Bovine Tuberculosis in Northern Ireland

2016 Annual Report

Department of
Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

INVESTORS IN PEOPLE

Contents

Executive Summary

> "... the sensitivity of the test can be increased by wider application of a more severe interpretation..."

This report is based around the key disease control components of the Northern Ireland Bovine Tuberculosis (bTB) eradication Programme, namely:

1. **Disease surveillance** - passive surveillance based on the post mortem examination (PME) of all slaughtered animals and active surveillance using the single intradermal comparative cervical tuberculin test (SICCT - skin test) and the interferon gamma blood test (IFNG) in selected herds.

2. **Removal of reactor animals** - disclosure of disease leads to the compulsory slaughter of reactor animals.

3. **Veterinary risk assessment and application of appropriate disease controls** - Herds or animals that are considered to be at increased risk are subject to additional testing and movement controls, if applicable, to prevent further spread.

The application of measures to control disease leads to more testing. In addition, the sensitivity of the test can be increased by wider application of a more severe interpretation of test readings and additional exposed animals can be removed, whether or not they have given a positive response to the skin test. However, the removal of infected and exposed animals at an early stage reduces the potential for spread and subsequently results in a reduction in disease levels.

In 2016, disease levels continued to rise steadily to reach 7.45% by the end of the year, compared to 7.15% in 2015.

2016 Surveillance Summary (compared with 2015)*:

During 2016 approximately 1.71 million cattle (+3.6% compared to 2015) in Northern Ireland (NI) were bTB tested in 23,344 herds:

a. There was an overall increase of 0.7% in the number of herd tests completed during 2016 (34,350 in 2016 compared to 34,110 in 2015). The number of risk herd tests also increased in 2016 by 5.1% (12,092 in 2016 compared to 11,506 in 2015).

b. There was a decrease of 4.4% in the number of individual animal level risk (skin) tests completed (9,187 in 2016 compared with 9,610 in 2015). There were reduced numbers of each of the 4 main test reasons (see paragraph 9.6 and **Table B** in Annex).

c. The total number of animal tests (at herd and individual animal level) in 2016 was 2,817,295, which represents a 3.9% increase since 2015. The number of animals tested at herd tests was 1,767,922, a 3.1% increase (some animals were tested more than once; hence this figure is lower than the total number of tests completed).

d. There was an 11.0% increase in the number of animals that were tested using IFNG (17,611 in 2016 compared to 15,871 in 2015) and a 4.5% increase in the number of herds that were tested using IFNG (185 in 2016 compared to with 177 in 2015).

e. In 2016 there were 424,898 cattle slaughtered in NI meat plants (including animals imported for direct slaughter) of which 1,676 (0.39%) had bTB suspected at routine slaughter (Lesioned at Routine Slaughter (LRS) and had samples submitted for further laboratory examination. During 2015, 1,459 LRS (0.35% of total slaughtered) were identified from 413,383 cattle (including animals imported for direct slaughter).

*Figures correct at time of writing (October 17).

2016 Disease Summary (compared with 2015)*:

a. The annual herd incidence increased (7.45% in 2016 compared to with 7.15% in 2015), as did the annual animal incidence (0.70% in 2016 compared to 0.66% in 2015).

b. An increasing level of bTB was observed at herd level in 6 of the 10 DVO areas.

c. The number of bTB skin test reactor animals identified in 2016 (11,923) was 8.4% higher than 2015 (11,004).

d. There was a 14.8% decrease in the number of animals that were positive to IFNG (1,041 in 2016 compared to 1,222 in 2015) and an 8.7% decrease in the number of IFNG-only positive animals that were removed (821 in 2016 compared to 899 in 2015).

e. In 2016, the number of new bTB herd breakdowns was 3.0% higher (1,739 in 2016 compared to 1,688 in 2015).

f. The number of bTB confirmed LRS per 1000 animals slaughtered increased in 2016 by 7.9% compared to 2015 (from 2.27 to 2.45). This figure does not include animals imported to Northern Ireland directly for slaughter.

g. Specified Programme costs for the 2016 Programme increased by 6.6% to £30,370,970. Co-funding of the 2016 Programme was approved by the European Commission and has been agreed at the time of writing (October 17). The amount received as co-funding for the 2015 Programme was £5.3million.

*Figures correct at time of writing (October 17).

Overall Conclusions

- There was a widespread increase in the level of bTB during the course of 2016. Coleraine, Londonderry/Strabane, Mallusk and Newry were the only DVO areas that showed a decrease in annual herd TB incidence, while only Ballymena, Londonderry/Strabane, Newry and Newtownards DVO areas had a decrease in animal incidence.

- The animal and herd incidence have followed the same temporal trend.

- This is reflected in an increase in the number of new breakdown herds and in the number of animals removed.
- The number of risk herd tests increased as well as the proportion in which a reactor was disclosed. This indicates these herds were identified correctly as being at higher risk.
- The number of traced animals that were reactors at individual animal tests decreased.
- The number of confirmed LRS per 1,000 cattle slaughtered in NI increased (excluding animals imported for direct slaughter).
- An increased burden of infection was reflected in the increase in the confirmed LRS rate.

> "... there was a widespread increase in the level of bTB during the course of 2016..."

1. Introduction

1.1 This report provides a descriptive overview of the key disease control components of our bTB Eradication Programme (TB Programme), including a summary of the 2016 statistics.

1.2 Detailed bTB statistics for NI are published monthly on the DAERA website and the purpose of this report is to add context to these statistics.

1.3 Whilst this is not designed to be a detailed technical report, it provides the background to key Programme measures and quantifies the outcomes of their application.

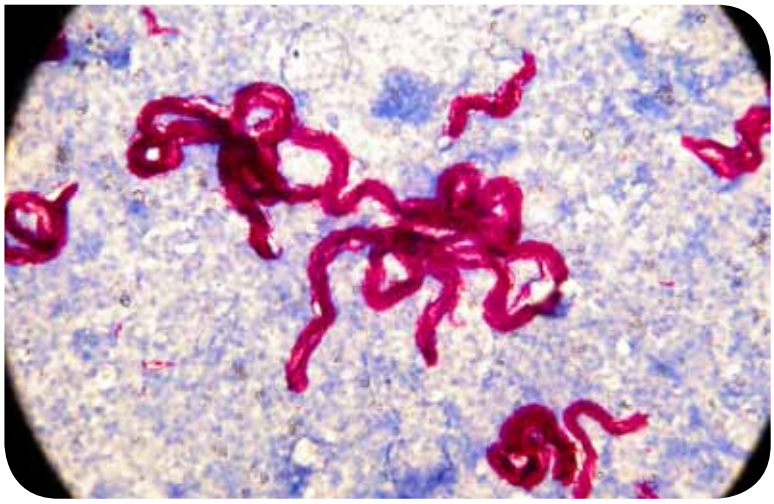
1.4 This report will be of value to anyone who has an interest in the control and eradication of bTB.

2. The Disease

2.1 Bovine tuberculosis (bTB) is an infectious disease of cattle. It is mainly caused by the bacterium *Mycobacterium bovis (M. bovis)* which can also infect and cause disease in many other mammals including humans, deer, goats, pigs, cats, dogs and badgers. In cattle, it is mainly a respiratory disease but clinical signs are now rare. TB in humans is usually caused by a very closely related infectious agent, *Mycobacterium tuberculosis*, but may also be caused by *M. bovis.*

2.2 Bovine TB is a very complex, multifactorial and challenging disease that has proven difficult to eradicate worldwide. This is due to the characteristics of the disease itself; the difficulties in diagnosis; the existence of reservoirs of infection in other species; and the nature of the local farming industry, e.g. fragmented holdings and a large number of cattle movements. It has an adverse impact on those farm businesses affected due to the interruption to market access and the additional disease control measures that are required. It is widely regarded as the most difficult animal disease problem currently facing government, the veterinary profession and the farming industry in these islands.

> "... Bovine TB is a very complex, multifactorial and challenging disease that has proven difficult to eradicate worldwide..."



Eradicating bTB in cattle will require the use of a range of measures aimed at addressing the infection in cattle and preventing its spread from wildlife. It is accepted that there is no simple cost-effective solution or 'quick fix'.

3. DAERA Goals

The progressive reduction and eradication of bTB from the national cattle herd is based on regular and targeted testing of cattle herds, slaughter of test positive animals and movement controls, supplemented by surveillance at routine slaughter of cattle.

DAERA's ultimate goal is the eradication of bTB in cattle, but it is important to highlight that this goal cannot be achieved without constructive co-operation between government, industry stakeholders and individual farmers.

> "...TB Strategic Partnership Group recognise that there will be no quick fix and eradication is likely to take 30-40 years ..."

3.1 Our immediate goals are to:

(a) maintain trade; and

(b) produce more effective and efficient ways of reducing the transmission of bTB between cattle and wildlife.

4. Policy Development and Programme Implementation

4.1 Policy Development and Stakeholder Engagement

Veterinary Service Animal Health Group (VSAHG) is responsible for the development of bTB policy and is also responsible for TB Programme implementation. DAERA continues to work in partnership with its science provider, the Agri-Food and Biosciences Institute (AFBI), to identify knowledge gaps and to explore options for research and development to complement current work. Stakeholder engagement is conducted via the Animal Health and Welfare Stakeholder Forum and the TB Stakeholder Working Group with membership from industry, veterinary and environmental organisations.

An industry led group, the TB Strategic Partnership Group (TBSPG), was established in autumn 2014 and tasked to develop a long-term strategy for the eradication of bTB in cattle, and a related implementation action plan. The Group published its Strategy in December 2016 (Bovine Tuberculosis Eradication Strategy for Northern Ireland).

The Strategy contains 38 recommendations under 7 thematic headings; Governance, Culture and Communication, Tools and Processes, Wildlife, Herd Health Management, Finance, and Research. The recommendations are presented as an integrated package of interdependent measures and the TBSPG recommend that they are taken forward as a package to maximise their impact. The overall aim of the Strategy is to eradicate bTB in cattle but the TBSPG recognise that there will be no quick fix and eradication is likely to take 30-40 years.

DAERA officials are considering the recommendations in detail and it is likely the majority of measures and options from the TBSPG Strategy will be subject to a public consultation. This will allow as broad a range of views as possible to be taken into account in developing a shared vision of how the timely eradication of bovine TB can be realised.

Programme Implementation

4.2 The delivery of the TB Programme involves a wide range of activities, including:

✓ Animal registration and movement control.

✓ Disease surveillance, post-mortem inspection of all carcasses at abattoirs and annual (at least) bTB testing on all cattle farms.

✓ Disease investigations and application of disease controls.

✓ Provision of advice on biosecurity and disease control, especially to breakdown herds and their neighbours.

✓ Epidemiological assessment and advice.

✓ Monitoring of Programme delivery.

✓ Export and import tracing and notifications.

✓ Valuation and removal of reactors to slaughter.

✓ Compensation payments.

✓ Quality assurance of bTB Testing.

✓ Management of contracts with private sector partners.

✓ Training of staff and delivery partners.

✓ Engagement with stakeholders.

✓ Liaison with external public health agencies, including the Health Service Consultants in Communicable Diseases, Health and Safety Executive and Public Health Authorities.

✓ Counter-fraud measures.

4.3 Programme delivery also requires a wide range of personnel and expertise including:

✓ Veterinary surgeons, either DAERA employees or DAERA-approved veterinary surgeons (AVSs), who carry out all “on farm” bTB skin tests.

✓ AFBI Veterinary Sciences Division not only carry out the laboratory testing necessary for the confirmation of the disease but also serve as the primary provider of bTB research and scientific advice for DAERA. A pivotal input to the epidemiological advice on bTB is also provided by DAERA’s Veterinary Epidemiology Unit (VEU).

✓ Animal identity, testing and movement are recorded and controlled through the Animal and Public Health Information System (APHIS) database. This includes post mortem results, mainly from abattoirs, and laboratory test results from AFBI. Controlled access to relevant data is provided to various users including farmers, markets, food business operators and private veterinary practitioners.

✓ VSAHG is responsible for the integrated delivery of the TB Programme in NI. There are ten Divisional Veterinary Offices (DVOs), incorporated in DAERA Direct Offices. The administrative area of each office is sub-divided into "patches", which are managed by a DAERA Veterinary Officer (VO) supported by a team of technical officers. Each TB breakdown has an allocated VO managing the disease control measures necessary to prevent further spread of bTB and to reinstate the herd's disease free status.

✓ Close engagement between DAERA staff and the farmer whose herd has become a new TB breakdown works to mutual benefit; it ensures the farmer has a point of contact to help address problems and concerns and also assists DAERA in ensuring that the potential for further spread of disease has been addressed.

4.4 A TB Implementation Team (TBIT) was set up in 2013 to oversee the delivery of the Programme.

The TB Implementation Team was established to oversee the day to day field implementation of the TB Programme.

The TBIT goal is to ensure that field staff apply a uniformed approach to implementing the TB Programme, with membership including managers and field officers with detailed knowledge and experience in bTB control.

"... The TB Implementation Team was established to oversee the day to day field implementation of the TB programme ..."

The focus in this report is the main outputs of TBIT during 2016. These include the development of a new TB investigation process for TB breakdowns involving Animal Health and Welfare Inspectors (AHWIs) and a number of training events delivered to DAERA employed Temporary Veterinary Officers and Veterinary Officers Testing (TVO/VOTs), VO's, and AHWI's.

4.4.1 New TB Investigation process

As part of DAERA's response to recommendations made following an EU Commission Food and Veterinary Office (FVO) Audit in 2015, a new procedure was developed and introduced in June 2016 to standardise the investigation of TB breakdowns. A welcome by-product of this new procedure was that it also freed up VO resource. This enables VOs to focus on the veterinary aspects of the breakdowns and area epidemiology.

As part of this new staged process the Animal Health and Welfare Inspectors (AHWI) visits the breakdown farm, completes a map of the breakdown farm and identifies contiguous herds. The AHWI also collects data and biosecurity details in a structured format. This data provided the information required by the VO to complete a veterinary risk assessment. Data is also captured by VEU for trend analysis.

4.4.2 The following training events were arranged and delivered by TBIT during 2016

- **VO Training (13 April and 5 May 2016)**
  This training included an overview from the DCVO and covered the new PVP contract, Bovine TB epidemiology, a talk on badger and bovine epidemiology and the new TB investigation process.

- **TB Investigation AHWI Training (25 May and 28 June 2016)**
  This training covered routine TB breakdown procedures, TB Investigation form Staff Instructions (SI) and processes involved.

- **TB Investigation Review Day (28 Sept 2016)**
  The process was reviewed by the field staff involved, following which TBIT considered their suggestions/recommendations as appropriate.

- **Testing Veterinary Officers (TVO/VOT) Training (3 and 6 Oct 2016)**
  This training included an introduction by the Deputy Chief Veterinary Officer (DCVO) and covered the TBSPG, the new Private Veterinary Practitioners (PVP) Contract, welfare, conflict resolution, safer cattle handling, enforcement, epizootic disease and well as the new TB investigation process.

4.4.3 Other outputs covered included

> Development of a report to identify herds associated by common management to assist disease controls.

> Development of a management report to identify high risk animals left on farm in breakdown herds.

> Support the development and introduction of a new map viewer to improve mapping process.

> Continuous engagement with Northern Ireland Food Animal Information System (NIFAIS) build team to ensure all field needs are considered and included, where possible.

Figure 1 shows the main DAERA branches and delivery partners involved in the delivery of the TB Programme.

Figure 2 is a map showing the areas covered by the 10 DVOs. Although this section describes the Programme, and its delivery from a DAERA perspective, we must acknowledge the vitally important role that herd keepers play in the development and delivery of the TB Programme through their cooperation and compliance, and also the contributions of industry stakeholders.

Figure 1: TB Programme - Main DAERA Branches and Delivery Partners

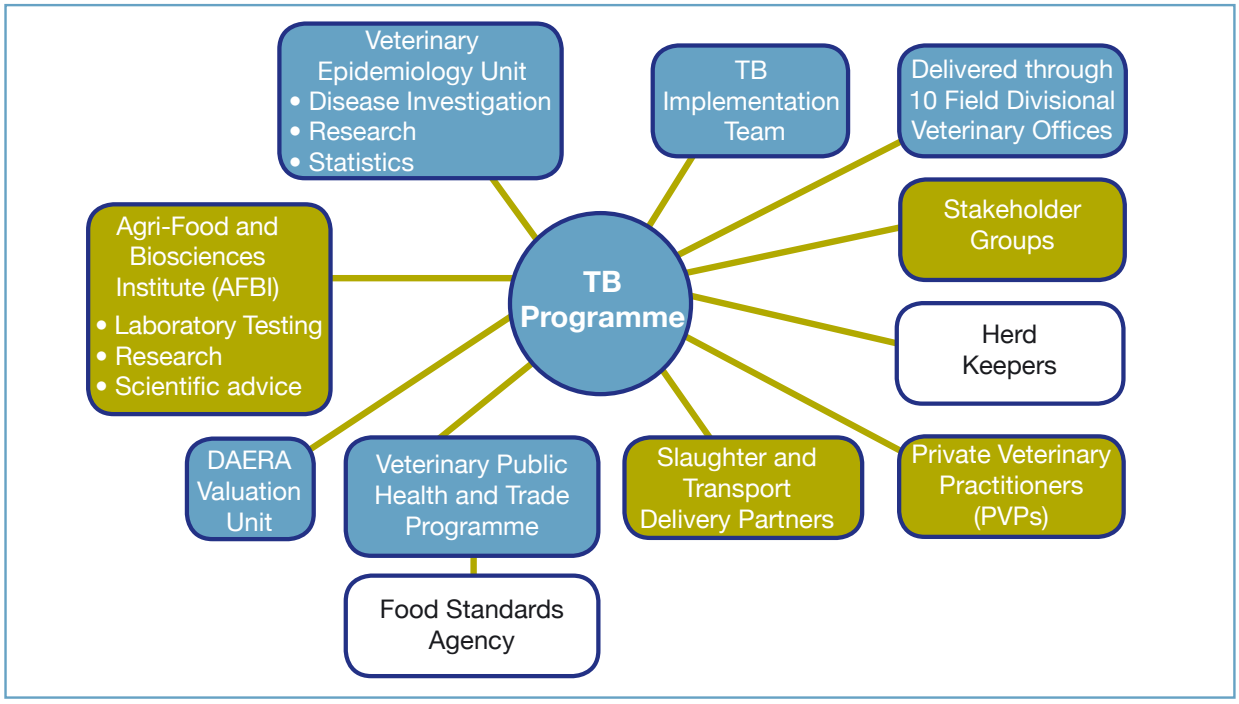
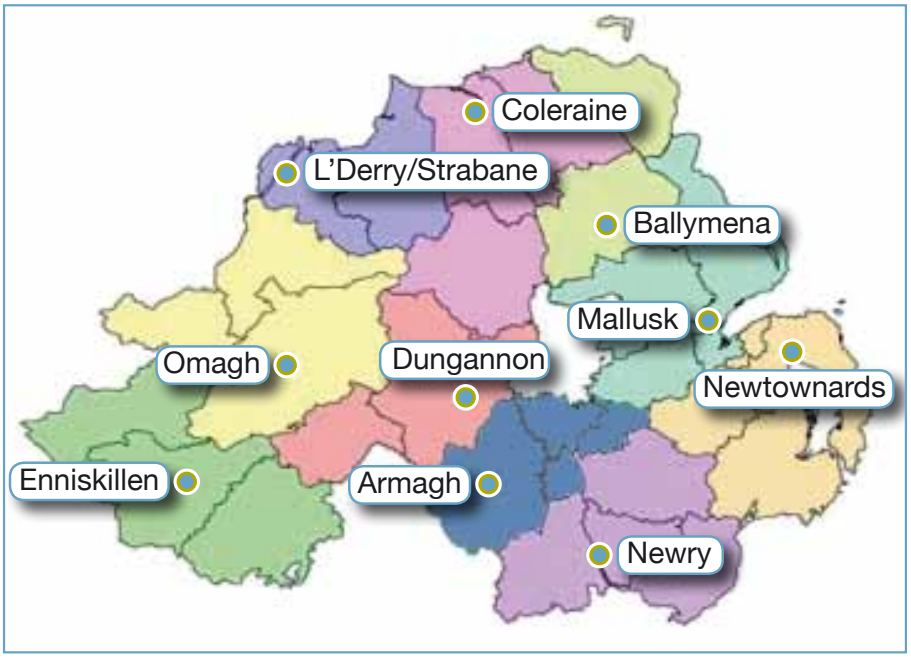


Figure 2: Divisional Veterinary Office (DVO) Locations and Areas Covered



5. The bTB Eradication Strategy for Northern Ireland

The TB Strategic Partnership Group (TBSPG) was established as a high-level industry led advisory group, with the support, as ex-officio members, of the Chief Veterinary Officer and the DAERA Director of Animal Health and Welfare Policy Division. The TBSPG was tasked to act in the public interest in developing a long-term strategy for the eradication of bTB in cattle, and a related implementation action plan.

