI), an 18.1% decrease on the 1,306 cases reported in 2009. Within the UK, epidemiological studies have indicated that the ratio of unreported human infection in the community to reports to national surveillance is approximately 7.4 to 1[40]. This suggests that, in 2010, there could have been as many as 9,000 VTEC O157 cases in the UK.

There are clear differences in the geographical distribution of laboratory-confirmed cases within the UK, and Scotland has consistently recorded the highest rates of infection per 100,000 head of population since the late 1980's (Figure 9). The 1996 and 1997 Scottish figures are inflated due to a large central Scotland outbreak.

[40] Tam CC, *et al.* Longitudinal study of infectious intestinal disease in the UK (IID2 study): incidence in the community and presenting to general practice. *Gut* 2011 [Epub ahead of print]

Figure 9: Annual rates of laboratory confirmed reports of human VTEC O157 infections in the UK, 1989–2010



Infections with VTEC O157 show a seasonal distribution with most cases occurring between July and September, although this may be affected by the occurrence of large outbreaks at other times.

In England and Wales about 20% of VTEC outbreaks have been linked to direct or indirect animal contact over the surveillance period 1992 to 2010. Prior to the large outbreak at an open farm in 2009, these have generally each comprised fewer than ten cases. Most large outbreaks have been related to food rather than direct contact with animals. In contrast, about 80% of human cases appear to be sporadic and unattributed to an identifiable source, although case-control studies suggest that contact with farm animals and the rural environment may be a major contributing factor.

In 2010, there were 12 non-foodborne and two foodborne outbreaks of VTEC O157 reported to the HPA in England and Wales. Non-foodborne outbreaks were linked to animal contact at open/petting farms (n=5), person to person spread (n=4), recreational water (n=1), and other/outdoor events (n=1), with one outbreak of unknown origin. A summary of foodborne outbreaks by zoonotic pathogen, broken down by food vehicle category is given in appendix 6.

VTEC in food

Consumption of contaminated raw meats is an important route of foodborne infection. VTEC O157 has a low infectious dose and cross-contamination from contaminated raw meats is an important route of transmission. Cold cooked meats, dairy products, minced beef product and salad vegetables have all been implicated in foodborne outbreaks.

At abattoirs, Food Business Operators are required to check the hide or skins of livestock presented for slaughter for faecal contamination, and take the necessary steps to avoid contamination of the meat during slaughter.

In 2009, the HPA undertook a butcher's shop survey where 1,944 samples were taken and tested for VTEC O157; there were no positive results[41].

Infection in animals

Frequency: VTEC O157 infection is widespread in cattle in the UK. However, because shedding of the organism is intermittent and it does not cause disease in cattle, prevalence figures are of limited help in assessing the degree of risk to humans. For risk assessment, the general principle of assuming an animal is infected with VTEC O157 is used.

During 2010, the VLA assisted the HPA with the investigation of nine possible outbreaks of human VTEC O157 infection potentially linked to an animal source. The main findings are summarised in Table 18.

[41] Elviss, N, McLauchlin J. (2010). How 'fit' are our butchers' shops? The proof is in the testing. HPA Health Protection Conference, University of Warwick 14th – 15th September 2010.

Table 18: Summary of VLA investigations of potential animal sources of nine VTEC O157 investigations in England and Wales, 2010

Premises/ Month	No. people with illness linked to outbreak	Species Tested	VTEC O157 positive	Phage Types
Agricultural Field (Cheshire, March)	3 cases (*E. coli* O157 PT 21/28)	Cattle, sheep	None	
Open farm (N. Yorks, May)	4 cases	Multiple species (≥10)	Cattle, sheep, goats, equines	21/28*
Commercial Farm (Devon, June)	2 cases (*E. coli* O157 PT 21/28)	Cattle, Sheep	Cattle	PT 21/28
Open farm (S Yorks, May)	6 cases	Multiple species (≥10)	Cattle, sheep, goats, pigs, camelids	1 *, 21/28*
Open farm (Devon, July)	2 cases	Cattle, goat, chicken	Cattle	21/28*
Open farm (E. Yorks, July)	2 cases (*E. coli* O157 PT 21/28)	Sampling not undertaken †		
Open farm (Bucks, June)	5 cases	Outbreak of VT-negative *E. Coli* O157, PT1; Sampling not undertaken †		
Country estate (Cheshire, Sept)	3 cases (*E. coli* O157 PT4), 1 case (*E. coli* O157 PT2)	Deer implicated, sampling not undertaken ‡	None	
Nursery/ agric college (W. Sussex, Aug)	4 cases (*E. coli* O157 PT 21/28)	Sampling not undertaken ‡		

*Molecular profiling indicated matches between human isolates and some or all of the isolates from animal species in this investigation.
† VLA assisted in the investigation of two outbreaks involving non-verocytotoxigenic strains of *E.coli* O157, PT1, only one of which involved in animal sampling.
‡ In a number of investigations either involving within family outbreaks, or where no clear link to livestock could be established, advisory support without sampling was given.

Further Information

Advice leaflets on minimising the risk of infection with VTEC can be found at:

- http://www.defra.gov.uk/foodfarm/farmanimal/diseases/vetsurveillance/documents/vtec-leaflet.pdf
- http://www.hse.gov.uk/pubns/ais23.pdf
- http://www.scotland.gov.uk/Publications/2005/03/20839/54388

Yersiniosis (*Yersinia* spp.)

The genus *Yersinia* includes the zoonotic species *Y. enterocolitica*, *Y. pseudotuberculosis* and *Y. pestis* (which causes plague). Plague does not occur in the UK. Yersiniosis in humans is

mostly caused by *Yersinia enterocolitica,* and humans usually acquire infection through food contaminated with the faeces of infected animals.

Y. enterocolitica has been isolated from many domestic and wild mammals, birds and some cold-blooded animals. More than 50 serotypes have been identified, not all of which cause disease in animals and man. *Y. pseudotuberculosis* has been isolated from various species of wild and domestic mammals, birds and reptiles.

Infection in humans

Cases: In 2010 there were 52 cases of yersiniosis in people reported in the UK, compared to 61 in 2009 (Table 19). No cases of yersiniosis were reported in Northern Ireland during 2009 or 2010.

Table 19: Confirmed human cases of yersiniosis in the UK, 2010

	England & Wales	Scotland	NI	UK total
Y.enterocolitica	39	4	0	43
Y. other species	6	3	0	9
Total	45	7	0	52

Infection in animals

Cases: During 2010, 23 cases (14 in GB) of yersiniosis (including fetopathy) were diagnosed in animals in the UK (Table 20). This is a decrease from the 37 cases reported in 2009.

Table 20: Laboratory confirmed cases of yersiniosis in animals in the UK, 2010

Sheep	Goats	Birds	Wildlife & Miscellaneous	Total
9	0	7	7	23

Further information

Reports on *Yersinia* in animals are produced by the VLA in the Non-Statutory Zoonoses Reports that can be found at:
http://www.defra.gov.uk/vla/reports/rep_surv_zoonoses.htm

Appendix 1

Notifiable and Reportable diseases in animals which are potential zoonoses in the UK

Notifiable diseases are those where there is a statutory requirement to report a suspicion of a clinical case of disease.

Reportable diseases (in animals) are those where there is a statutory requirement to report laboratory confirmed isolation of organisms of the genera *Salmonella* and *Brucella* under the Zoonoses Order 1989. The report is to be made by the laboratory which isolated the organism from an animal derived sample.

Disease	Species	Last Occurred in UK[42]	Notifiable to Animal Health in GB (now AHVLA), Veterinary Service in NI	Reportable
Anthrax (*Bacillus anthracis*)	Cattle/other mammals	2006	✓	
Avian Influenza (HPAI)	Poultry/ waterfowl	2008	✓	
Bovine Spongiform Encephalopathy	Cattle	Present	✓	
Brucellosis (*Brucella abortus*)	Cattle[43]	2004 GB/ 2009 NI[44]	✓	✓
Brucellosis (*Brucella melitensis*)	Sheep and goats	Never	✓	✓
Chlamydiosis	Sheep and goats	Present	[45] Ornithosis (including psittacosis) notifiable in NI in poultry	
Contagious Epididymitis (*B. ovis*)	Sheep and goats	Never	✓	✓
Equine Viral Encephalomyelitis	Horses	Never	✓	
Echinococcus multilocularis and *granulosus*	Dogs, and foxes	Present[46]		
Equine morbillivirus	Horses	Never	✓ (Not notifiable in	

[42] Figures taken are correct as at December 2010 and may be subject to change.
[43] In the Zoonoses Order 1989 Brucella reporting relates to (a)"animal" meaning cattle (bull, cow, steer, heifer, calf), horse, deer, sheep, goat, pig or rabbit; and (b)"bird" meaning a domestic fowl, turkey, goose, duck, guinea-fowl, pheasant, partridge, quail or pigeon.
[44] Present in NI; outbreak in Scotland in 2003 and Cornwall, England in 2004.
[45] Legislative veterinary powers under The Psittacosis or Ornithosis Order 1953 (S.I. 1953 No. 38) give discretionary powers to serve notices to impose movement restrictions and require cleansing and disinfection of affected premises so Animal Health (now AHVLA) may be involved in the control of Psittacosis, even though it is not a notifiable disease in animals or birds.
[46] *E. granulosus* is present in the UK. *E. multilocularis* has only been identified in animals imported into the UK and kept in captivity since their arrival.