In June 2015, after an initial consultation, the Group published an Interim Report.

The group published its Bovine Tuberculosis Eradication Strategy for Northern Ireland in December 2016 drawing together the consultation responses to its interim report conclusions from a wide range of meeting with interested individuals, stakeholders organisations and bodies reviews of appropriate and focused scientific papers, as well as the Group's own engagement with colleagues across jurisdictional boundaries.

The Strategy contains 38 recommendations under 7 thematic headings; Governance, Culture and Communication, Tools and Processes, Wildlife, Herd Health Management, Finance, and Research. The recommendations are presented as an integrated package of interdependent measures and the TBSPG recommend that they are taken forward as a package to maximise their impact. The overall aim of the Strategy is to eradicate bTB in cattle but the TBSPG recognise that there will be no quick fix, and that eradication is likely to take 30-40 years.

> "...The Strategy contains 38 recommendations under 7 thematic headings; Governance, Culture and Communication, Tools and Processes, Wildlife, Herd Health Management, Finance, and Research ..."

International experience has shown that the eradication of bTB can only be achieved by simultaneously addressing all the factors that meaningfully contribute to the persistence and spread of the disease in infected animal populations. The TBSPG consider that the recommendations made in the Strategy represent a complete package of actions which would lead not only to disease eradication in the cattle population but also contribute to the health of the badger population.

> "...International experience has shown that the eradication of bTB can only be achieved by simultaneously addressing all the factors that meaningfully contribute to the persistence and spread of the disease in infected animal populations ..."

One of the threads running through the Strategy is a desire to effect changes in culture and practice. Such changes will enable bTB eradication to be viewed as a shared industry and government commitment with all stakeholders understanding and accepting they have a part to play in achieving the eradication of bTB.

> “...There is no single solution or quick fix ...”

There is no single solution or quick fix, indeed some of the measures recommended may lead to an intial rise in bTB detection as a result of tighter controls and increased testing. This is a long-term Strategy designed to achieve a sustained reduction and eventual eradication of bTB in cattle and will require both a change of attitude and intense effort by all involved in the years ahead.

DAERA officials are now considering the Group’s recommendations in detail and it is likely that the majority of options from the TBSPG Strategy will be subject to public consultation. This will allow as broad a range of views as possible to be taken into account in developing a shared vision of how the timely eradication of bovine TB can be realised.

6. The bTB Eradication Programme

DAERA has an EU Commission approved bTB eradication Programme, ensuring compliance with the EU Trade Directive 64/432/EEC (as amended). Importantly, Programme controls reduce the risk of spread to humans and clinical disease in cattle.

EU approval of the bTB eradication Programme is vital in safeguarding export-dependent livestock & livestock products industry (worth in excess of £1,000 million per annum). Through the implementation and delivery of the Programme, in the region of 89% of herds are free to access international markets at any one time. EU Commission approval also secures some £5 million per year of EU co-funding. The approved bTB eradication Programme for 2016 is available at 2016 TB Eradication Plan (UK).

6.1 This 2016 Annual Report is based around the key disease control components of the Programme. The key components are:

> Disease surveillance;

> Removal of reactor animals;

> Veterinary risk assessment and application of appropriate disease controls.

6.2 Disease Surveillance

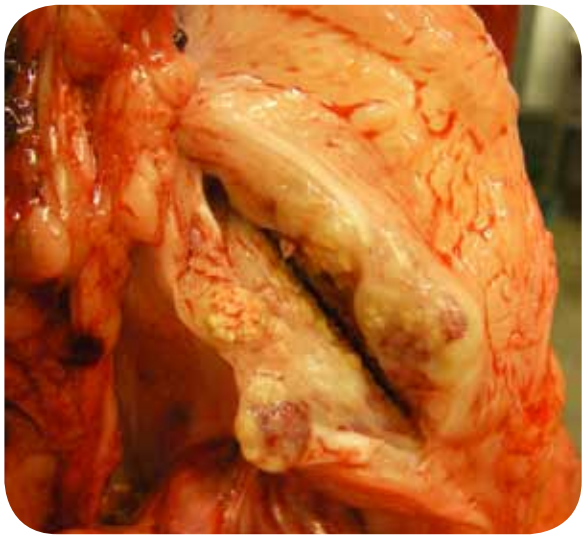
Our disease surveillance is based on two distinct elements:

6.2.1 Post-mortem examination (PME) of all slaughtered animals

All animals slaughtered for human consumption are subject to PME, primarily for public health assurance. Carcases are examined for visible signs of bTB infection, amongst other things. Disclosure of visible signs (or lesions) at PME will, subject to veterinary risk assessment, result in the exclusion of either the infected part of the carcass or the entire carcass from human consumption. It will also trigger the application of disease control measures to the herd presenting the animal.

The finding of bTB - like lesions (granulomas) alone is not definitive because similar lesions may be caused by other diseases or conditions. Therefore, samples are taken for further laboratory examination.

When suspected visible signs are seen in skin test negative animals that are not compulsorily slaughtered under the TB Programme, the animal is said to have a “Lesion at Routine Slaughter”



(LRS). Appropriate disease control measures, such as movement restrictions and increased frequency of testing, are applied to the relevant herds. The number and distribution of LRS animals can be an indication of the underlying disease levels and trends in the cattle population as they represent an important independent sampling system outside live animal surveillance.

6.2.2 Live Animal Surveillance

This is based primarily on the single intradermal comparative cervical tuberculin test (SICCT), as approved by the EU. This is usually referred to as the "skin test". All cattle herds must be tested annually, as a minimum requirement, but some are tested more frequently if they are considered at increased risk of infection following veterinary risk assessment of a disease incident. An animal that gives a positive response to the skin test is called a 'reactor' and the herd in which reactors are found is referred to as a 'TB Breakdown Herd' because a positive skin test is considered indicative of infection in a herd. The other live animal surveillance diagnostic method employed by the Programme is the interferon gamma blood test (IFNG), which is used in conjunction with the skin test to improve diagnosis of bTB in certain situations. Use of the IFNG is voluntary and it is not compulsory for farmers to give up any IFNG positives that are detected, unless they animal is also skin test positive.

6.3 Removal of Reactor Animals

6.3.1 Disclosure of disease leads to the compulsory slaughter of reactor animals, with compensation paid at full market value. DAERA aims to remove reactor animals in 15 working days of completion of the positive test. During 2016, this target was met for 92.9% of reactors.

6.3.2 Reactor animals, compulsorily removed by DAERA, are subject to PME, which along with further laboratory diagnostic work on samples, provides further information to the Programme.

> "... the absence of visible lesions at slaughter does not mean that the animal was not infected..."

A crucial point to emphasise is that the absence of visible lesions at slaughter does not mean that the animal was not infected. The diagnostic test is based on an immunological response to infection that may precede development of visible lesions therefore infected and reactive animals may not have had time to form a lesion, or the lesion may not have been visible to the inspector conducting the post-mortem.

6.3.3 The Programme includes the use of *M. bovis* strain typing, a high-resolution DNA fingerprinting method, that allows the identification of genetically distinct *M. bovis* strains. Currently, all visibly lesioned reactors are cultured in addition to animals cultured for statutory confirmation of disease. When *M. bovis* is isolated, it is strain typed by AFBI. The multiple strains of *M. bovis* show a striking degree of geographical localisation, which can be exploited to inform on potential disease source and spread (see **Figure 28** page 47). The strain typing data is made available to the DAERA VOs and are used to retrospectively inform outbreak investigations, and for research into bTB epidemiology and *M. bovis* evolution.

6.4 Veterinary Risk Assessment and Application of Disease Controls

6.4.1 Controls are applied as soon as the disease is suspected. Their purpose is to prevent spread from the breakdown herd, to indicate where infection may have come from, or spread to, and to remove it. Disclosure of infection leads to the immediate restriction of the movement of cattle from affected herds until they are no longer considered to be infected. When a herd is declared as a breakdown herd, only routine movements directly to slaughter in NI are permitted. Breakdown herds are unable to access live markets, to move animals directly to another farm (except in very exceptional animal welfare circumstances following disease risk assessment), or to export. This is to prevent disease spread to other herds. In conducting the risk assessment the VO:

> “... Controls are applied as soon as the disease is suspected...”

- considers which herds the infected animals came from, or passed through, before they entered the breakdown herd;
- checks what animals have moved from the breakdown herd between the estimated date of infection and the date restrictions were applied, and
- investigates possible direct and indirect contacts with livestock in other herds.

6.4.2 Cattle herds that are considered to be at increased risk of infection are subject to additional testing. This may be because **(i)** their animals have been in close proximity to animals in the breakdown herd e.g. grazing in neighbouring fields; **(ii)** animals from the breakdown herd had moved into the herd before the breakdown was detected or **(iii)** the reactor animals had moved from the herd into the breakdown herd. Some individual animals are also tested following a veterinary risk assessment. Therefore the level of disease risk has a direct influence on the volume of testing that is required to control the disease.

6.4.3 To further control disease, primarily within the breakdown herd itself, the risk assessment may lead to the removal of animals that are considered to be at increased risk due to the extent of their exposure to infected animals, even if they do not give a positive skin test result. These animals are called "Negative in Contacts" (NICs). IFNG may also be used to support the control of disease in a breakdown herd.

Further information about what happens when a herd becomes a bTB breakdown can be found in the TB in your Herd Booklet which is provided to all keepers of breakdown herds

6.5 Measuring Disease Levels

6.5.1 We use different measures to monitor levels of disease.

6.5.2 The primary measure is a calculation of bTB incidence. It is used both at herd level and at animal level. In our routine statistics we use the 12 month moving average data because they give the clearest indication of long term trends.

6.5.3 There is a continuum of infection levels across Northern Ireland. Although there are no defined regional differences, certain DVO areas tend to have higher levels of the disease and others tend towards a lower incidence. The disease tends to cluster locally and, depending on how long and in which animal population infection has been established, it may take some time before the Programme controls take effect. Disease levels therefore fluctuate locally and, if there is significant spread, a rise may be observed locally or further afield. In this situation the Programme controls are, essentially, those previously described but their intensity and the scale of their application can be adjusted to match the existing disease risk.

6.5.4 Controls can be applied on an area risk basis, rather than on an individual farm basis. In the face of increasing levels of disease the sensitivity of the skin test can be increased by the wider application of a more severe interpretation of test readings and additional exposed animals can be removed, as partial or complete herd depopulations, whether or not they have given a positive response to the skin test. Application of these measures leads to the removal of an increased number of animals, which in turn leads temporarily to an increased animal incidence. However the removal of infected and exposed animals at an early stage reduces the potential for spread and should subsequently result in a reduction in disease levels.

> "... Controls can be applied on an area risk basis, rather than on an individual farm basis..."

7. TB Contract

7.1 The Northern Ireland Audit Office's 2009 Report, The Control of Bovine Tuberculosis in Northern Ireland, contained several comments and recommendations in relation to the use of Private Veterinary Practitioners (PVPs) in the TB eradication programme.

7.2 In response to these recommendations DAERA had explored options for delivering a new TB Services Contract to develop the relationship with PVPs on a more business like footing. With the assistance of Central Procurement Division (Department of Finance), an innovative Service Contract has been developed, the first of its kind in Northern Ireland, availing of Recital 4 of the European Procurement Regulations, to enable farmers to continue to work with their nominated PVP.

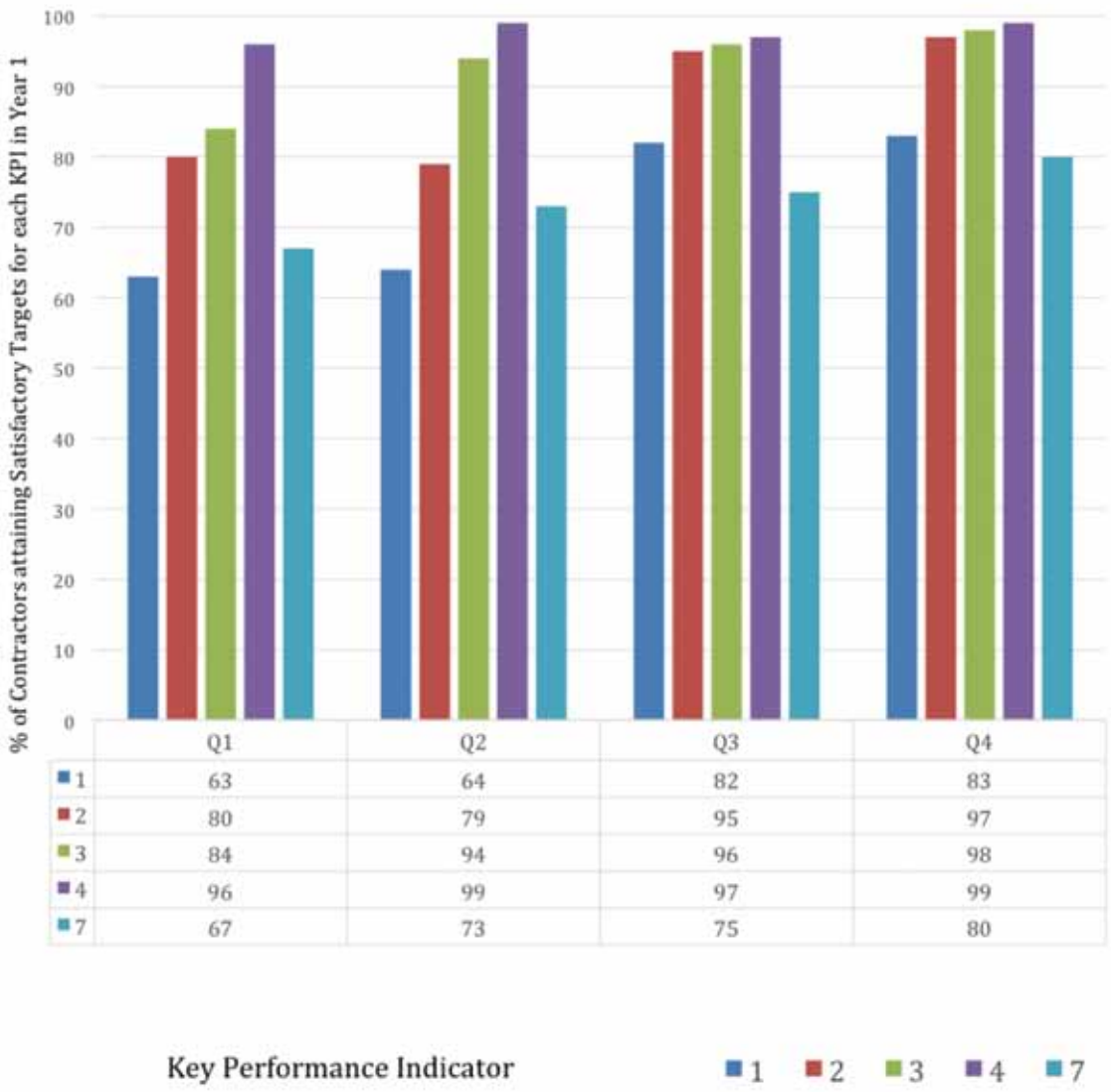
7.3 Further, the recent report of the TBSPG contains the recommendation at 3.1.1 that "We recommend that DAERA ensures that optimum levels of test sensitivity are achieved through robust training, management and monitoring of all testing vets. We are pleased to see that DAERA has appointed a contract manager for this purpose.

7.4 Following a series of Open Information Meetings the contract was released for a statutory consultation period. On 4 April 2016, 79 Contractors agreed to deliver the new TB Contract.

7.5 The framework of the arrangements are based on operating standards with Key Performance Indicators for a range of administrative and performance standards that have an impact on the provision of a quality, value for money, public service. This is to ensure positive outcomes for citizens with a focus on continuous performance. The commitment from DAERA is to maintain regular quarterly reports on standards with feedback on statistical analysis of individuals provided twice a year. At the commencement of the contract, group based Contract Initiation meetings were held across the Northern Ireland to give support and answer questions. A feature of the contract is to increase and improve collaboration with key personnel in the private practices. Four mandatory class room based seminars communicated current research and updates to all of the "Approved Veterinary Surgeons" (AVS) delivering farm services and the "End of Year Review Meetings" with practices have been very informative and beneficial.

7.6 Improving performance has been a main driver - and results from the Key Performance Indicators (KPI) standards (**Figure 3**) show clear improvements in the first year:

Figure 3: % of Contractors attaining Satisfactory Performance across KPI 1,2,3,4 and 7 in Year 1 of the TB Services Contract



	Q1	Q2	Q3	Q4
1	63	64	82	83
2	80	79	95	97
3	84	94	96	98
4	96	99	97	99
7	67	73	75	80

Key:

Key Performance Indicator	Area of Compliance	Standard (% of tests) for 2016/17
1	Test appointments to be notified to DAERA by Wednesday 5pm of the week preceding.	80
2	Test reports with Positive Reactor animals to be notified to DAERA within 1 working day.	85
3	Test reports with inconclusive animals to be notified to DAERA within 2 working days.	80
4	Test reports with only negative animals to be notified to DAERA within 5 working days.	80
7	Test reports to be accurate so they do not require recertification.	No tests <25 days post certification

Note*

*KPI 5 is satisfactory compliance at Field Audit. In 2016/17 there were 170 Field Supervisions with 9 suspensions due to technical failings.

**KPI 6 is not yet operational.

8. 2016 Disease Summary

8.1 During 2016 approximately 1.71 million cattle were bTB tested in NI, in 23,343 herds. The annual herd incidence increased to 7.45%, and the annual animal incidence increased to 0.70% (compared to 7.15% and 0.66%, in 2015).

> "... During 2016 approximately 1.71 million cattle were bTB tested in NI, in 23,343 herds..."

8.2 At herd and animal level, increased bTB incidence was observed in 6 of the 10 DVO areas.

8.3 The number of bTB skin test reactor animals identified during 2016 (11,923) was 8.4% higher than the number identified in 2015 (11,004).

8.4 The number of confirmed bTB positive Lesion at Routine Slaughter animals (LRS) per 1000 animals slaughtered increased in 2016 by 7.9% compared with 2015 (2.45 in 2016 compared with 2.27 in 2015). This figure does not include animals imported to NI directly for slaughter.

8.5 There was a 14.8% decrease in the number of animals that were positive to IFNG (1,041 in 2016 compared with 1,222 in 2015), and an 8.7% decrease in the number of IFNG positive animals which were offered voluntary slaughter (821 in 2016 compared to 899 in 2015).

8.6. The number of new bTB herd breakdowns was 3.0% higher than in 2015 (1,739 in 2016 compared with 1,688 in 2015).

9. Disease Levels

Historic Trends (Updated for 2016)

9.1 In relation to the annual bTB herd incidence (i.e. the incidence for each calendar year (**Figure 4**)), there was a rising trend in disease levels through the mid to late 1990s which continued into the early 2000s. The annual herd incidence in 1995 was 4.07%, rising to 9.92% in 2002 then falling to 5.35% in 2007. Over the years 2007-2010, herd incidence remained relatively level and in 2010 the annual incidence was 5.12%, its lowest level since 1998. A sharp rise occured in 2011 and this continued until 2012 when the annual herd incidence reached 7.34%. In 2013/14 the herd incidence fell, but rose again in 2015/16. The annual animal incidence followed the same trend as herd incidence except in 2014. In 2016 the annual TB herd incidence was 7.45% and the annual TB animal incidence was 0.70%.