(Hendra)			**NI)**	
Glanders & Farcy (*Burkholderia mallei*)	**Horses**	**1928**	✓	
Newcastle disease and paramyxovirus infection	**Poultry and pigeons**	**2006**	✓	✓ **(Not reportable in NI)**
Rabies (Terrestrial)	**Dogs and other mammals**	**1970**[47]	✓	
Rabies (EBLV)	**Bats**	**2009**[48]	✓	
Rift Valley Fever	**Cattle, sheep and goats**	**Never**	✓	
Salmonella	**All species**	**Present**	**Salmonellosis in poultry is notifiable in NI**	✓
Trichinella	**Pigs, horses and other mammals**	**Present**[49]		
Tuberculosis (*Mycobacterium bovis*)	**Domestic cattle, buffalo, bison and deer**	**Present**[50]	✓[51]	✓
Vesicular stomatitis virus (VSV)	**Cattle/ other mammals**	**Never**	✓	
West Nile Virus	**Horses**	**Never**	✓	

[47] A quarantine case was confirmed in 2008, however this does not affect the national disease status.
[48] European bat Lyssavirus type 2 was isolated from a Daubenton's bat in 2009.
[49] Trichinella is known to be present in wildlife in Northern Ireland following the identification of a single positive fox in 2007 and again in 2009 during wildlife surveillance. Trichinella does not appear to be present in animals in GB.
[50] Scotland has been officially free since October 2009, although sporadic incidents continue to be identified in cattle herds.
[51] In addition to any bovines and deer with suspect clinical signs of tuberculosis, under the Tuberculosis (England) Order 2007, the Tuberculosis (Wales) Order 2011, and the Tuberculosis (Scotland) Order 2007 (as amended), there is a statutory requirement to notify to the local Animal Health office (now AHVLA) of the presence of suspect TB legions in the carcases of any bovine animals or other farmed or companion (pet) mammals. Furthermore, identification of *Mycobacteriun bovis* in samples taken from any mammal (other than man) is also notifiable to VLA (now AHVLA) Weybridge unless the organism was present in the sample as a result of an agreed research procedure. Notifying the suspicion of TB in a living domestic animal in the course of clinical examination, surgery, by radiography or in biopsy material is not mandatory (except for cattle or deer), but submission of clinical samples from such cases to AHVLA is encouraged.

Appendix 2

Notifiable zoonotic diseases and organisms in humans in 2010

Disease	Notifiable in humans under public health legislation in			Reportable under RIDDOR* to HSE
	England & Wales	Scotland	NI	
Anthrax	✓	✓	✓	✓
Acute infectious hepatitis/Hepatitis unspecified: viral (e.g. Hepatitis E)	✓		✓	✓
Botulism	✓	✓		
Brucellosis	✓	✓		✓
Chlamydiosis (avian)				✓
Chlamydiosis (ovine)				✓
Cholera	✓	✓	✓	
Diphtheria	✓	✓	✓	
Dysentery			✓	
Clinical syndrome due to *E. coli* O157 infection		✓		
Gastro-enteritis (persons under 2 years of age only)			✓	
Haemolytic uraemic syndrome	✓	✓		
Food poisoning	✓		✓	
Infectious bloody diarrhoea	✓			
Leptospirosis			✓	✓
Lyme disease				✓
Plague	✓	✓	✓	
Q fever				✓
Rabies	✓	✓	✓	✓
Streptococcus suis				✓
Tetanus	✓	✓	✓	✓
Tuberculosis (including bovine TB)	✓	✓	✓	✓
Tularemia		✓		
Viral haemorrhagic fevers	✓	✓	✓	
West Nile Virus		✓		
Yellow fever	✓	✓	✓	

* RIDDOR: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (not including Part II: Diseases additionally reportable in respect of offshore work places)

The table above lists notifiable diseases only; further organisms are notifiable when isolated in laboratories. The lists of notifiable organisms can be found here:

Scotland: http://www.legislation.gov.uk/asp/2008/5/contents
Wales: http://www.legislation.gov.uk/wsi/2010/1546/contents/made
England: http://www.legislation.gov.uk/uksi/2010/659/contents/made
Northern Ireland: http://www.legislation.gov.uk/apni/1967/36/contents

Appendix 3

Relevant Legislation (covering statutory and non-statutory zoonoses)

Note that other associated legislation not listed below may exist in Devolved Administrations (Wales, Scotland and Northern Ireland).

Human legislation

Control of Substances Hazardous to Health (COSHH) Regulations 1999
Health and Safety at Work etc Act 1974
Health and Services and Public Health Act 1968
Health and Social Care Act 2008
The Health Protection (Local Authority Powers) Regulations 2010
The Health Protection (Local Authority Powers) (Wales) Regulations 2010
The Health Protection (Notification) Regulations 2010
The Health Protection (Notification) (Wales) Regulations 2010
The Health Protection (Part 2A Orders) Regulations 2010
The Health Protection (Part 2A Orders) (Wales) Regulations 2010
Public Health (Control of Disease) Act 1984 (as amended)
Public Health etc. (Scotland) Act 2008
The Public Health (Ships) Regulations 1979
The Public Health (Aircraft) Regulations 1979
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995