Figure 4: bTB herd and animal incidence from 1995 to 2016

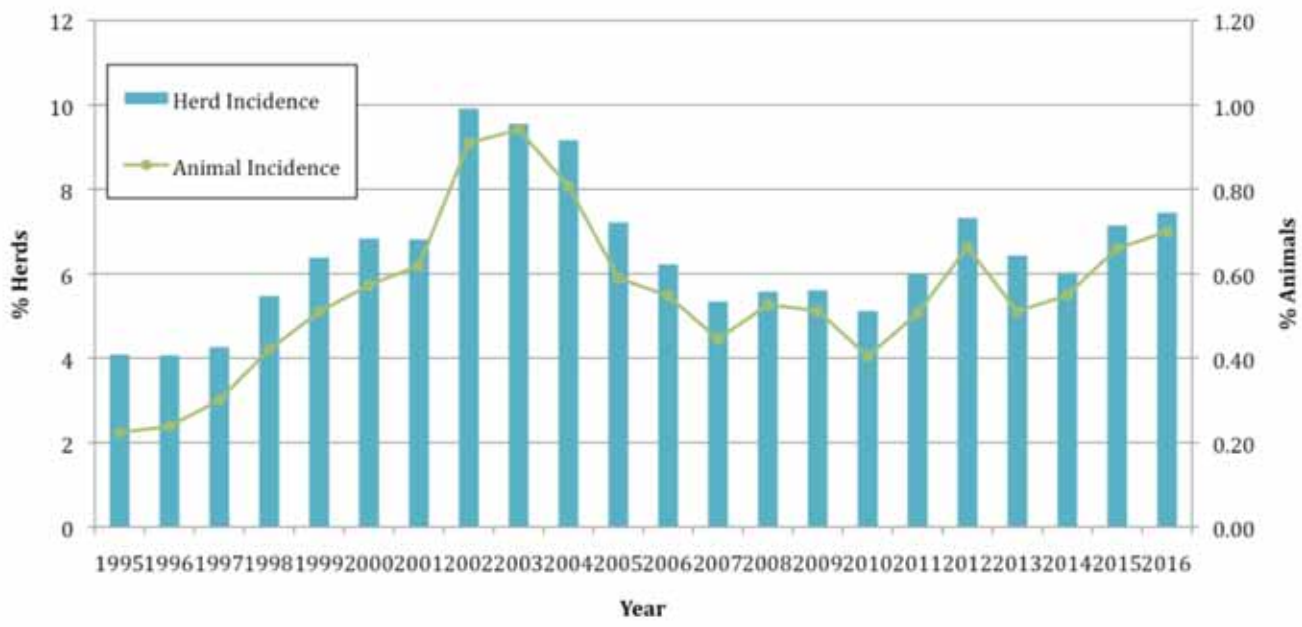
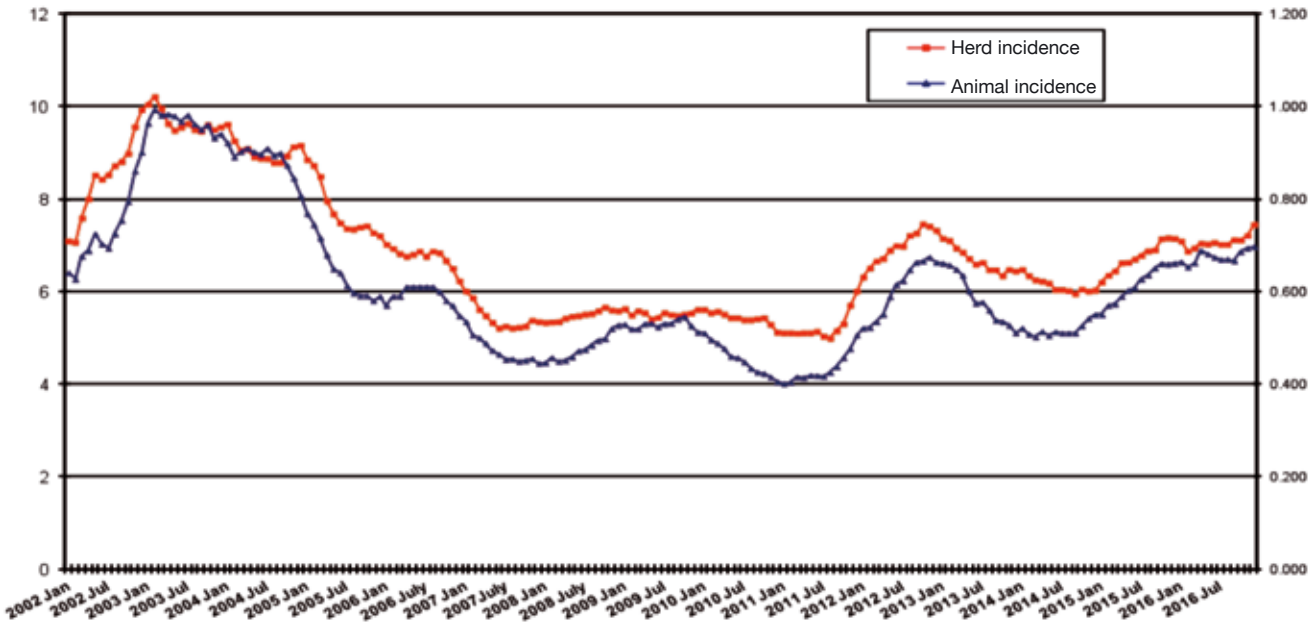


Figure 5 provides further detail of the monthly rises and falls in incidence levels since 2002. A peak in herd incidence of 10.21% occurred in February 2003. In August 2011, the 12 month bTB herd incidence was 4.99%. It then increased, reaching a peak of 7.46% in October 2012. The downward trend that followed that peak started to level out at the end of 2014 followed by a steady rise in herd incidence which stabalised towards the end of 2015. Animal incidence also followed this pattern although its rise started earlier. In 2016 both herd and animal incidence increased steadily to 7.45% and 0.70% respectively by December 2016.

Figure 5: 12 Month Moving Average bTB Herd and Animal Incidence from January 2002 to December 2016



2016 Herd Incidence

9.2 As mentioned previously, the herd incidence for 2016 was 7.45% and an increase was observed in 6 of the 10 DVO areas. Armagh, Dungannon and Newtownards DVO areas showed the most significant increases in herd incidence levels (**Figures 6 and 7**).

Londonderry/Strabane DVO area is historically one of the lowest incidence areas (3.4% in December 2016), but its incidence peaked at (7.89%) in September 2016.

Figure 6: Annual bTB Herd Incidence by DVO Area (Northern Region) 2016

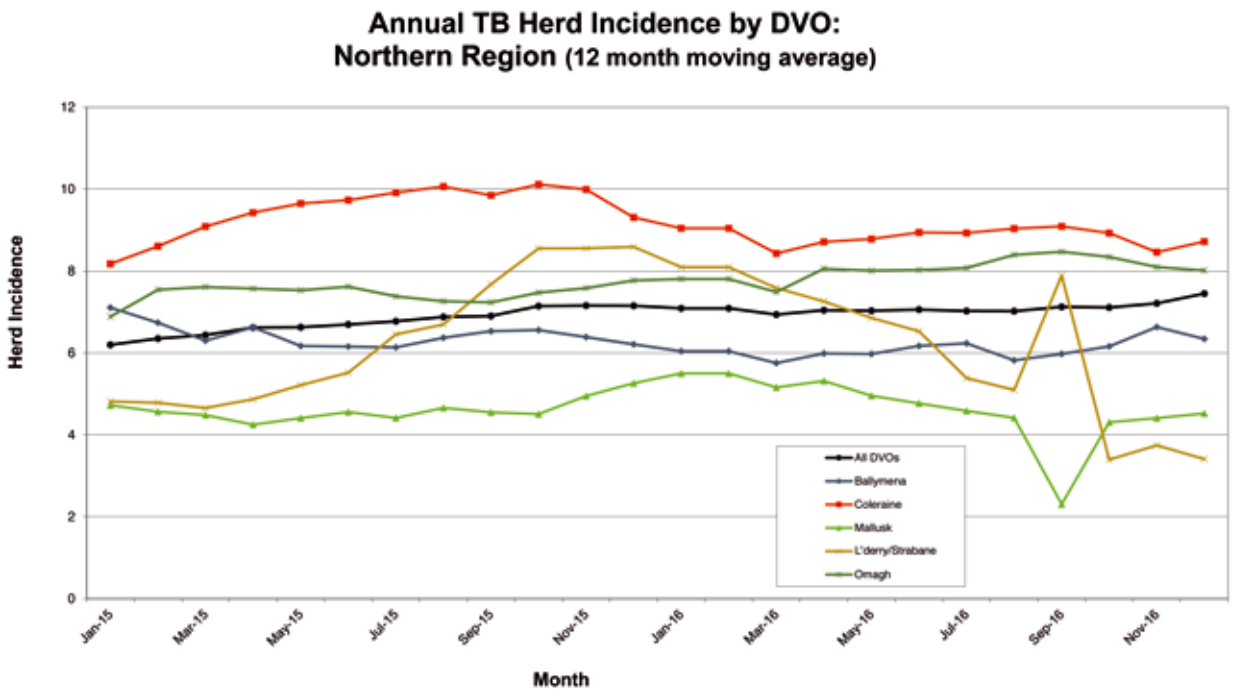
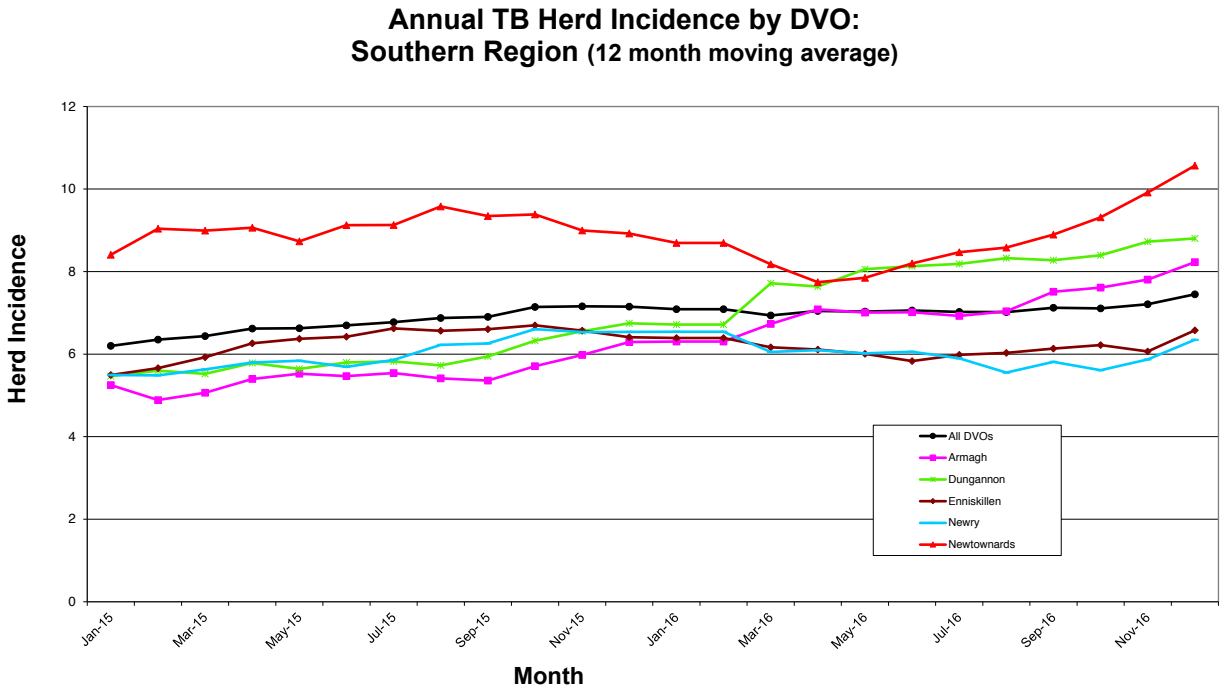


Figure 7: Annual bTB Herd Incidence by DVO Area (Southern Region) 2016



Animal Incidence

9.3 The annual animal incidence increased to 0.70% in December 2016.

9.4 Enniskillen and Newtownards had the highest animal incidence (1.09 and 0.89% respectively) in December 2016, while Londonderry/Strabane and Ballymena had the lowest animal incidence (both at 0.24%) (**Figures 8 and 9**).

Figure 8: Annual bTB Animal Incidence by DVO Area (Northern Region) 2015 and 2016

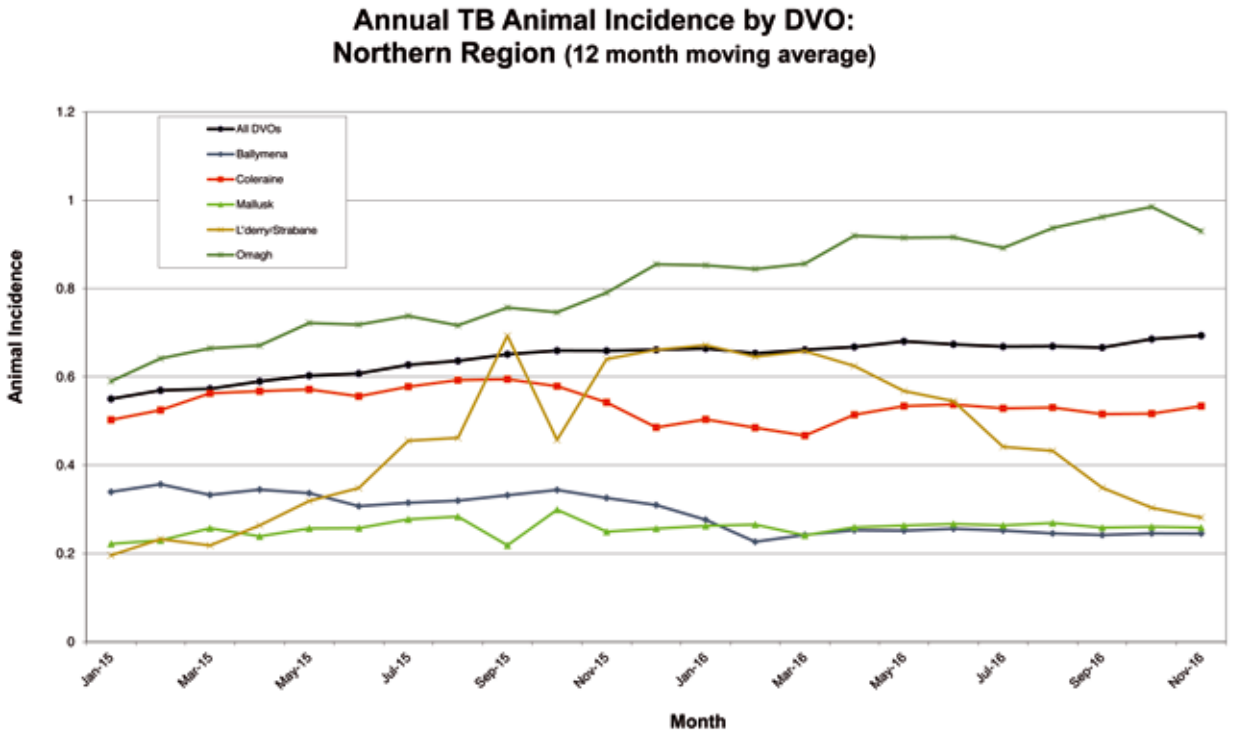
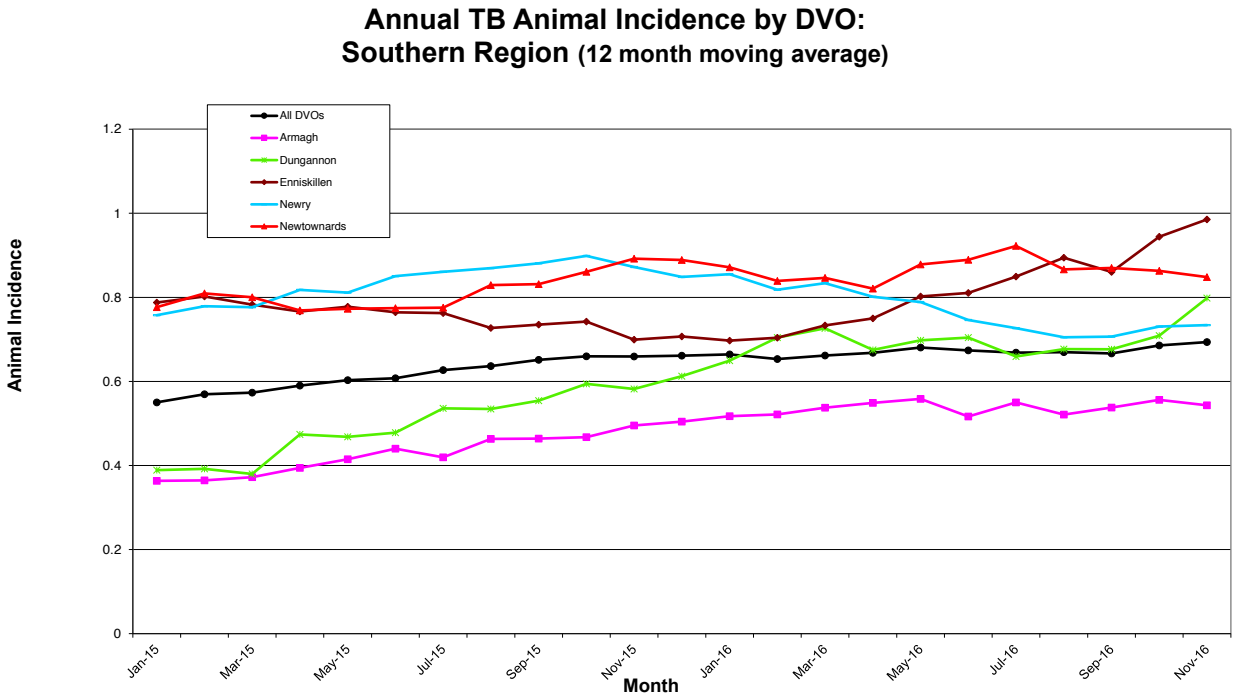


Figure 9: Annual bTB Animal Incidence by DVO Area (Southern Region) 2015 and 2016



10. Surveillance Outputs

> "... There were a total of 424,898 cattle slaughtered in NI during 2016 ... of which 1,676 were found to have Lesions at Routine Slaughter ..."

Post Mortem Examination (PME)

10.1 There were a total of 424,898 cattle slaughtered in NI during 2016 (including animals that were imported for slaughter) of which 1,676 (0.39 %) were found to have Lesions at Routine Slaughter (LRS) and from which samples were submitted for further laboratory examination. **Table 1** below shows the overall figures for cattle slaughtered during 2015 and 2016 with and without animals that were imported for direct slaughter. These 'direct imports' were not resident in NI herds, and therefore did not contribute to the local disease profile. During 2016, a further 19 LRS were identified in cattle exported from NI to Great Britain or the Republic of Ireland (ROI) directly to slaughter (26 during 2015).

Table 1: Numbers of Cattle Slaughtered and Numbers of LRS (Confirmed and unconfirmed) for 2015 and 2016

Year	Animals slaughtered	LRS (Number per 1000 animals slaughtered)	Animals slaughtered excluding direct imports	LRS excluding direct imports (Number per 1000 animals slaughtered)
2015	413,383	1,459 (3.53)	383,544	1,362 (3.55)
2016	424,898	1,676 (3.94)	411,469	1,635 (3.97)

Skin Test - Herd Level Tests

10.2 The number of herds that completed a herd test in 2016 was 23,344. A total of 34,350 herd tests were carried out in 2016 compared with 34,110 in 2015 (**Table 2**), an increase of 0.7%. There were more herd tests than herds because a proportion of herds were tested more than once during the year.

Table 2: bTB Herd Tests Completed 2015 - 2016 (By Test Category)

Herd Test Reason	Herd tests completed in 2015	Herd tests completed in 2016	% Difference in test numbers between 2015 & 2016 (%)
Restricted	6,391	6,843	7.1
Risk	11,506	12,092	5.1
Routine	16,213	15,415	-4.9
Total herd tests	34,110	34,350	0.7

10.3 The distribution of tests varies in each DVO area and is a function of the number of herds, the disease levels and the predominant disease risk factors in each area (see **Table 3** and **Figures 10 and 11** below). Newry, Enniskillen and Omagh are the DVO areas with the highest number of herds that are eligible for testing, each with over 3,000 herds. Londonderry/Strabane, Mallusk and Ballymena DVO areas have the lowest numbers.

Table 3: Number of bTB Herd Tests in 2016 (per category by DVO area)

DVO	Routine Tests	Restricted Tests	Risk Tests	Total Tests
Armagh	1,564	705	1,073	3,342
Ballymena	997	344	532	1,873
Coleraine	1,523	948	1,639	4,110
Dungannon	1,952	943	1,246	4,141
Enniskillen	2,032	586	1,679	4,297
Mallusk	1,308	350	420	2,078
L'Derry/Strabane	685	216	256	1,157
Newry	2,368	991	2,139	5,498
Newtownards	1,105	813	1,269	3,187
Omagh	1,881	947	1,839	4,667
Total	15,415	6,843	12,092	34,350

Figure 10: Percentage of the NI Total bTB Herd Tests Completed by DVO Area in 2015-2016

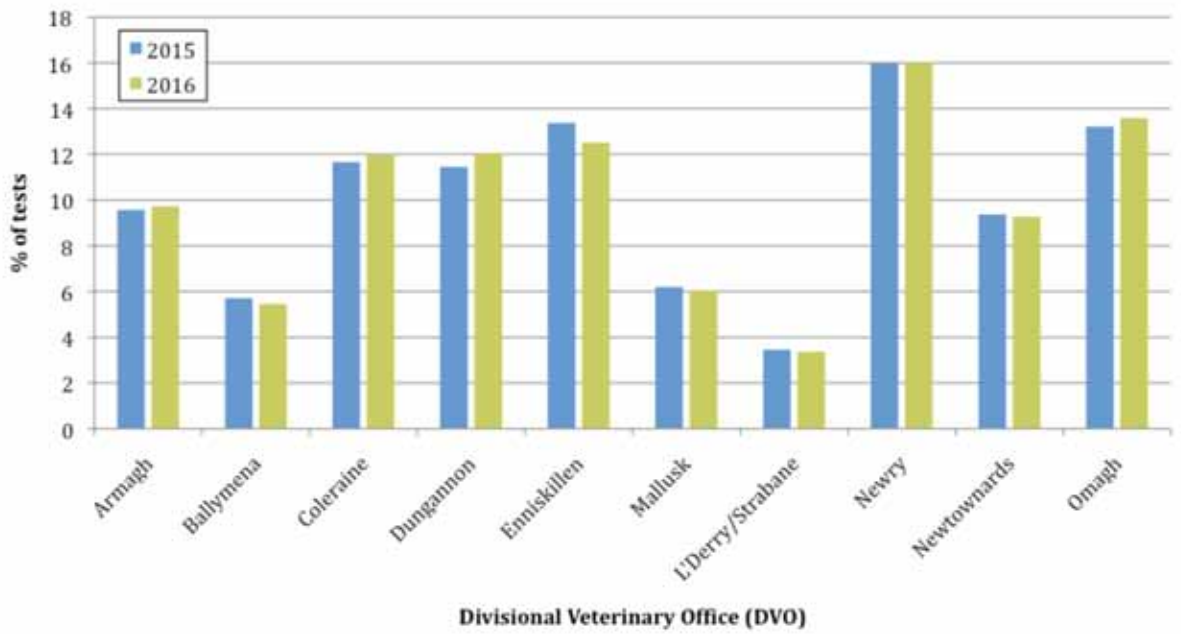
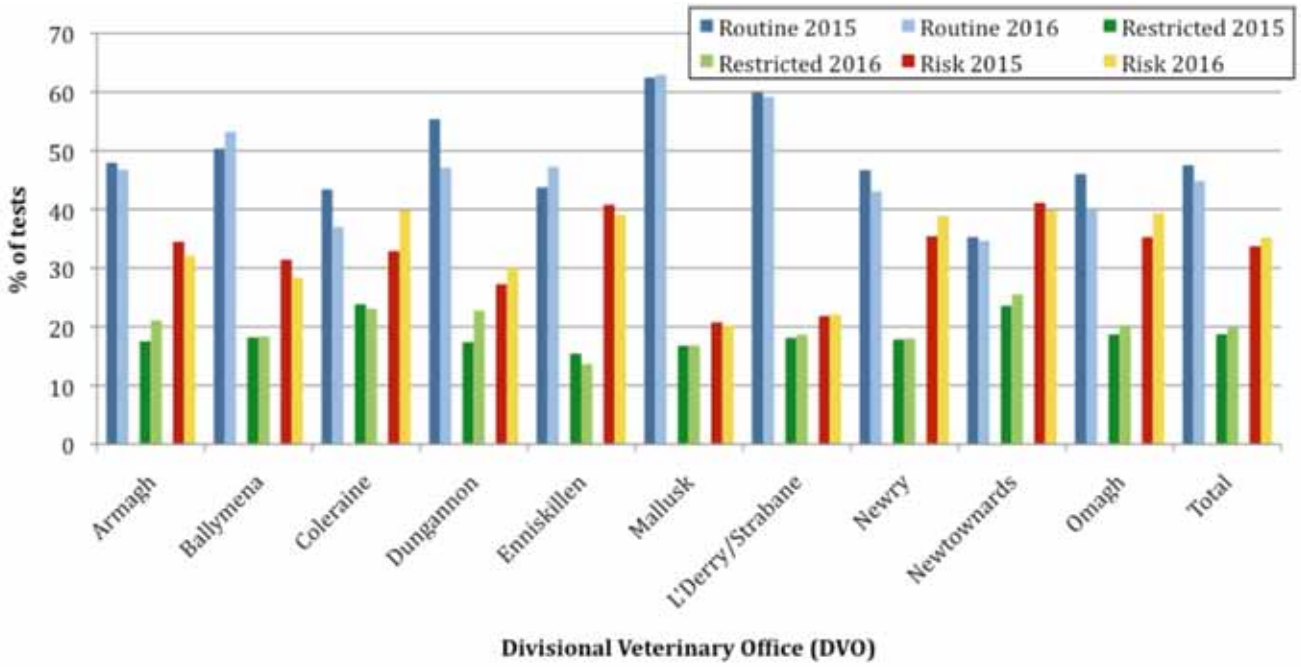


Figure 11: Percentage of bTB Herd Test Categories within each DVO Area in 2015 and 2016



10.4 There was an overall increase in the volume of restricted and risk herd tests both numerically and proportionally, as one would expect as a consequence of the increase in herd incidence. For a detailed comparison of the number and percentage of each test category by DVO area see **Table A** in **Annex**.

Skin Test - Individual Animal Level Risk Tests

10.5 There are many and varied reasons for allocating individual animal tests. For the purpose of this report the test reasons included are those allocated as a result of the disease surveillance and risk assessment processes (**TABLE 4**). Other individual animal level tests, such as PCTs, PNAs and PNTs (see definitions in the glossary of terms) are paid for by farmers. PCTs are required prior to certain animal movements and pre-export. PNAs and PNTs are imposed by the Programme when an animal has moved from a restricted herd in contravention of a notice prohibiting movement of animals to other herds, or when an animal has not been tested in the previous 15 months respectively.

The overall number of individual risk animal tests (CTTs, CTS, CTQs and RIs) completed in 2016 was 9,187, compared with 9,610 in 2015, a decrease of 4.4%.

> “... Overall there was an increase in the volume of restricted and risk herd tests both numerically and proportionally, as one would expect as a consequence of the increase in herd incidence ...”

Table 4: Individual Animal Level Risk bTB Tests completed in 2015 - 2016

Test reason *	Tests completed during 2015 (cattle >0)	Tests completed during 2016 (cattle >0)	Difference between years 2015 & 2016 (%)
Inconclusive retest (RI)	1,753	1,573	-10.3%
Check Test Trace (CTT)	6,407	6,250	-2.5%
Check Test Query (CTQ)	1,051	1,024	-2.6%
Check Test Status (CTS)	399	340	-14.8%
Total	9,610	9,187	-4.4%

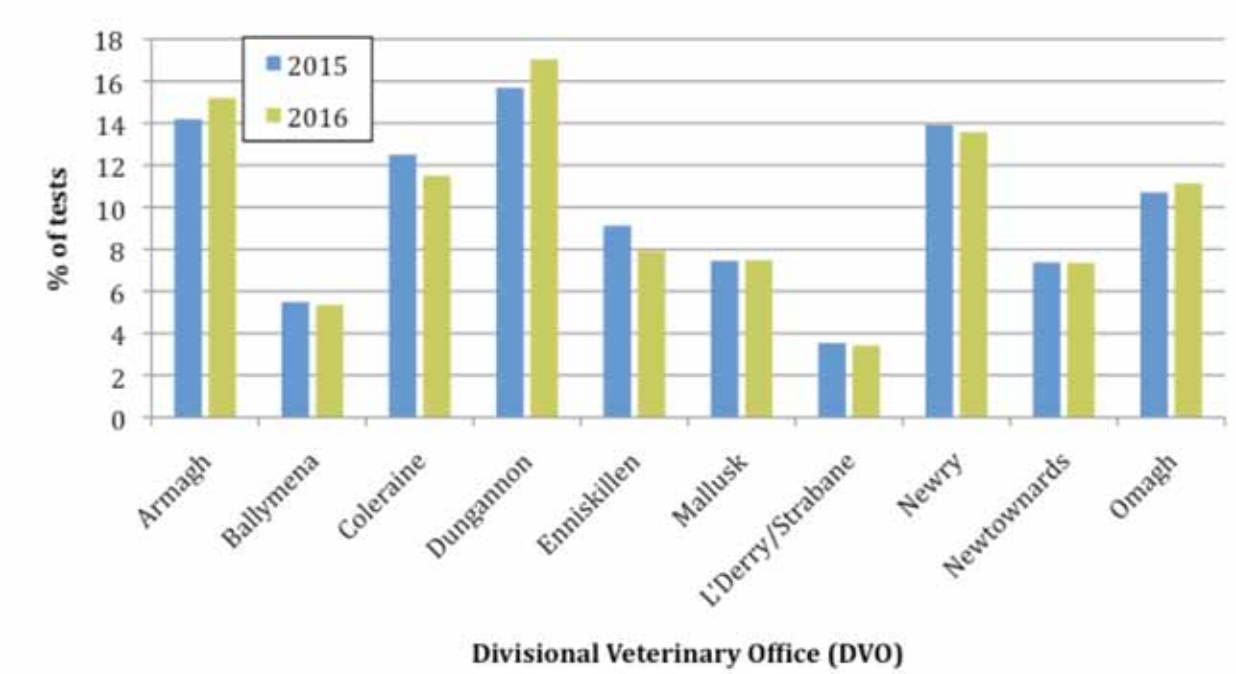
*Description of the test reasons can be found in the glossary.

10.6 The number of individual animal level risk tests in each DVO area (see **Table 5** and **Figure 12** and **Table B** in the annex) varies widely and is dependent on the number of herds and animals, the level of disease, the areas from which farmers purchase their stock and other disease risk factors. Dungannon was the DVO area with the highest proportion of individual animal level risk tests. Most check tests of animal(s) forward traced from a breakdown herd (CTTs and CTQs) were also carried out in this DVO area which may be an indication of the pattern of movement of animals in this area from higher incidence areas.

Table 5: Number of Individual Animal Level Risk Tests in each DVO area in 2016

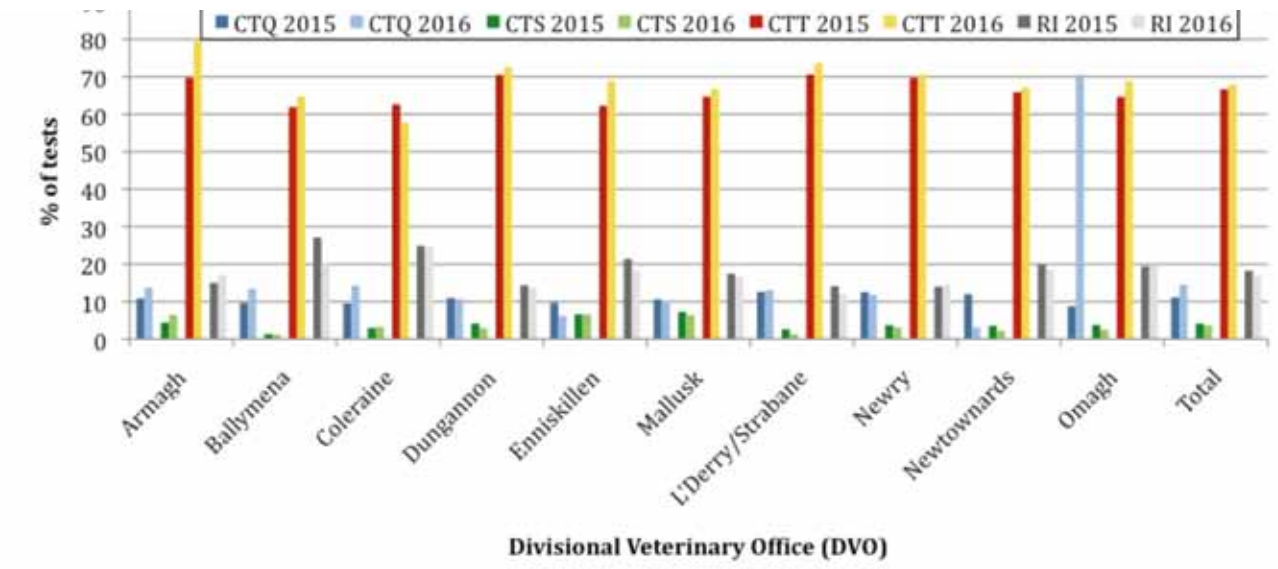
DVO	CTQ	CTS	CTT	RI	Total
Armagh	164	77	952	204	1,397
Ballymena	66	6	318	101	491
Coleraine	151	35	611	260	1057
Dungannon	168	46	1,137	215	1,566
Enniskillen	45	48	502	133	728
Mallusk	71	44	459	113	687
L'Derry/Strabane	41	4	232	38	315
Newry	147	39	880	181	1,247
Newtownards	81	15	454	126	676
Omagh	90	26	705	202	1,023
Total	1,024	340	6,250	1,573	9,187

Figure 12: Percentage of Individual Animal Level Risk bTB Tests* Completed in NI 2015-2016 (by DVO area)



** CTT, CTQ, RI1, CTS*

Figure 13: The Percentage contribution by test reason of Individual Animal Level Risk bTB Tests within each DVO area in 2015 and 2016



Skin Test - Animals Tested

10.7 The total number of animal tests (at herd and individual animal level) during 2016 was 2,817,295, which represents a 3.9% increase compared with 2015 (**Table 6**). The number of animals tested at herd tests was 1,767,922, a 3.1% increase on the previous year (**Table 6**). The number of animal tests is higher than the number of animals tested due to some of the animals being tested two or more times in the same year. The pattern of testing (**Tables 6 and 7**) generally reflects that described previously but it is worth reiterating that given the level of disease risk it was important that a strict approach to assessment of risk was maintained.

Table 6: Total Animals Tested for bTB and Total Animal Tests in Herd Tests (2015 - 2016)

Test Category	2015	2016	Difference 2015 v 2016 (%)
Total animal tests	2,675,319	2,783,283	4.0
Total animals tested	1,715,246	1,767,922	3.1
Total animals with a restricted herd test	515,174	563,476	9.4
Total animals with a risk herd test	713,197	765,139	7.3
Total animals with a routine herd test	766,559	741,101	-3.3

Table 7: Number of Animals bTB Tested in Individual Animal Level Risk Tests (2015 - 2016)

Test Reason	2015	2016	Difference 2015 v 2016 (%)
Check Test Trace (CTT)	10,583	11,868	12.1
Check Test Status (CTS)	911	913	0.2
Check Test Query (CTQ)	1,489	1,789	20.1
Inconclusive retest (RI)	3,026	2,690	-11.1
Total	15,648	17,749	13

Interferon Gamma Blood Testing

10.8 Since July 2004, IFNG has been used in at the same time as the skin test in bTB breakdowns where certain criteria for selection are met with the purpose of identifying, and thereby providing the opportunity to remove, infected animals that have not been identified by the skin test.

10.9 In February 2016 significant changes were implemented to maximise the overall disease control benefit IFNG contributes to the TB Programme. IFNG is now targeted at the cohort groups of previous skin reactors or animals with confirmed TB lesions at routine slaughter and IFNG testing is no longer offered at consecutive breakdown skin tests to give more herds the opportunity to use the test. Following analysis of previous results by AFBI the test positive cut-off has been increased from (B - A) >= 0.05 to (B - A) >= 0.1. The test is now run on single wells rather than duplicate wells and the routine use of the ESAT6 antigen has been discontinued.

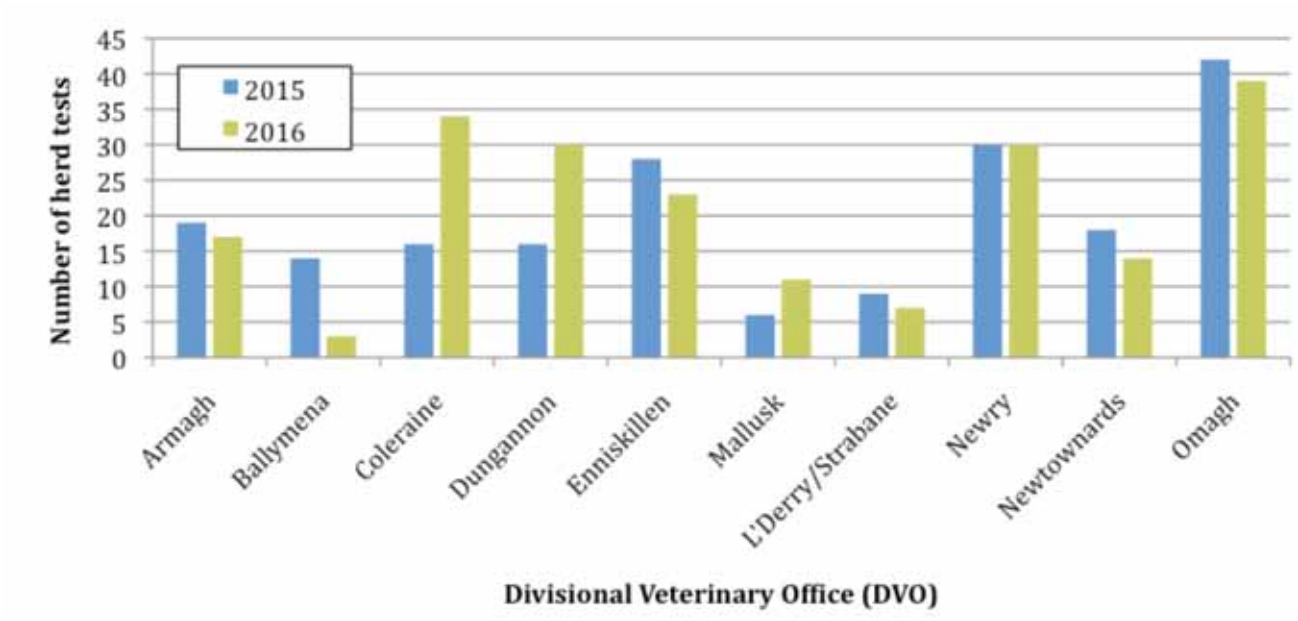
10.10 The number of IFNG samples taken during the year is dependent on disease levels, the number and the size of eligible herds and resource availability. There were more herds and more animals tested using IFNG in 2016 compared to 2015 (**Table 8**).

Table 8: IFNG Tests and Animals Tested (2015-2016)

	2015	2016	% difference 2015 v 2016
N° of Herds IFNG Tested	177	185	+4.5%
N° of IFNG Herd Tests	198	208	+5.1%
N° of animals IFNG tested	15,871	17,611	+11.0%

10.11 The number of herds tested using IFNG by DVO area is shown in **Figure 14**. IFNG is a complex and expensive test and the high cost and strict sampling conditions limit the number of animals that can be tested.