Animal legislation

Animal Boarding Establishments Act 1963
Animal Boarding Establishment Regulations (NI) 1974
Animal Health Act 1981(as amended)
Diseases of Animals (NI) Order 1981 (as amended)
Animal Health and Welfare (Scotland) Act 2006
Anthrax Order 1991
Anthrax Order (NI) 1969 (as amended)
Avian Influenza and Influenza of Avian Origin in Mammals (England) Order 2006
Avian Influenza and Influenza of Avian Origin in Mammals (England) (No 2) Order 2006
Avian Influenza and Influenza of Avian Origin in Mammals (Northern Ireland) Order 2007
Avian Influenza and Influenza of Avian Origin in Mammals (Scotland) Order 2006
Avian Influenza and Influenza of Avian Origin in Mammals (Wales) Order 2006
Avian Influenza and Influenza of Avian Origin in Mammals (Wales) (No 2) Order 2006
Brucellosis (England) Order 2000
Brucellosis (England and Wales) Order 1981 (as amended) (current Welsh legislation)
The Brucellosis (Scotland) Order 2009 (as amended)
Control of Salmonella in Broiler Flocks Order 2009
Control of Salmonella in Poultry Order 2007
Control of Salmonella in Turkey Flocks Order 2009

Dangerous Wild Animals Act 1976
Dogs Act 1906
EU Zoonoses Directive 2003/99/EC.
EU Zoonoses Regulation (EC) no 2160/2003
Infectious Diseases of Horse Order 1987
Litter (Animals Droppings) Order 1991
Non-Commercial Movement of Pet Animals Regulations 2004
Pet Animals Act 1951 and 1983
Prevention of Damage by Pests Act 1949
Psittacosis or Ornithosis Order 1953
Rabies Control Order 1974
Rabies Control Order (NI) 1977
Rabies (Importation of Dogs, Cats and other Mammals) Order 1974 (as amended)
Specified Animal Pathogens Order 2008
Specified Animal Pathogens (Wales) Order 2008
Specified Diseases (Notification and Slaughter) Order 2006
Specified Diseases (Notification) Order (NI) 2004
Transmissible Spongiform Encephalopathies (England) Regulations 2010
Transmissible Spongiform Encephalopathies (NI) 2010
Transmissible Spongiform Encephalopathies (Scotland) Regulations 2010
Transmissible Spongiform Encephalopathies (Wales) Regulations 2008
Tuberculosis (England) Order 2007
Tuberculosis (Scotland) Order 2007 (as amended)
Tuberculosis (Wales) Order 2010 (as amended)
Tuberculosis (Wales) Order 2011
Tuberculosis (NI) Control order 1999 (as amended)
Tuberculosis (Scotland) Order 2007 (as amended)
Tuberculosis (Deer) (Order) 1989
Zoonoses (Monitoring) (England) Regulations 2007 (equivalent NI legislation in 2008)
Zoonoses (Monitoring) (Wales) Regulations 2007
Zoonoses (Monitoring) (Scotland) Regulations 2007
Zoonoses Order 1989
Zoonoses Order (NI) 1991

Food

EC Regulation 852/2004, 853/2004, 854/2004
Food and Environment Protection Act 1985
Food Safety Act 1990
Food Safety (1991 Order) (commencement) Order (NI) 1991
The Food Hygiene (England) Regulations 2006 (and Amendment 2007)
The Food Hygiene (Wales) Regulations 2006 (as amended)
The Food Hygiene (Scotland) Regulations 2006 (as amended)
Food Hygiene regulations (NI) 2006
Regulation EC 2075/2005, laying down specific rules and controls for Trichinella in meat
The General Food Regulations 2004 (as amended)

General

Animal By-Products (Enforcement) (England) Regulations 2011
Animal By-Products (Enforcement) Regulations (Northern Ireland) 2011
Animal By-Products (Enforcement) (Scotland) Regulations 2011
Animal By-Products (Enforcement) (Wales) Regulations 2011
Environmental Protection Act 1990
EU Directive 64/432/EEC as amended (EU Consolidated Text, CONSOLEG: 1964L0432
European Regulations (EC) No 1069/2009 and (EU) No 142/2011 (ABP legislation)
Riding Establishment Act 1964 and 1979
Riding Establishment Regulations (NI) 1980
The Water Supply (Water Quality) Regulations 2000
Zoo Licensing Act 1981

Appendix 4

Laboratory confirmed cases of zoonotic disease in humans in the UK, 2001-2010[52]

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Anthrax	2	0	0	0	0	1	0	1	13[a]	39
Avian Influenza	0	0	0	0	0	1[53]	4[54]	0	0	0
Mycobacterium bovis	31	20	16	20	39	34	22	21	25	N/A
Brucella abortus	8	13	4	9	1	4	8	9	4	0
Brucella melitensis	6	6	5	9	9	9	7	5	8	6
Brucella sp	13	17	15	13	2	3	0	1	5	6
Campylobacter	61,404	54,075	51,473	49,758	52,196	52,662	58,054	55,609	65,000	70,298
Cryptosporidium	4,482	3,663	6,626	4,197	5,288	4,360	3,671	4,909	5,587[a]	4,589
Hantavirus	0	0	0	0	0	0	0	0	0	0
Hydatid	11	10	5	8	11	14	10	18	9	7
Leptospirosis	48	58	28	32	46	51	81	76	54	42
Listeriosis	162	160	247	230	220	208	255	208	235	176
Lyme disease	296	384	347	586	691	945	1,036	1,098	1,094	1,361
Orf	9	4	6	3	2	2	2	3	1	4
Pasteurella	412	302	375	395	434	486	466	489	559	586
Psittacosis	142	94	106	75	72	40	54	65	60	55
Q fever (acute and chronic infections)	88	163	51	39	25	148[55]	62	67*	31*[a]	60*
Rabies 'classical'	2	0	0	0	1	0	0	1	0	0
Rabies EBLV	0	1	0	0	0	0	0	0	0	0
Salmonella	18,667	16,569	16,920	15,797	13,707	13,787	13,289	11,518	10,479[a]	9,683
Strep suis	1	1	1	0	2	2	2	7	2	3
Taenia	107	75	87	92	72	87	98	99	73[a]	112
Toxocara	1	3	3	4	5	2	1	2	4[a]	12
Toxoplasma	129	138	99	100	115	127	148	459*	494*	421*
Trichinella	1	0	0	0	0	0	0	0	0	1
vCJD[56]	20	17	18	9	5	5	5	1	3	3
VTEC O157	1,049	852	874	926	1,169	1,287	1,120	1,237	1,306	1,069
West Nile Virus	0	0	0	0	0	1[57]	1	0	0	0
Yersiniosis	66	44	95	70	64	62	73	62	61	52

* Includes Enhanced England & Wales data.
[a] There has been an amendment to the 2009 figure printed in last year's report as data is derived from a dynamic database.
[52] This is not a definitive list of zoonotic pathogens that are reported each year, but covers zoonotic diseases reported annually in the UK Zoonoses Report.
[53] Case of H7N3
[54] Cases of H7N2
[55] 111 confirmed with a further 28 probable and 5 possible in an outbreak in Scotland.
[56] Defined as deaths from definite or probable cases.
[57] Infection imported from Canada

Appendix 5

Laboratory confirmed cases of zoonotic disease in animals in UK, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Anthrax*	0	1	0	0	0	2	0	0	0	0
Avian Influenza[58]*	0	0	0	0	0	0	1[59]	2[60]	0	0
Mycobacterium bovis isolates in cattle[61]	NA	NA	1,246	4,490	5,463	4,857	4,765	5,981	5,134	5,318
Mycobacterium bovis incidents in non-bovine animals (data excludes badgers)	1	18	35	56	64	78	68	119	144	134
Mycobacterium species in non-bovine animals (excluding *M. bovis*)*	NA	NA	18	25	55	138	104	77	122	130
Brucella abortus	0	0	0	0	0	0	0	0	0	0
Brucella melitensis	0	0	0	0	0	0	0	0	0	0
Brucella sp ***	0	6	6	5	2	0	30	6	5	0
BSE[62]*	1,187	1,137	611	343	225	114	67	37	12	11
Campylobacter **	170	168	223	284	150	170	217	155	152	233
Chlamydiosis (*Chlamydophila abortus*) fetopathy**	426	506	559	390	473	462	532	349	370	347
Cryptosporidium **	994	1,086	1,237	1,156	1,229	1,146	841	1,330	1,346	1,674
Hydatid **	0	1	0	1	0	0	0	0	0	1[63]
Leptospirosis **	163	217	93	38	46	45	93	39	5	4
Listeriosis **	119	150	210	214	193	200	134	196	177	215
Orf **	31	30	39	37	27	38	45	44	37	40

* Confirmed cases were notifiable to Animal Health during 2010, and since 1st April 2011 should be notified to AHVLA.
** Confirmed cases obtained through scanning surveillance/ VIDA database.
*** Confirmed cases statutorily reportable under Zoonoses Order 1989.
[58] Only highly pathogenic strains of avian influenza were notifiable to Animal Health during 2010 (since 1st April 2011 suspect cases should be notified to AHVLA). Table shows number of incidents per year.
[59] H5N1 isolates were found in samples from one turkey farm in 2007.
[60] H7N7 isolates were reported from samples taken from an egg laying chicken farm in 2008, and isolates of H5N1 were reported in a cluster of 10 wild mute swans and 1 Canada goose found dead.
[61] This figure is different from the number of incidents. This is because laboratory confirmation is not sought for all individual reactors in an incident. However, where several reactors are tested from an incident, multiple isolations can result.
[62] Figures for BSE are obtained through scanning and targeted surveillance.
[63] Confirmed case obtained via scanning surveillance undertaken by VLA on behalf of Defra and identified in a zoo-kept imported Philippine spotted deer.
[a] There has been an amendment to the figure printed in last year's report.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Pasteurella multocida **	254	435	587	511	471	452	347	281	319[a]	368
Psittacosis (C. psittaci) **	16	23	17	9	5	2	2	1	3	8
Q fever **	5	6	3	3	6	7	4	5	3	4
Rabies 'classical' *	0	0	0	0	0	0	0	1[64]	0	0
Rabies EBLV *	0	1	0	2	0	1	1	2	1	0
Salmonella (all types) ***	1,088	1,560	1,942	1,429	1,261	1,255	998	1,635[a]	1,966[a]	2,096
Streptococcus suis **	18	49	59	68	48 (91)	63 (73)	54 (104)	92 (115)	69 (116)	89
Swine Influenza **	8	9	21	10	20	11	9	17	14	36
Toxoplasma **	201	279	352	335	376	310	338	201	205[a]	216
Trichinella [65]	0	0[a]	0	0	0	0[a]	1[a]	0	1[a]	0
Yersiniosis **	19	21	28	34	36	29	24	32	33	14