Figure 14: Numbers of `IFNG Herd Tests 2015-2016 (by DVO area)



11. Surveillance Outcomes

(PME)

> "... The PME figures indicate that underlying disease levels have risen along with live animal surveillance incidence rates ..."

11.1 In 2016, 1,635 animals were found with TB-like lesions at routine slaughter (this figure does not include animals imported for direct slaughter), 20% more than in 2015. Of these, 1,007 (61.6%) were confirmed as TB positive by histology and/or bacteriology (**Table 9**), a 15.7% increase on the number confirmed in the previous year. The number of confirmed LRS animals per 1000 animals slaughtered (excluding direct slaughter imports) increased by 7.9%.

In 2016, 703 herds were restricted as a result of finding TB-like lesions at routine slaughter, compared to 590 herds in 2015. (This includes cases where laboratory testing provided an alternative diagnosis e.g. actinobacillosis).

In 2016, 421 TB breakdowns were triggered by an animal found with TB-like lesions at routine slaughter which was subsequently confirmed by histology and/or bacteriology, compared to 359 TB breakdowns in 2015.

During 2016, in 297 herds a TB-like lesion at routine slaughter triggered a breakdown where one or more reactor animals were disclosed at the resulting skin test. This compares to 207 herds that were similarly affected in 2015.

The increased disease detection at live animal surveillance is considered to be due to a combination of improved surveillance and a real increase in disease burden.

Table 9: Number of LRS Animals and Confirmed LRS* Animals in 2015 and 2016

Year	N° of LRS	N° of confirmed LRS (%)	N° of LRS excluding direct imports	N° of confirmed LRS excluding direct imports (%)	bTB confirmed LRS per 1000 animals slaughtered excluding direct imports (%)
2015	1,459	935 (64.1)	1,362	870 (63.9)	2.27
2016	1,676	1025 (61.2)	1,635	1,007 (61.6)	2.45
% change 2015 v 2016	14.9%	9.6%	20.0%	15.7%	7.9%

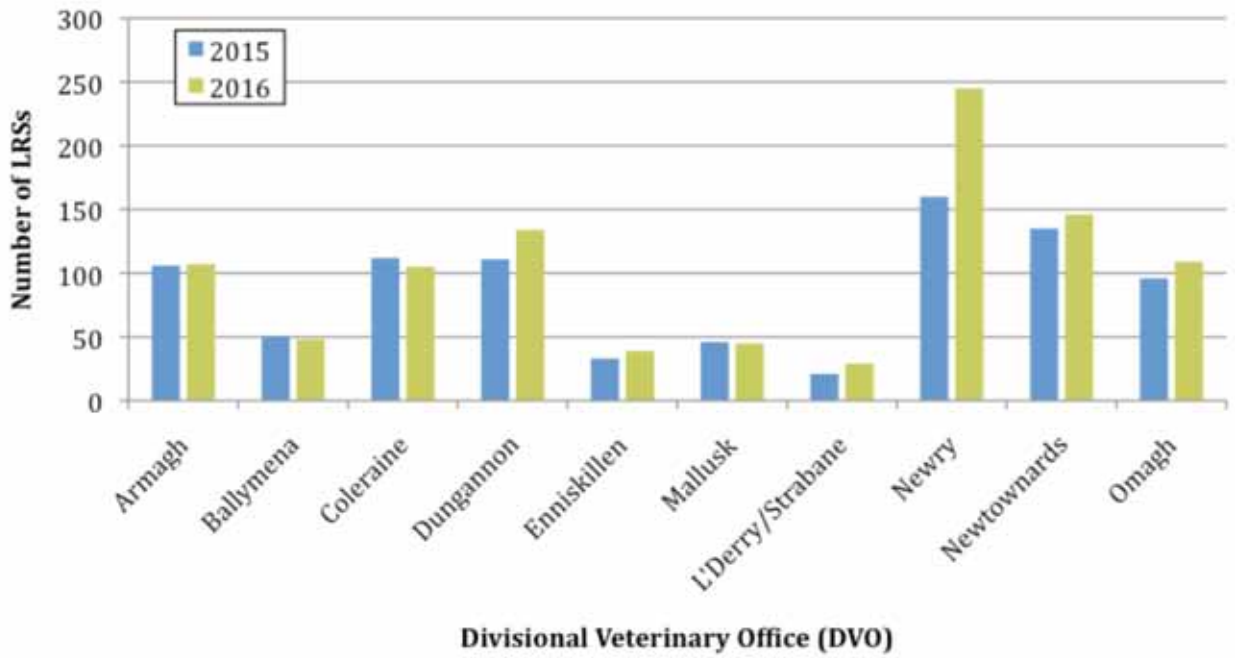
*Histology and/or bacteriology positive.

11.2 The distribution of LRS animals across the 10 DVO areas is shown in **Figure 15**. The DVO area attributed to each LRS is the one where the herd that presented the animal for slaughter is located. Although Enniskillen was the DVO area with the highest bTB animal incidence during 2016 (1.09%), Newry DVO had the highest number of LRS (245 confirmed in 2016). This difference could be explained by both animal movements and animal density in those DVO areas. The animals may have been infected in previous herds located in different DVO areas. This explains the lack of association in some DVO areas between animal incidence (**Figure 8 and Figure 9**) and location of the presenting herd of the LRS (**Figure 15**).

A VEU study on LRS during 2011-2013 in NI showed that the likelihood of an animal being an LRS was associated with;

- The herd incidence of the area (patch) from which the animal was moved to slaughter, when the patch incidence was greater than 9%;
- Whether the animal was purchased or homebred (purchased animals were more likely to be LRS);
- The age of the animal at slaughter (the likelihood of being LRS increased as the animal got older), and
- The time the presenting herd was free of bTB (relative to restricted herds). There were significantly more LRS found from herds that did not have bTB in the previous 2-3 years. However, there was no statistical difference between restricted herds and herds that were clear of bTB for less than two years or more than three years.

Figure 15: Number of Confirmed LRS by DVO area of Origin (2015 and 2016*)



**The DVO area of origin is the DVO area of the herd that presented the LRS animal for slaughter.*

Skin Test

11.3 In relation to the bTB skin test, there was an 8.4% increase in the number of bTB skin test reactors in 2016 compared with 2015, (**Table 10**).

Table 10: Total Number of bTB Reactors and Negative in Contacts (NICs) 2015 - 2016

Year	Number of reactors	Number of NICs	Total
2015	11,004	755	11,759
2016	11,923	579	12,502
% change 2015 v 2016	8.4%	-23.3%	6.3%

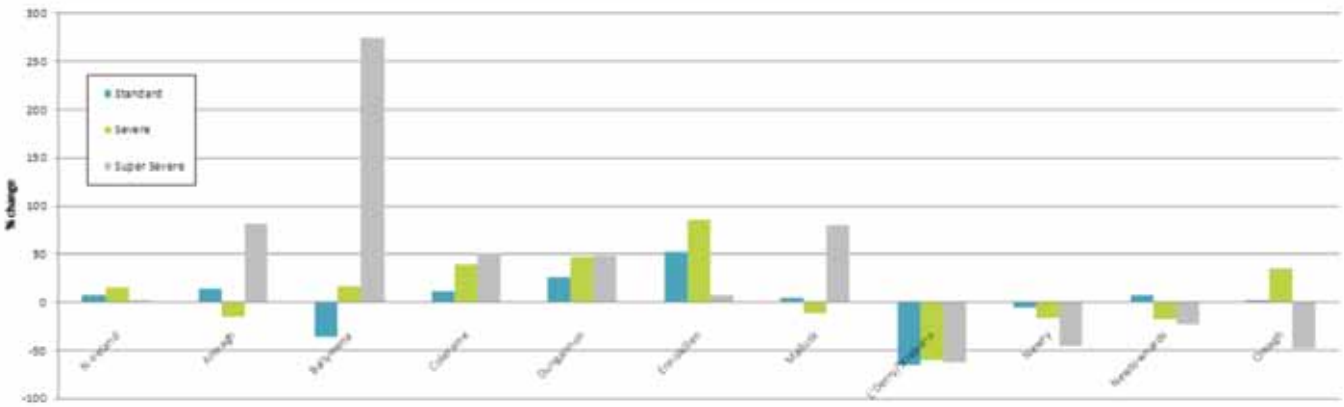
11.4 The number of Negative-In-Contacts (NICs) decreased by 23.3% (**Table 10 and 11**).

Table 11: Number of Negative in Contacts (NICS) in 2015 and 2016 (by DVO area)

	2015		2016	
	N° of NICs	N° of Herds	N° of NICs	N° of Herds
Armagh	59	14	37	11
Ballymena	10	7	11	3
Coleraine	23	10	78	15
Dungannon	62	5	24	8
Enniskillen	37	22	105	24
Mallusk	45	5	8	2
L'Derry	9	2	57	3
Newry	73	9	17	9
Newtownards	95	16	63	14
Omagh	342	41	179	36
Total	755	131	579	126

11.5 Of the reactors, 81.8% were removed under standard interpretation of skin test results. The rest were removed using more rigorous interpretations of the skin test readings, called severe (13.0%) or super severe (5.2%) interpretation, used in TB breakdown herds to increase the capability of the test to disclose infected animals. Test sensitivity is therefore increased and infected animals are removed sooner, thereby reducing the potential for spread and future risk. A VEU study reported that during a TB breakdown, animals that are only positive on severe interpretation are 8 times more likely to subsequently become reactors than animals that tested negative in the same herd tests.

Figure 16: % change in interpretation of TB reactors in 2016 compared to 2015 by DVO



Reactors Disclosed in Herd Tests

11.6 The number of herd tests that disclosed at least one skin test reactor (positive herd test) increased by 10.1% in 2016 (See **Table 12**), the highest percentage increase was observed in the risk herd test category with an increase of 16.3%.

Table 12: bTB Herd Tests with Reactors 2015-2016

Herd Test Category	2015 Herds tests with reactor(s)	2016 Herds tests with reactor(s)	Difference 2015 v 2016
Restricted	1,257	1,390	10.6
Risk	761	885	16.3
Routine	453	445	-1.8
Positive	2,471	2,720	10.1

11.7 The DVO area that disclosed the highest proportion of all the positive herd tests in 2016 was Omagh (**Figure 17**). Although Coleraine DVO area has the highest herd prevalence there are fewer herds in this DVO area, therefore it contributes a lower proportion of the overall number of positive herd tests.

Figure 17: Percentage Contribution by each DVO area of all Herd Tests with Reactor(s) in NI, (2015 - 2016)

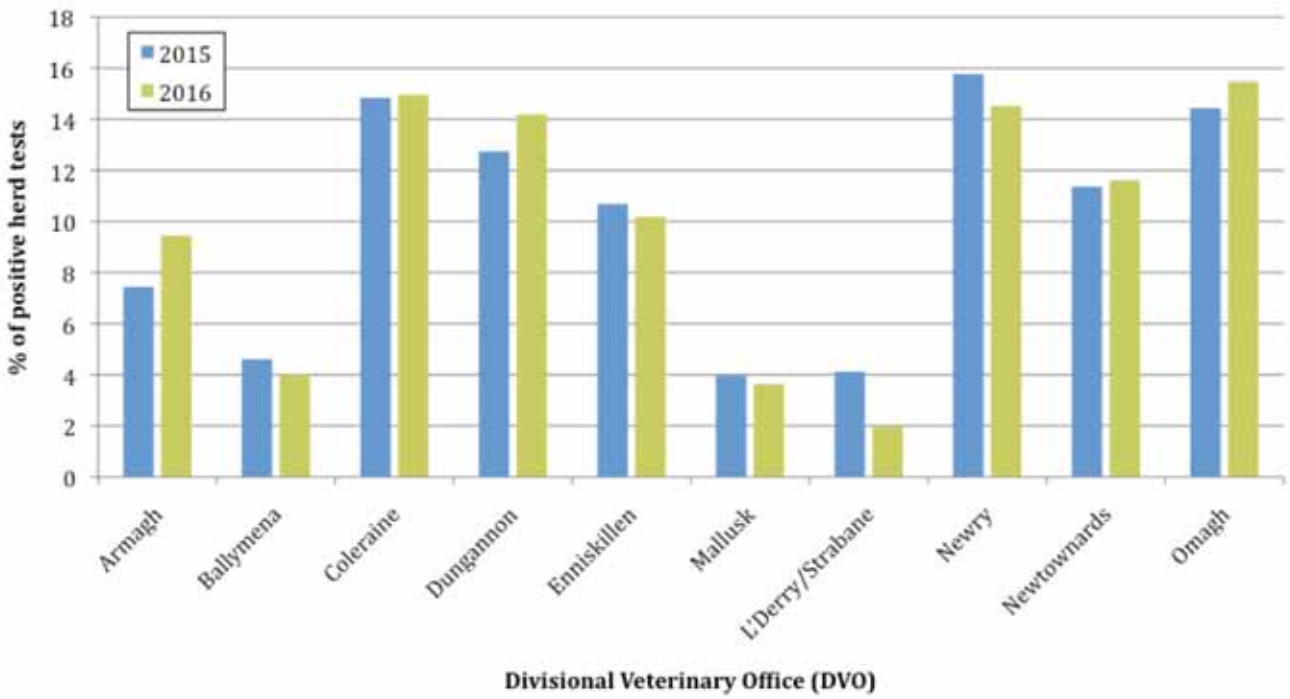


Figure 18 shows the percentage change in herd tests with reactors between 2015 and 2016 across the DVO areas with Armagh showing the greatest increase. **Figure 19 and 20** show the moving average of the percentage of herds with reactors in the Northern and Southern Regions during 2015 and 2016.

Figure 18: % change of herd tests positive in 2016 compared to 2015 by DVO area

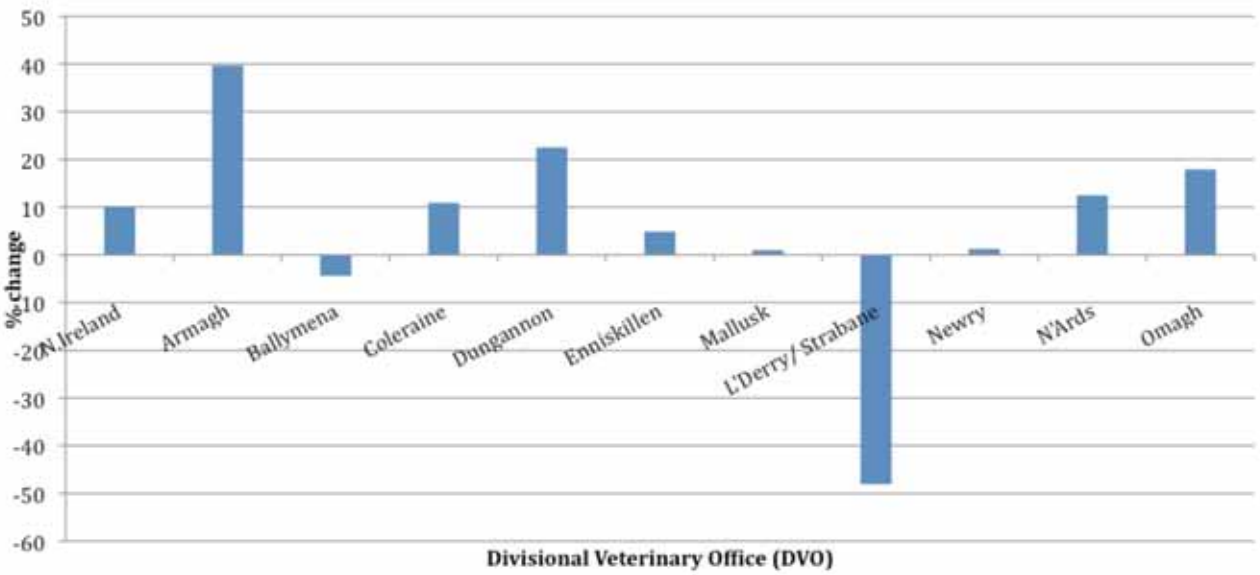


Figure 19: % positive herd tests by DVO (2015-2016): Northern Region (6 month moving average)

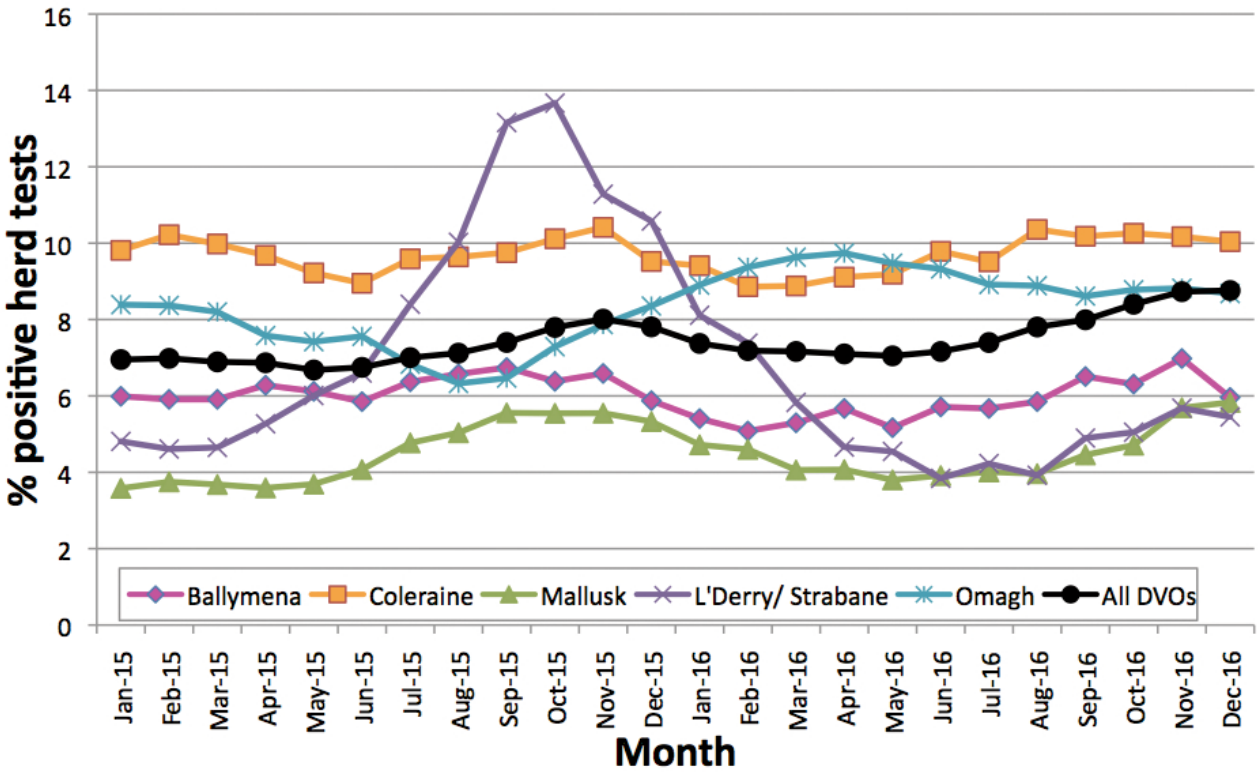
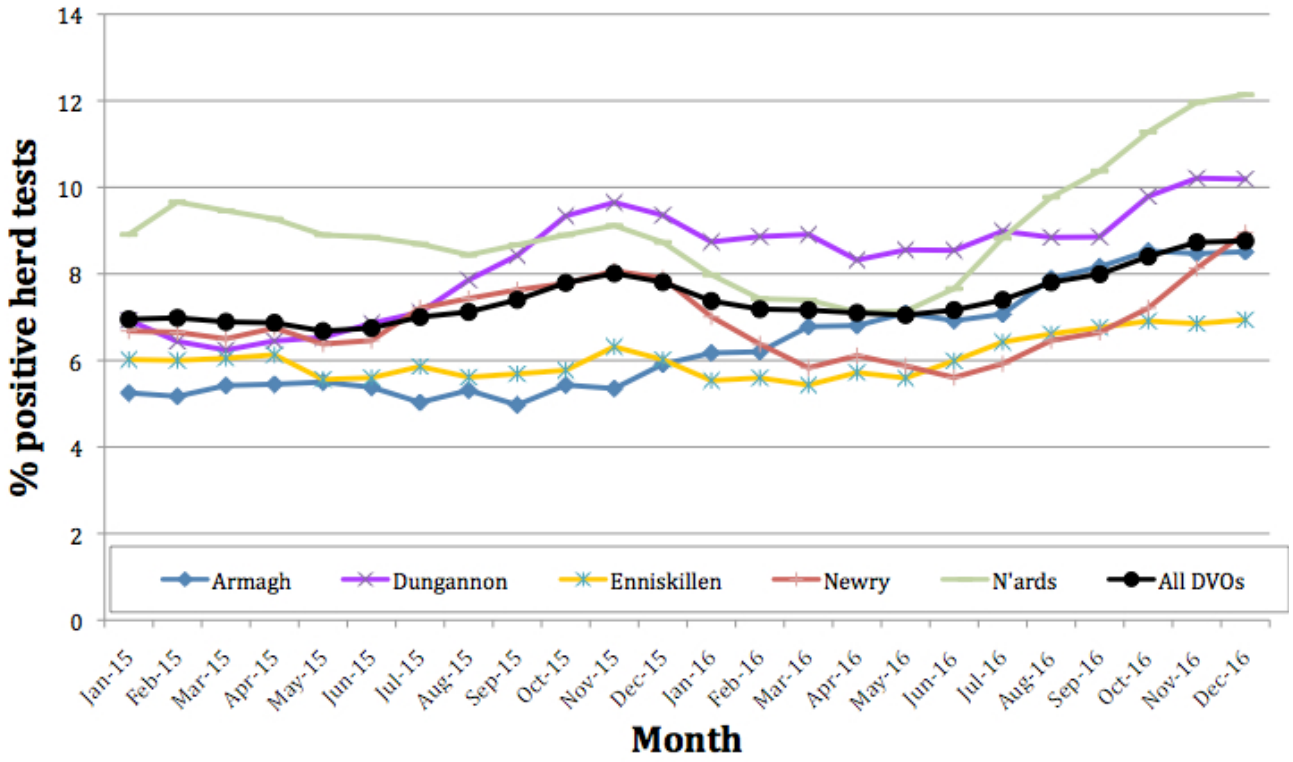
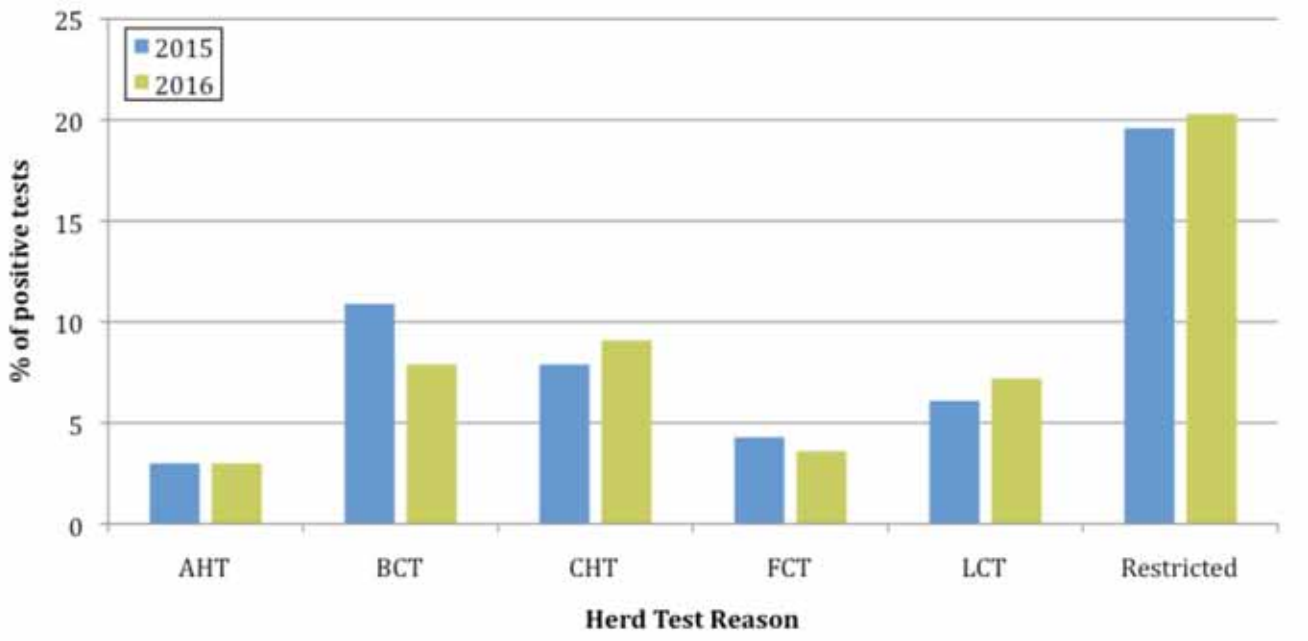


Figure 20: % positive herd tests by DVO (2015-2016):Southern Region (6 month moving average)



11.8 **Figure 21** shows the percentages of herd tests that disclosed reactor animal(s) for each test reason (see glossary for definitions). Compared with the rate detected in Annual Herd Tests (AHT), the lowest risk category of test, all of the other test reasons had a higher breakdown rate which supports the assessment that the herds were at a higher disease risk.

Figure 21: % of bTB herd tests with reactors by test reason for 2015 and 2016



Reactors Disclosed at Individual Animal Level Risk bTB Tests

11.9 In 2016 there was a decrease of 0.2% (**Tables 13 and 14, Figures 22 and 23**) in the number of individual animal tests in which a reactor was disclosed (553 in 2016 compared to 554 in 2015).

Table 13: 12 month comparison of the number of individual tests positive 2015-2016

Number Individual test positive	N. Ireland
2016	553
2015	554
Difference	-1
% change	-0.2

Table 14: Individual Animal Risk bTB Tests with Reactors 2015 and 2016 (by Test Reason)

Test Reason	2015	2016	% difference 2015 v 2016
Check Test Query (CTQ)	3	5	66.7
Check Test Status (CTS)	13	6	-53.8
Check Test Trace (CTT)	149	124	-16.8
Inconclusive retest (RI)	389	418	7.5

Figure 22: % positive individual tests by DVO area 2015-2016 Northern Region (6 month moving average)

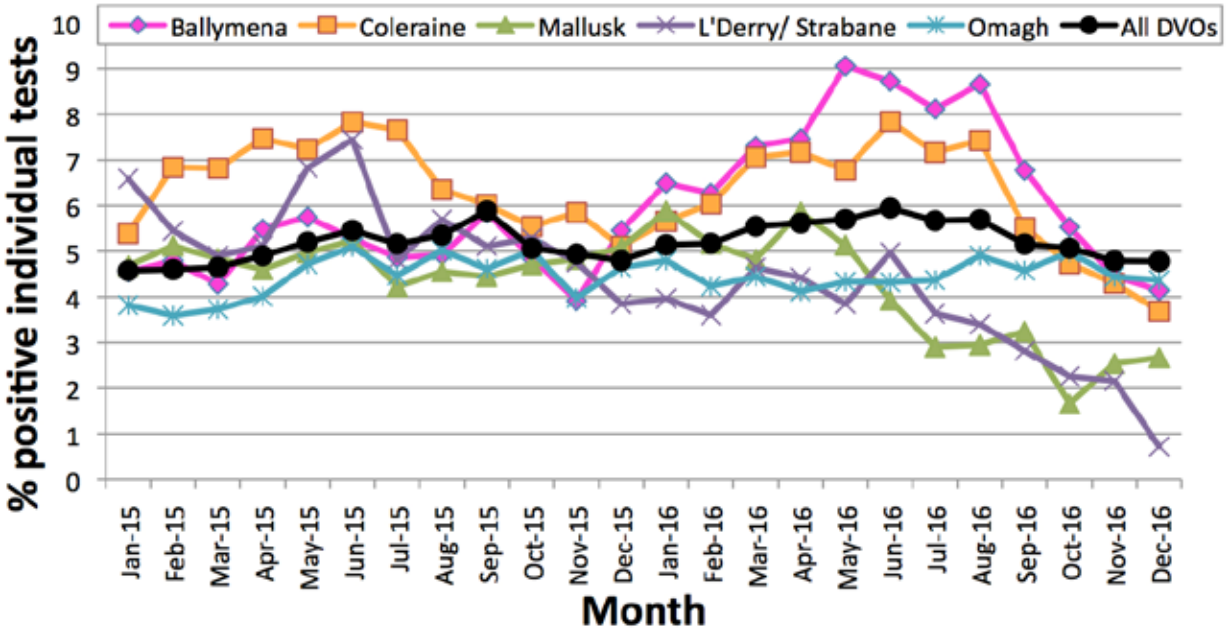
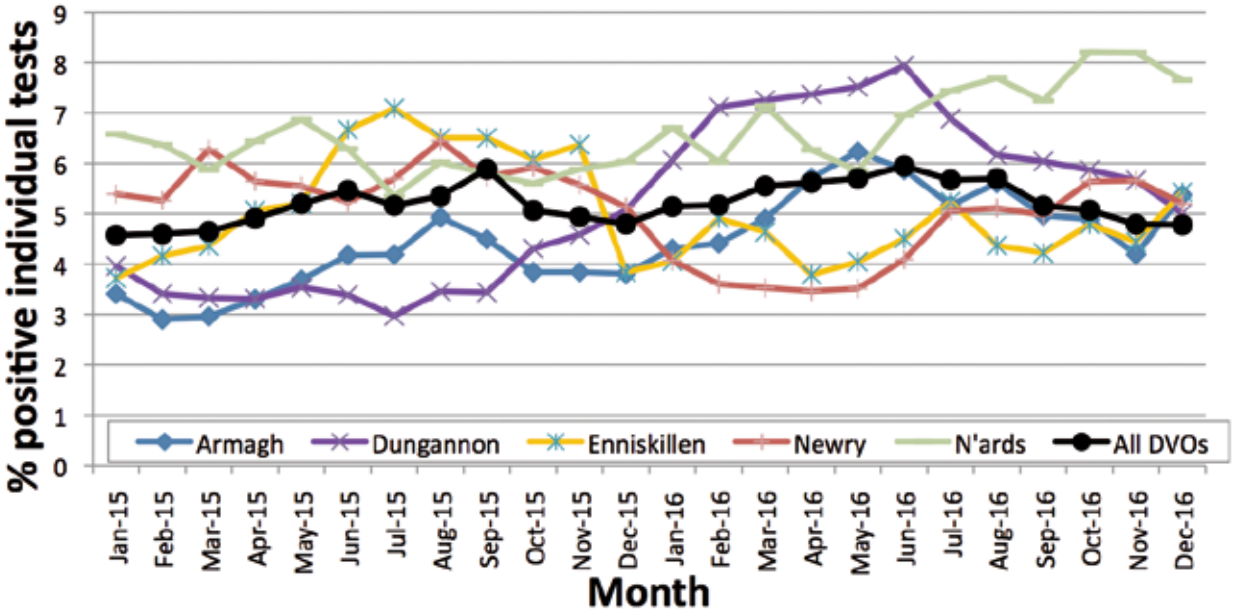


Figure 23: % positive individual tests by DVO area 2015-2016 Southern Region (6 month moving average)



12. Surveillance Outputs

12.1 However, the proportion of tests that were positive increased from 5.76% in 2015 to 6.51% in 2016. The number of reactors disclosed at Individual Animal tests (**Figures 24 and 25 and Table 15**) decreased by 11.5% (from 762 in 2015 to 674 in 2016).

Table 15: Number of reactors disclosed at Individual Animal Level Risk bTB Test (2015/2016)

Test	Number of reactors in 2015	Number of reactors in 2016	Difference 2015 v 2016 %
CTQ	3	5	+66.7%
CTS	36	7	-80.6%
CTT	175	139	-20.6%
RI	548	523	-4.6%
Total	762	674	-11.5%

Figure 24: Percentage of all Positive Individual Animal Level Risk bTB Tests 2015 and 2016 (by DVO area)

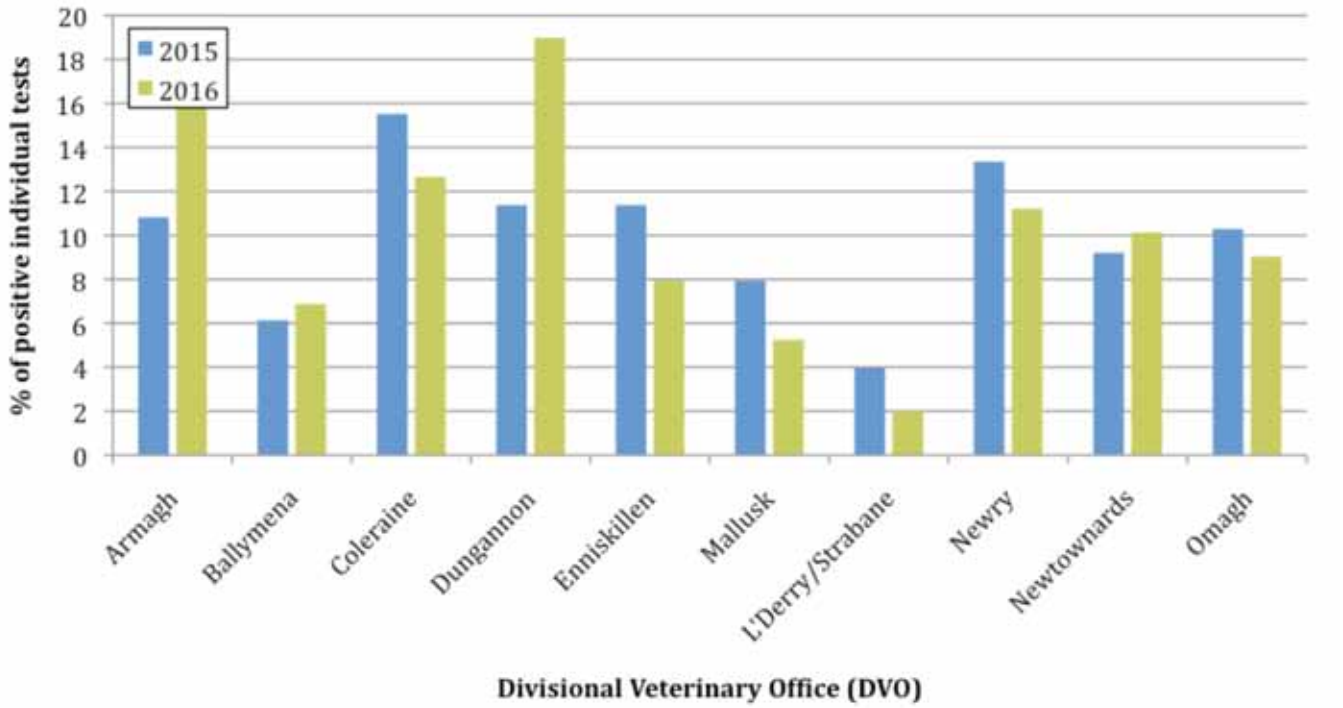
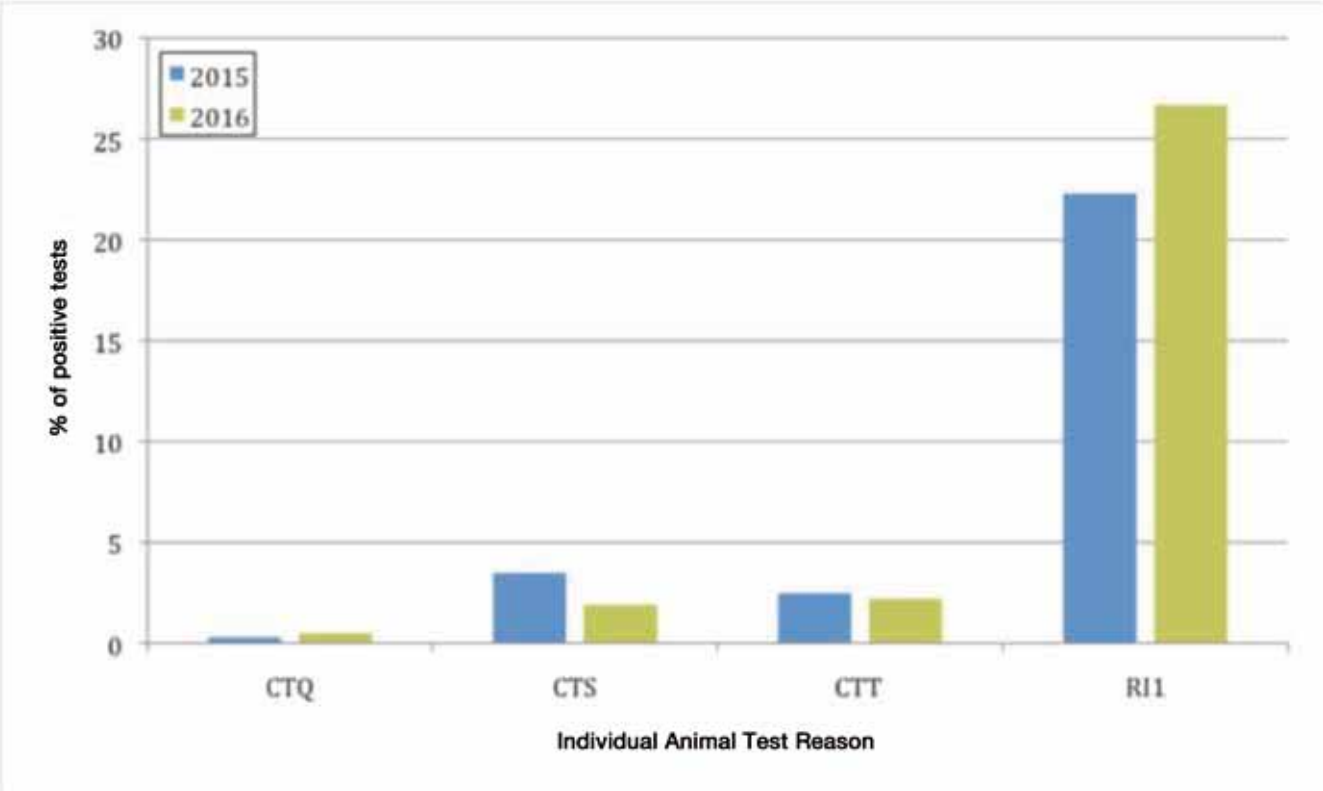


Figure 25: Individual Animal Level Risk bTB Test Reactor Disclosure Rate for 2015 and 2016 (by Test Reason)



Skin Test Reactor Confirmation Rate

12.2 The confirmation rate (see glossary) for skin test reactor animals during 2016 was 44.8%, which was lower than during 2015 (**Table 16**). Overall the number of reactors increased by 8.4% (from 11,004 in 2015 to 11,923 in 2016), and the number of confirmed reactors increased by 0.7% (from 5,304 in 2015 to 5,339 in 2016). A positive culture result is definitive evidence of infection. However from a TB Programme perspective a reactor animal is considered to be confirmed if, in addition to being positive to the skin test, it has bTB like lesions at post mortem inspection or is positive by histological examination or by culture.

During breakdowns, where no reactors show visible lesions at slaughter, and bTB has not previously been confirmed, samples from up to 5 reactors per test are submitted for laboratory testing. From a breakdown herd perspective, a herd has its Officially Tuberculosis Free status withdrawn (OTW) if infection is confirmed in a reactor or LRS, if there are more than 5 unconfirmed reactors or LRS during the course of a breakdown, or if otherwise indicated by a veterinary risk assessment. Thus, in Programme terms, more herds and animals are treated as confirmed and have appropriate control measures promptly applied, than would be indicated by positive culture alone. Control measures include severe interpretation of the skin test, two clear whole herd tests required post removal of reactors, disease tracing and lateral check testing.