Note: this is not a definitive list of all zoonotic pathogens that are reported each year, but covers those for which data are available (notifiable/reportable and those recorded by VIDA system).

Survey Data

Survey data is available for Hantavirus and West Nile Virus, which are not routinely recorded and reported by VLA/SAC. See the quarterly reports of the GB Wildlife surveillance partnership: http://www.defra.gov.uk/vla/reports/rep_surv_wildlife.htm

Outbreak Investigations

Isolations of VTEC are not routinely recorded and reported by VLA/ SAC. A list of outbreak investigations and further references can be found within the VTEC A-Z section of this report.

Unavailable data

Annual data for *Toxocara* and *Taenia* are unavailable as they are not recorded on the VIDA database.

[64] Rabies case was in a quarantined animal.
[65] Figures provided by FSA.

Appendix 6

Food vehicles associated with foodborne gastrointestinal outbreaks in the UK in relation to *Campylobacter*, *L. monocytogenes*, *Salmonella*, and VTEC O157

Food vehicle category	*Campylobacter* [66]	*L. monocytogenes*	*Salmonella*	VTEC O157
Poultry meat	17	1	1	0
Red meat	2	1	0	0
Vegetables & fruits	0	0	4	0
Rice	0	0	1	0
Eggs & egg dishes	0	0	1	0
Composite/Mixed foods	2	1	1	0
Potable water	1	0	0	0
Unknown	2	0	2	2
Total*	23	3	9	2

*The total differs from the total number of foodborne outbreaks reported as more than one food vehicle may be identified in a single outbreak.

There was 1 Norovirus genotype 2 isolated from both human faeces and oysters in Northern Ireland in 2010.

[66] HPA. Campylobacter now the leading cause of general foodborne outbreaks in England and Wales. *HPR* **5**(19) (13 May 2011). Available at: http://www.hpa.org.uk/hpr/archives/2011/hpr1911.pdf

Appendix 7

Animal population: Number of livestock for each country in UK in 2010

	England	Wales	Scotland	N. Ireland	UK
Cattle	5,542,934	1,158,429	1,881,050	1,604,400	10,186,813
Sheep	14,239,840	8,244,162	6,752,642	1,847,700	31,084,344
Pigs	3,606,117	26,974	409,287	424,600	4,466,978
Poultry	262,184,400	13,008,655	29,440,845	16,531,100	321,165,000
Goats	78,916	7,447	3,705	2,900	92,968
Farmed Deer	20,837	880	6,074	3,100	30,891
Horses	653,100	100,100	53,900	34,300	841,400

*Source: Radar Veterinary Surveillance database (Defra)
Cattle data is for 1st June 2010 and obtained from the GB Cattle Tracing System on 10th June 2011
Pig, sheep and goat numbers come from the June Agricultural Surveys for 2010
Poultry data is for 1st June 2010 obtained from the GB Poultry Register on 10th June 2011
Farmed deer numbers come from the June Agricultural Survey for 2010
Horse population data obtained from the National Equine Database (NED) on 6th April 2011
Northern Ireland data provided by Department of Agriculture and Rural Development Northern Ireland, current at 3rd June 2011

Note that figures in the above table are a snapshot of the population at a specific time during the year, as shown in the table footnotes. For further information on data quality including accuracy and comparability contact: vetsurveillance@defra.gov.uk

Animal population: Number and percentage of pet owning households in the UK in 2011

Species	Percentage of total households	Approximate number of households (millions)
Dogs	22%	5.7
Cats	18%	4.7
Rabbits	2.7%	0.7
Birds (indoor)	2.0%	0.5
Guinea Pigs	1.5%	0.4
Hamsters	1.4%	0.4
Lizards	0.6%	0.2
Tortoises/turtles	0.6%	0.2
Rats	0.4%	0.1

Snakes	**0.4%**	**0.1**
Horses/Ponies	**0.2%**	**0.1**
Gerbils	**0.1%**	**0.0**

*Source: Pet Food Manufacturers' Association: http://www.pfma.org.uk/statistics/index.cfm?id=83&cat_id=60

In 2011, approximately 46% of households in the UK owned a pet. Some households may own more than one type of pet.