Table 16: Numbers of bTB Reactors and Confirmed Reactors (2015 and 2016)

Year	Number of Reactors	Number of confirmed Reactors
2015	11,004	5,304 (48.2)
2016	11,923	5,339 (44.8)
% change 2015 v 2016	8.4	0.7

12.3 It is important to re-emphasise that failure to confirm infection does not mean that the animal was not infected (the sensitivities of the confirmatory tests post-mortem inspection, histology and culture, are not 100% accurate and therefore false negative results will occur). Recently published[1] figures reinforce that the skin test is 99.98% accurate in identifying TB-free animals and is our primary diagnostic tool. Therefore the fact that an animal is a reactor to the skin test means that it is highly likely to be infected, whether or not this is subsequently confirmed after removal. Recent research has also shown that number of reactors and not confirmation is predictive of future herd breakdown (Olea-Popelka et al., 2012: Doyle et al., 2014).[2,3]

> “... the fact that an animal is a reactor to the skin test means that it is highly likely to be infected, whether or not this is subsequently confirmed after removal ...”

12.4 There was an increase of 11% in the number of animals that were IFNG tested during 2016 as a result of increased investment in IFNG by DAERA and changes to lab testing procedures (**Table 17**).

Despite this increase in the number of animals tested, fewer animals were IFNG positive. This is likely to be at least in part due to the increase in test positive cut-off which was introduced in February 2016 following analysis by AFBI of previous test outcomes.

Herd keepers were offered valuation and removal of the 821 animals that were only positive to the IFNG test. This was an 8.7% decrease from the 899 animals offered valuation and removal in 2015. Of these, 719 animals were voluntarily slaughtered, a 19% increase compared to 2015 (604 animals). Of the IFNG positive animals offered removal, 87.6% were slaughtered in 2016, a significant increase from the 67.2% slaughtered in 2015. This increased voluntary slaughter rate is a direct result of the switch from whole herd testing to cohort testing, and the increased test positive cut-off since February 2016.

Overall the TB confirmation rate at post mortem of all the IFNG positive cattle slaughtered (including those that were also skin reactors or negative in contacts) was 23.2% compared to 29.9% in 2015. TB was confirmed at post mortem in 9.5% of the voluntarily slaughtered IFNG positive animals (9.1% in 2015).

Table 17: IFNG Positives in 2015 and 2016

Year	2015	2016	% Change
Animals sampled	15,871	17,611	+11.0%
Animals IFNG positive (%*)	1,222 (8.2%)	1,041 (6.0%)	-14.8%
Animals IFNG positive offered voluntary slaughter	899	821	-8.7%
Animals IFNG positive voluntarily slaughtered	604	719	+19.0%

*Only animals with valid IFNG and skin test results are included (17,351 animals in 2016 and 14,911 animals in 2015).

13. New Herd Breakdowns

13.1 New bTB herd breakdowns are herds with at least one reactor animal where the herd had no other reactor animals during the previous 12 months. The number of new bTB herd breakdowns (**Table 18**) was 3.0% higher for 2016 compared with 2015 (1,739 compared with 1,688). Four of the 10 DVO areas (Coleraine, Mallusk, Londonderry/ Strabane and Newry) had a reduced number of new breakdowns during 2016.

Table 18: Number of New bTB Breakdown Herds (2015 and 2016)

Year											
	Armagh	Ballymena	Coleraine	Dungannon	Enniskillen	Mallusk	L'Derry/ Strabane	Newry	N'Ards	Omagh	Totals
2015	145	88	243	194	200	75	87	245	173	238	1,688
2016	189	88	223	250	201	73	30	238	205	242	1,739
% change 2015 v 2016	30.3	0	-8.2	28.9	0.5	-2.6	-65.5	-2.9	18.5	1.7	3.0

13.2 **Figure 26** shows the density of herds with reactors per km^2 in 2016 in NI. This information was requested by Private Veterinary Practitioners to increase awareness of the distribution of infection in their locality. (2015 map in **Figure A** in the Annex).

Figure 26: Density of Herds with bTB Reactors in 2016

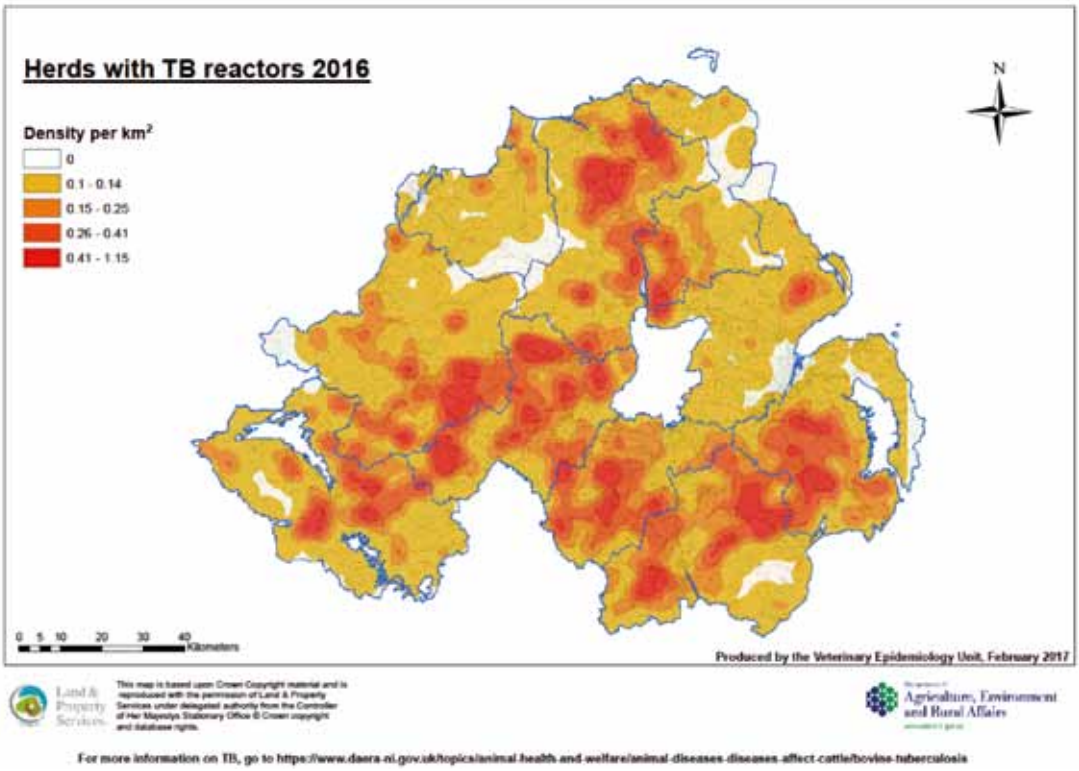
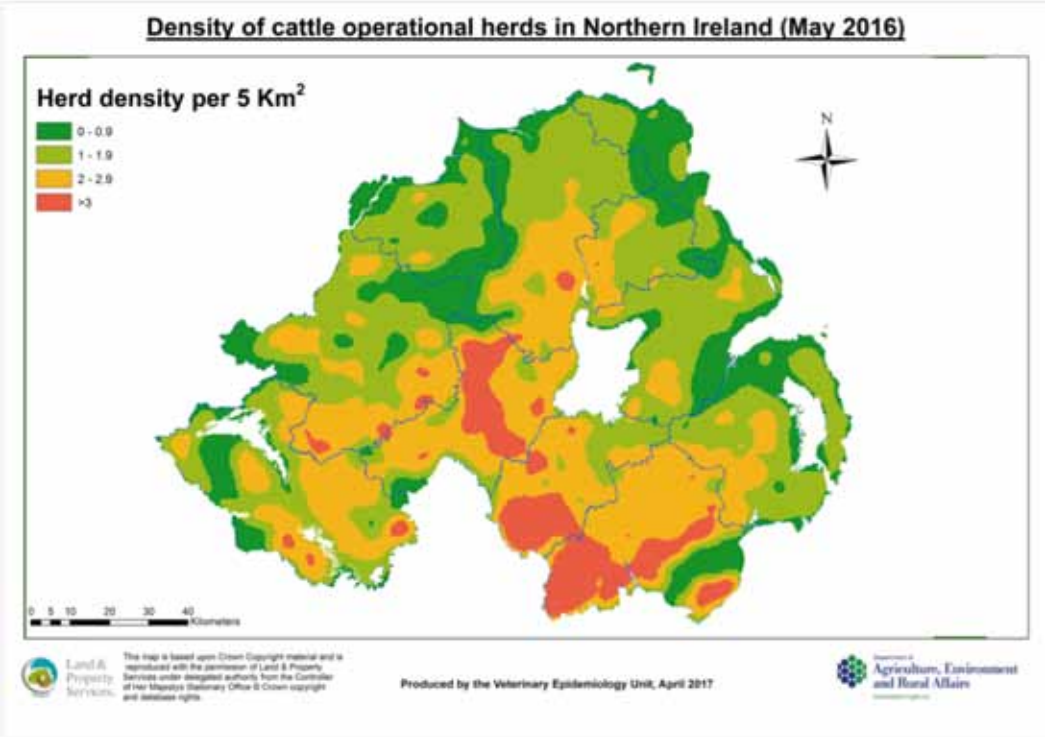


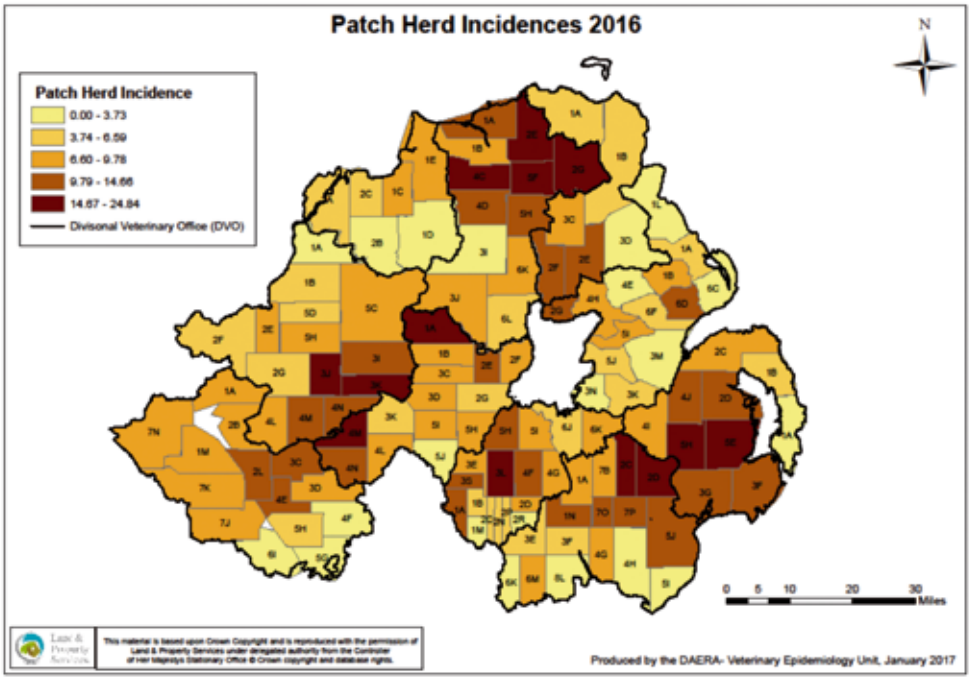
Figure 27 shows cattle herd density across NI and when compared with **Figure 25** there is an association between the two.

Figure 27: Operational cattle herd density in NI 2016



Taking into account the number of herds in each area and the number of new herd breakdowns, we have produced a patch bTB incidence map (see glossary of terms for definitions) for 2016 (**Figure 28**). Every DVO area can be seen to have a variation in incidence across its patches.

Figure 28: Patch Incidence in 2016

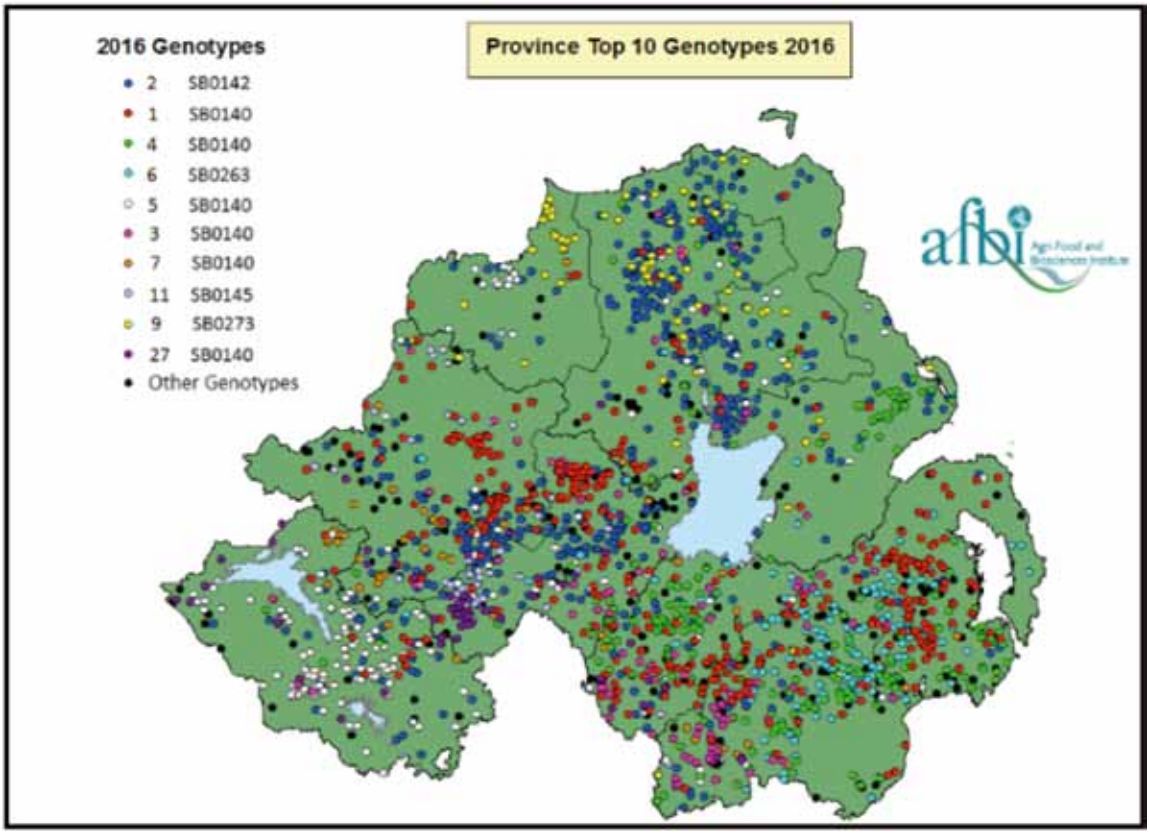


M. bovis Strain Types

> "... in 2016 the top 10 strains accounted for 82.5% of the confirmed cases..."

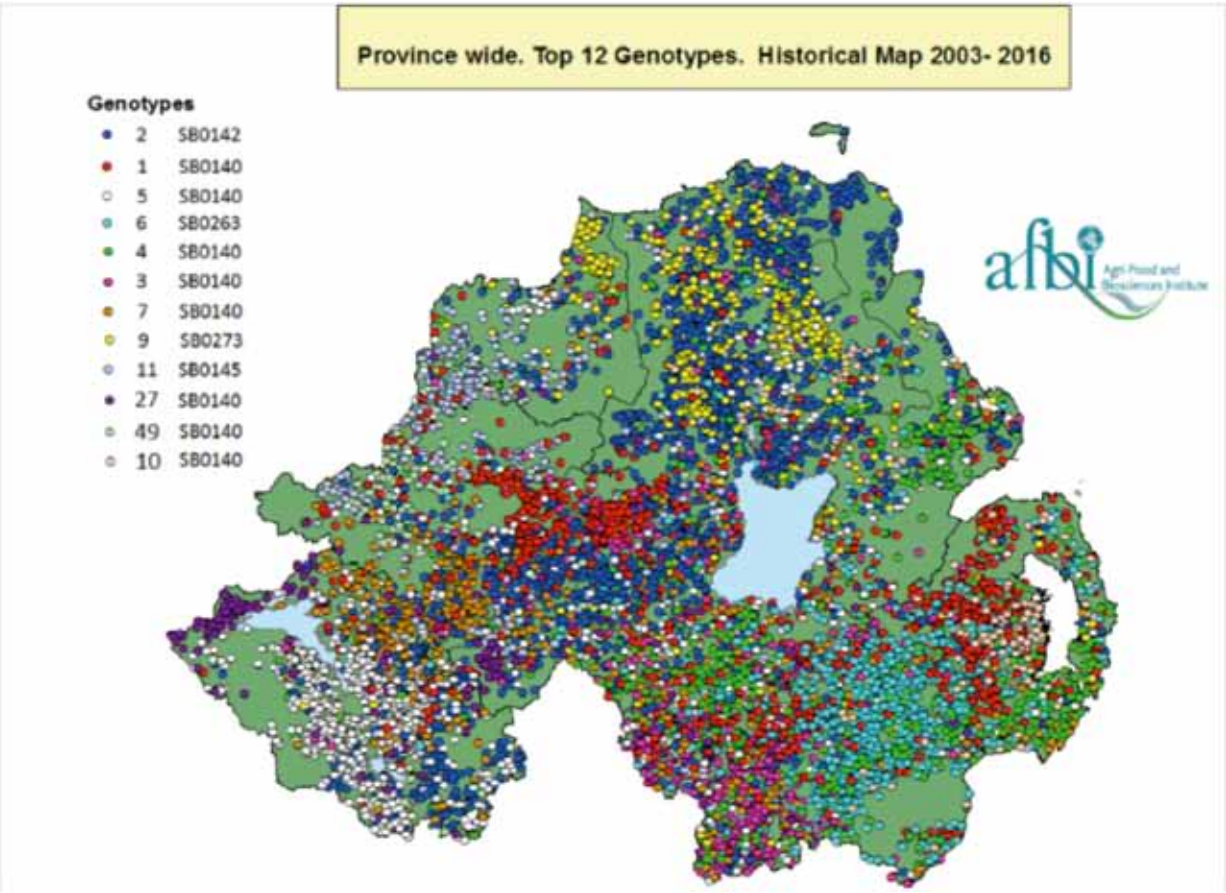
13.3 **Figure 29** shows the distribution of the most prevalent bTB strain types found in bTB confirmed cases in 2016. The 10 most prevalent strain types have changed slightly and there were slight changes in the relative prevalence. In 2015 the top 10 strains accounted for 78.2% of culture positive breakdown herds and in 2016 the top 10 strains accounted for 82.5%. Strain type 122 has dropped out of the top 10 in 2016 and strain 27 has been introduced. The clustering effect seen with bTB is visible, and the home ranges of strain types appear unchanged. However, some strain types are visible in areas outside their normal cluster, which would suggest spread due to animal movements (Strain types from 2003 to 2016 can be found in **Figure 30** and the most prevalent strain types in 2015 can be found in **Figure B** in the Annex.

Figure 29: Distribution of the most prevalent bTB strain types in 2016



There has been a slight change to the historical prevalence (2003-2016) in that strain type 27 has replaced strain type 10 and strain type 49 has replaced strain 122 in the top 10. Strain type 27 is an ROI strain type and strain type 49 is a "daughter" of strain type 5. Strain type 27 is clustered in Enniskillen DVO near Belleek and a second cluster in west Dungannon DVO near Fivemiletown. Strain type 49 can be seen to cluster mainly in the same area of west Omagh DVO where strain type 5 occurs (**Figure 30**).