Appendix 8

Further reading

General further reading

Advisory Committee on the Microbiological Safety of Food: Report on microbial antibiotic resistance in relation to food safety. The Stationery Office, ISBN 0 11 322283 1. http://acmsf.food.gov.uk/acmsfreps/acmsfreports

Defra - Zoonoses web pages
http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/zoonoses/index.htm

Defra Publications - Zoonoses Reports UK
http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/zoonoses/reports.htm

Food Standards Agency: A report on the study of Infectious Intestinal Disease in England, The Stationery Office, ISBN 0 11 322308 0
http://www.food.gov.uk/science/research/foodborneillness/microfunders/intestinal

Food Standard Agency – Foodborne Illnesses web pages
http://www.food.gov.uk/safereating/microbiology/58736

Health Protection Agency - Zoonoses web pages
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Zoonoses/

Health Protection Agency - Zoonoses newsletters
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Zoonoses/ZoonosesNewsletters

HSE Agriculture Information Sheet 2 'Common zoonoses in agriculture' available free from HSE Books, tel. 01787 881165

http://www.hse.gov.uk/pubns/ais2.pdf

HSE Books: The Occupational Zoonoses, ISBN 0 1188 6397 5
http://www.hse.gov.uk/biosafety/information.htm#a7

Joint Agency Guidelines for the Investigation of Zoonotic Disease (England and Wales)
http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1240530336599

VLA - Non-Statutory Zoonoses Reports
http://www.defra.gov.uk/vla/reports/rep_surv_zoonoses.htm

Oxford Textbook of Zoonoses: Biology, Clinical Practice and Public Health Control, 2nd Ed. (Palmer, Soulsby, Torgerson and Brown) OUP ISBN 9780198570028

Disease specific further information:

Can also be found at the end of each A-Z section.

Appendix 9

List of Abbreviations/ Acronyms

ACMSF	Advisory Committee on the Microbiological Safety of Food
AFBI	Agri-Food and Biosciences Institute
AH	Animal Health (a former agency of Defra which existed until 1/4/2011 when it was merged with VLA to form AHVLA)
AHVLA	Animal Health and Veterinary Laboratories Agency (an agency of Defra created by the merger of Animal Health and VLA on 1st April 2011)
BIP	Border Inspection Posts
BSE	Bovine Spongiform Encephalopathy
bTB	Bovine Tuberculosis
CCDC	Consultant in Communicable Disease Control
CDC	Centres for Disease Control and Prevention (United States)
CfI	Centre for Infections (HPA)
cfu/g	Colony forming units/gramme
CJD	Creutzfeldt-Jakob Disease
DARD(NI)	Department of Agriculture and Rural Development (Northern Ireland)
Defra	Department for Environment, Food and Rural Affairs
DNA	Deoxyribonucleic acid
EAE	Enzootic Abortion of Ewes
EBLV(-2)	European Bat Lyssavirus (Type 2)
EC	European Commission
EFIG	Epidemiology of Foodborne Infections Group
EFSA	European Food Safety Authority
EHD	Environmental Health Department
ELISA	Enzyme-Linked Immunosorbent Assay
EU	European Union
FDA	Food and Drug Administration
FSA	Food Standards Agency
FSA Operations	Food Standards Agency Operations (known as Meat Hygiene Service (MHS) until April 2010)
GB	Great Britain (England, Wales, Scotland)
HAIRS	Human, Animal Infections and Risk Surveillance Group
HIV	Human immunodeficiency virus
HPA	Health Protection Agency

HPAI	Highly Pathogenic Avian Influenza
HPS	Health Protection Scotland
HPU	Health Protection Unit (part of the HPA)
HSE	Health and Safety Executive
HUS	Haemolytic Uraemic Syndrome
ICT	Incident Control Team (multinational/ multiagency)
LACORS	Local Authorities Co-ordinators of Regulatory Services
LGR	Local Government Regulation
LPAI	Low Pathogenic Avian Influenza
MHS	Meat Hygiene Service (from April 2010 became Food Standards Agency Operations)
MLVA	Multi-locus variable number tandem repeat analysis
MST	Multi-spacer sequence typing
MZN	Modified Ziehl-Neelson stain
NaTHNaC	National Travel Health Network and Centre
NCP	National Control Programme for *Salmonella* in Poultry
NI	Northern Ireland
OBF	Officially Brucellosis Free
OCT	Outbreak Control Team
OIE	World Organisation for Animal Health
PCR	Polymerase Chain Reaction
PETS	Pet Travel Scheme
PFGE	Pulsed field gel electrophoresis
PHA	Public Health Agency (Northern Ireland)
PT4	Phage Type 4
RADAR	Rapid Analysis & Detection of Animal-related Risks
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (HSE)
RTE (foods)	Ready to eat foods
RT-PCR	Reverse Transcriptase-Polymerase Chain Reaction
SAC	Scottish Agriculture College
SGDIA	Surveillance Group on Disease and Infections in Animals (merged with UKZG to form UKZADI)
SNH	Scottish Natural Heritage
TB	Tuberculosis
TSE	Transmissible Spongiform Encephalopathy
UK	United Kingdom (England, Wales, Scotland, Northern Ireland)
UKZADI	United Kingdom Zoonoses, Animal Diseases and Infections

	Group
UKZG	United Kingdom Zoonoses Group (merged with SGDIA to form UKZADI)
US	United States
VIDA	Veterinary Investigation Diagnosis Analysis Database
VLA	Veterinary Laboratories Agency (a former agency of Defra which existed until 1/4/2011 when it was merged with Animal Health to form AHVLA)
VNTR	Variable number of tandem repeat analysis
VTEC	Verocytotoxigenic *Escherichia coli*
WAG	Welsh Assembly Government (WAG has now become WG)
WG	Welsh Government (WG was formerly WAG)
WHO	World Health Organisation
ZNCP	Zoonosis National Control Programme for *Salmonella* in Pigs

Appendix 10

Acknowledgements

This report was produced by a small group formed under the Chairmanship of Dilys Morgan, HPA. The group contained representatives of, or received assistance from, the following organisations:

Animal Health and Veterinary Laboratories Agency (AHVLA)

New Haw, Addlestone, Surrey KT15 3NB
http://www.defra.gov.uk/vla/

Department for Environment, Food and Rural Affairs (Defra)

Area 4A, Nobel House, 17 Smith Square, London SW1P 3JR
http://www.defra.gov.uk

Department of Agriculture and Rural Development (Northern Ireland) (DARDNI)

Dundonald House, Upper Newtownards Road, Belfast BT4 3SB http://www.dardni.gov.uk

Department of Health

Skipton House, 80 London Road, Elephant and Castle, London SE1 6LW http://www.dh.gov.uk

Department of Health, Social Services & Public Safety (Northern Ireland)

Castle Buildings, Stormont, Belfast BT4 3SJ
http://www.dhsspsni.gov.uk

Food Standards Agency (FSA)

Aviation House, 125 Kingsway, London WC2B 6NH
http://www.food.gov.uk

Health Protection Agency (HPA)

Centre for Infections, 61 Colindale Avenue, London NW9 5EQ
http://www.hpa.org.uk/

Health Protection Scotland (HPS)

Meridian Court, 5 Cadogan Street, Glasgow G2 6QE
http://www.hps.scot.nhs.uk

Leptospira Reference Unit

(HPA Collaborating Laboratory)
Department of Microbiology and Immunology, County Hospital, Hereford HR1 2ER
http://www.hpa.org.uk/ProductsServices/InfectiousDiseases/LaboratoriesAndReferenceFacilities/LeptospiraReferenceUnit/

Lyme Borreliosis Unit

Southampton HPA Laboratory, Level B South Laboratory Block, Southampton General Hospital, Southampton SO16 6YD
http://www.hpa.org.uk/ProductsServices/InfectiousDiseases/LaboratoriesAndReferenceFacilities/LymeBorreliosisUnit/

Public Health Agency (Northern Ireland)

18 Ormeau Avenue, Belfast, BT2 8HS
http://www.publichealth.hscni.net/

Public Health Wales

Communicable Disease Surveillance Centre, Health Protection Division, The Temple of Peace and Health, Cathays Park, Cardiff CF10 3NW
http://www.wales.nhs.uk/sitesplus/888

Scottish Agricultural College

West Mains Road, Edinburgh EH9 3JG
http://www.sac.ac.uk

Scottish *Salmonella* Reference Laboratory

North Glasgow University Hospitals NHS Trust, 133 Balornock Road,
Glasgow G21 3UW
http://www.ssrl.scot.nhs.uk/

Scottish *E. coli* O157/VTEC Reference Laboratory (SERL)

Department of Clinical Microbiology, Western General Hospital, Crewe Road
Edinburgh EH4 2XU
http://www.hps.scot.nhs.uk/reflab/RefLabDetail.aspx?id=13

Scottish Government, Rural Directorate

Pentland House, 47 Robb's Loan, Edinburgh EH14 1TY
http://www.scotland.gov.uk

Toxoplasma Reference Unit

(HPA Collaborating Laboratory)
Public Health Wales, Microbiology Swansea, Singleton Hospital, Sketty, Swansea SA2 8QA
http://www.wales.nhs.uk/sites3/page.cfm?orgId=457&pid=25359 and
http://www.hpa.org.uk/ProductsServices/InfectiousDiseases/LaboratoriesAndReferenceFacilities/ToxplasmaReferenceLaboratory/

UK *Cryptosporidium* Reference Unit

(HPA Collaborating Laboratory)
Public Health Wales, Microbiology Swansea, Singleton Hospital, Sketty, Swansea SA2 8QA
http://www.wales.nhs.uk/sites3/page.cfm?orgId=457&pid=25284 and
http://www.hpa.org.uk/ProductsServices/InfectiousDiseases/LaboratoriesAndReferenceFacilities/CryptosporidiumReferenceUnit/

Welsh Government (WG)

Cathays Park, Cardiff, CF10 3NQ
http://www.wales.gov.uk