Figure 30: Distribution of the most Prevalent Strain Types in 2003-2016

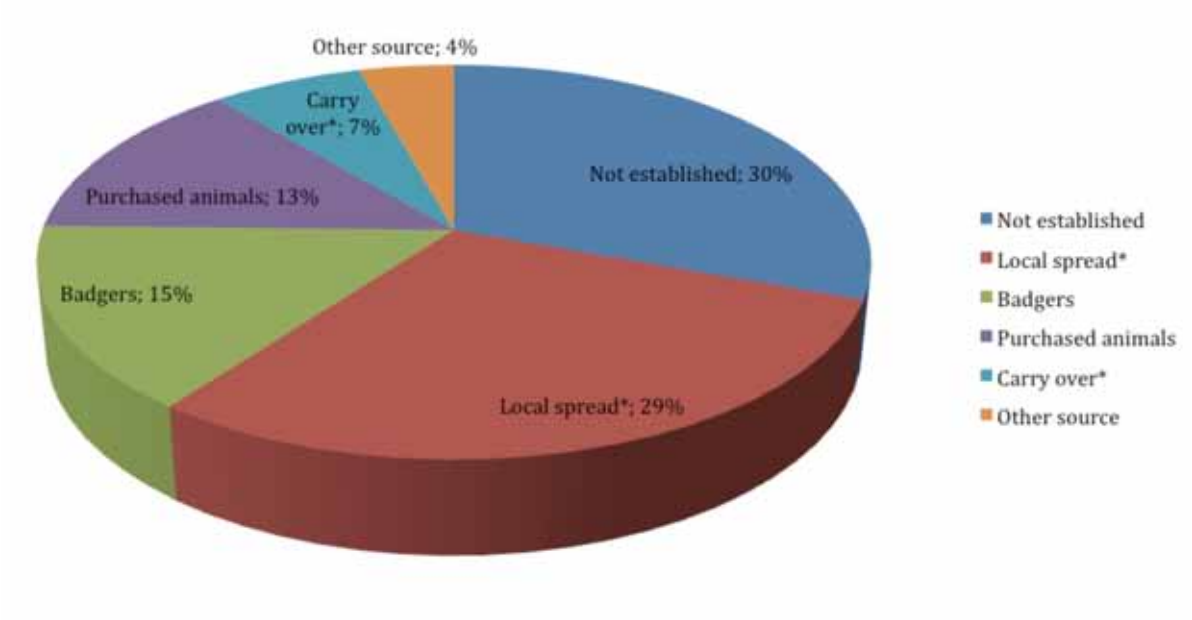


(Map courtesy of AFBI)

14. bTB Investigations

14.1 During the course of the management of a bTB breakdown, and based on the available evidence, the VO records an assessment of the cause of the breakdown. In many cases it is not possible to determine a single cause with a reasonable degree of certainty and additional information may only come to light months or years after the breakdown has been dealt with because of the chronic and complex nature of the disease. "Not established" includes breakdowns where more than one possible source has been identified[5]. The percentages of the infection sources recorded by the field VOs for OTW breakdowns during the period 2002 to 2016 is shown in **Figure 31**.

Figure 31: Infection sources for OTW bTB herd breakdown from 2002 to 2016 for all DVOs (n=11,062)



*Definitions in the glossary

14.2 These conclusions correlate with established risk factors for bTB (Skuce et al., 2015: Doyle et al., 2014). DAERA continues to provide advice on biosecurity measures that farmers can employ to reduce the risk of infection affecting their herd. Advice is given by staff during visits to farms and also through the distribution of leaflets to all farmers. Information on the possible causes of a TB breakdown can be found on the DAERA bTB web-pages.

15. EU Co-funding and Programme Costs

15.1 Since 2010 our Programme has been annually approved for co-funding as part of the overall UK bTB Eradication Plan. An end of year summary of specified Programme costs is submitted annually to the EU Commission. A summary of the costs for 2016 is shown in **TABLE 19** below.

15.2 The amount of co-funding received from the EU Commission for 2015 was £5,3million. At the time of writing (October 2017) the 2016 co-funding has been agreed, but has not yet been received.

Table 19: Specified Programme Costs for 2016

TB Programme Element	Cost
Compensation for reactors, negative in contacts and voluntarily slaughtered interferon gamma positive cattle	£15,463,151
Haulier expenses	£274,142
PVP Tuberculin testing (excluding travel)	£7,194,010
TVO/VOT tuberculin testing (excluding travel)	£1,518,961
Tuberculin	£669,516
Laboratory analysis for interferon gamma and culture	£604,196
Research	£318,981
Veterinary and Administrative Staff	£6,961,047
Salvage monies	-£2,633,034
Total	£30,370,970

14.3 The specified costs of the Programme for 2016 were £1.8 million higher than 2015.

This is largely due to an increase in expenditure in DAERA staff and PVP costs, with other less significant increases and reductions across the Programme elements.

16. Research and Development

> "... there is still much that is not known about how bTB spreads ..."

16.1 There is still much that is not known about how bTB spreads, how it can be diagnosed more accurately, and what can be done to prevent its spread in and between cattle herds and wildlife. In 2016, DAERA continued to invest in bTB and wildlife research and studies to build evidence to help deal effectively with the disease risk factors and reduce bTB further.

16.2 The following studies/projects have been commissioned (ongoing and new) in 2016 as part of the DAERA's ongoing portfolio of research on bTB:

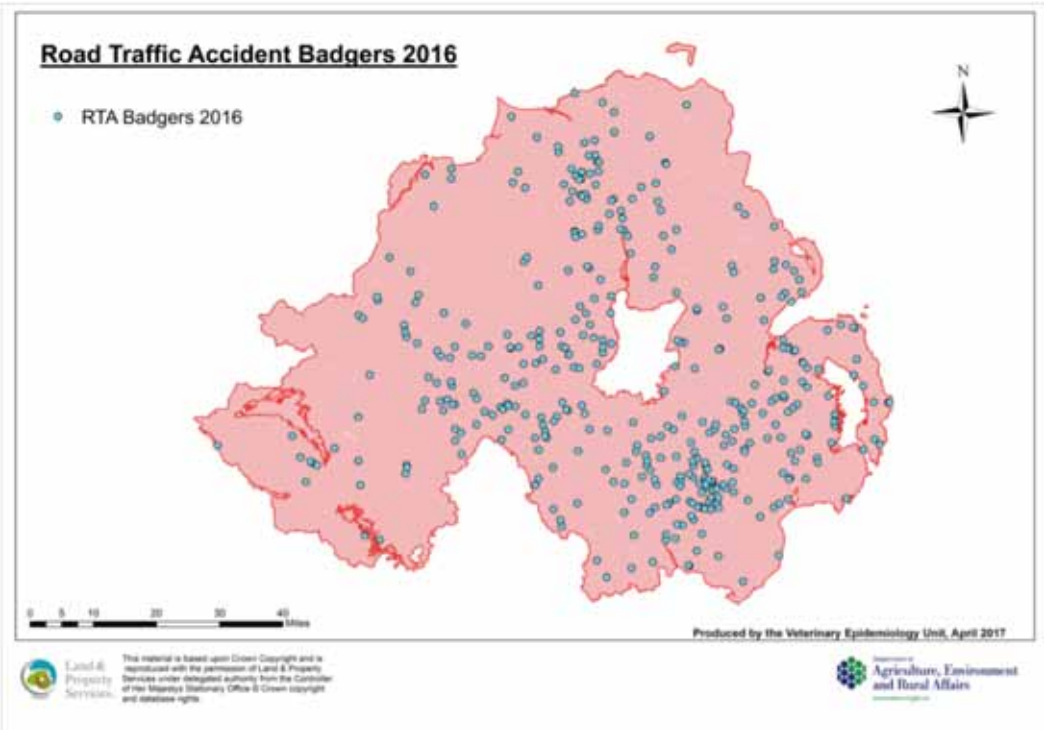
- Investigating TB transmission dynamics using genome epidemiology.
- An evaluation of the role of multiple reactor and chronic breakdown herds in the epidemiology of bTB in NI.
- The role of endemic diseases and other factors in the occurrence of bTB.
- Resuscitation Promotion Factors enhanced culture of *Mycobacterium bovis* from clinical tissue.
- Optimisation and enhancement of the test format for the IFNG.
- To improve reliability of genomic prediction for TB resistance in cattle.
- Bovine TB molecular epidemiology analysis of cattle movements and optimization of epidemiological investigations.

16.3 Furthermore, DAERA progressed with Year 3 of the Test, Vaccinate or Remove (TVR) Wildlife Intervention Research Project in County Down. Field activities commenced in late June 2016. Co-operation by land owners has been excellent and they were visited to update the DAERA's TVR land ownership information, carry out survey work and to start the initial digging in of cages. The actual capture of badgers started in July to comply with the conditions of the Northern Ireland Environment Agency (NIEA) licence. Captured badgers were tested for TB (using a sett side test), microchipped, examined and had other diagnostic samples taken. As per previous years, the TVR field activities were carried out by a dedicated team from VSAHG. Field work was completed on 21 October 2016.

16.4 There were a total of 586 capture events in 2016, with 271 unique badgers being cage trapped. This is the second year that badgers positive to the sett side test were removed; those that tested negative were vaccinated and released. It is not proposed to disclose the number of test positive badgers removed during the TVR Research Project, as this could potentially undermine the project (and possibly lead to a change in land owner behaviour), and lead to premature, inaccurate or misleading claims about the effect of the TVR approach. A report will be provided once the project has ended and following analysis of the relevant data. This is anticipated to be in late 2019. The TVR wildlife intervention research project year 3 report (2016) is available on the DAERA website.

16.5 The Badger Road Traffic Accident (RTA) Survey has been ongoing since 1998. During 2016 337 badgers were submitted and 53 (15.7%), of these were confirmed *M. bovis* positive. To report RTA badgers please phone 0776 7271431 or send an email to rtabadger@daera-ni.gov.uk. To balance the distribution of submissions, reports from the North West, West and Southern parts of Northern Ireland are very welcome. **Figure 32** shows the location of the RTA badgers collected during 2016.

Figure 32: location of collection of RTA badgers in 2016



More details about the projects and studies, as well as completed reports and literature reviews, are available on the DAERA website at TB research in Northern Ireland.

17. bTB in Other Species

DAERA considers the significance of disease confirmation in a non-bovine species in relation to the risk to the bovine population. During 2016, suspected TB lesions were examined at AFBI from four pigs, three otters, two deer, an alpaca, a chicken and a cat. Three of the pigs, both deer and the alpaca were positive for *M.bovis*.

> "... Three of the pigs, both deer and the alpaca were positive ..."

References

1 Goodchild A.V., Downs S.H., Upton P., Wood J.L.N, de la Rua - Domenech R. Specificity of the comparative skin test for bovine Tuberculosis in Great Britain. Veterinary Record 2015; 177: 258.

2 Olea-Popelka, F.J., White, P.W., Collins, J.D., O'Keeffe, J., Kelton, D.F., Martin, S.W. (2012): Breakdown severity during a bovine tuberculosis episode as a predictor of future herd breakdowns in Ireland. Preventive Veterinary Medicine 63, 163-172.

3 Doyle, L.P., Gordon, A.W., Abernethy, D.A., Stevens, K. (2014): Bovine tuberculosis in Northern Ireland: Risk factors associated with time from post-outbreak test to subsequent herd breakdown. Preventive Veterinary Medicine 116, 47-55.

4 Skuce, R.A., Allen, A.R., McDowell, S.W.J. (2011). Bovine tuberculosis (TB): a review of cattle- to-cattle transmission, risk factors and susceptibility.

5 Doyle, L.P., Gordon, A.W., Abernethy, D.A., Stevens, K. (2014): Bovine tuberculosis in Northern Ireland: Risk factors associated with time from post-outbreak test to subsequent herd breakdown. Preventive Veterinary Medicine 116, 47-55.

Annex

Reference Section 10 Surveillance Outputs paragraph 10.4.

Table A: bTB Herd Tests Completed in 2015 and 2016 by DVO area (Cattle>0).

	Routine		Restricted		Risk		Totals	
DVO	2015	2016	2015	2016	2015	2016	2015	2016
	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)
Armagh	1567 (9.7)	1564 (10.2)	573 (9.0)	705 (10.3)	1126 (9.8)	1073 (8.9)	3266 (9.6)	3342 (9.7)
Ballymena	980 (6.0)	997 (6.5)	354 (5.5)	344 (5.0)	612 (5.3)	532 (4.4)	1946 (5.7)	1873 (5.5)
Coleraine	1729 (10.7)	1523 (9.9)	942 (14.7)	948 (13.9)	1309 (11.4)	1639 (13.5)	3980 (11.7)	4110 (12.0)
Dungannon	2165 (13.4)	1952 (12.7)	679 (10.6)	943 (13.8)	1065 (9.3)	1246 (10.3)	3909 (11.5)	4141 (12.1)
Enniskillen	1996 (12.3)	2023 (13.1)	705 (11.0)	586 (8.6)	1861 (16.2)	1688 (13.9)	4562 (13.4)	4297 (12.5)
Mallusk	1320 (8.1)	1308 (8.5)	355 (5.6)	350 (5.1)	439 (3.8)	420 (3.5)	2114 (6.2)	2078 (6.0)
L'Derry/ Strabane	709 (4.4)	684 (4.4)	214 (3.3)	216 (3.2)	258 (2.2)	256 (2.1)	1181 (3.5)	1156 (3.4)
Newry	2544 (15.7)	2368 (15.4)	973 (15.2)	991 (14.5)	1931 (16.8)	2139 (17.7)	5448 (16.0)	5498 (16.0)
N'Ards	1129 (7.0)	1105 (7.2)	754 (11.8)	814 (11.9)	1315 (11.4)	1269 (10.5)	3198 (9.4)	3188 (9.3)
Omagh	2074 (12.8)	1881 (12.2)	842 (13.2)	947 (13.8)	1590 (13.8)	1839 (15.2)	4506 (13.2)	4667 (13.6)
Total	16213 (100)	15405 (100)	6391 (100)	6844 (100)	11506 (100)	12101 (100)	34110 (100)	34350 (100)

Figure A: Density of Herds with bTB Reactors in 2015

(Reference to Section 12 New Herds Breakdowns Paragraph 12.2)

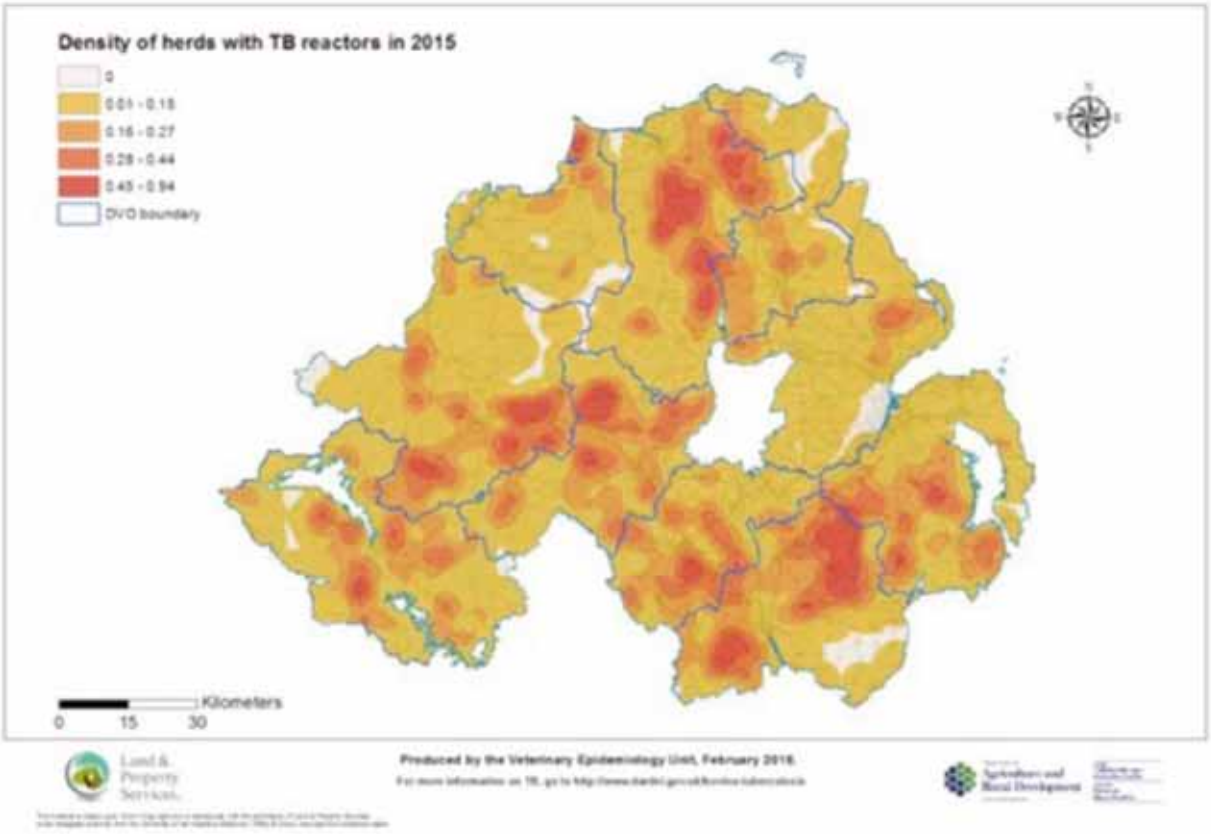
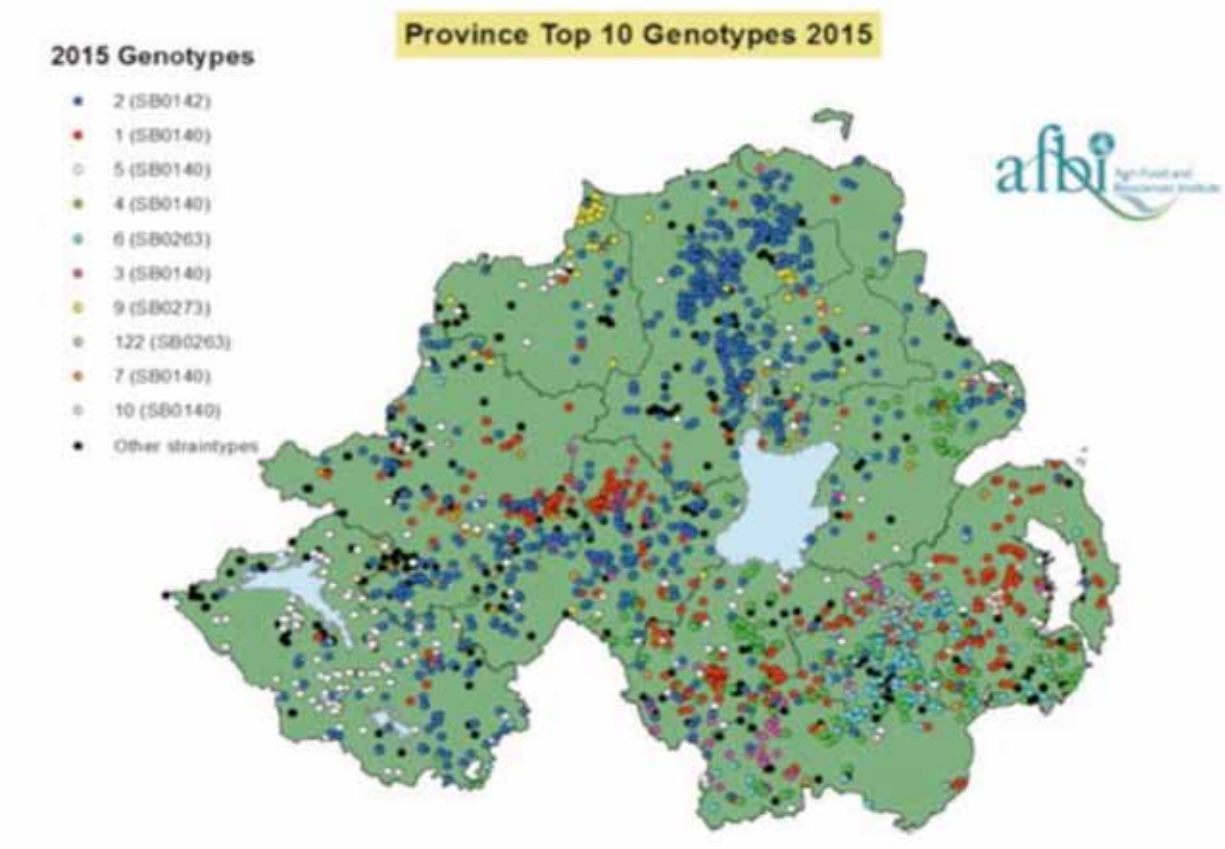


TABLE B: TOTAL ANIMAL LEVEL RISK bTB TESTS IN 2015 AND 2016 BY DVO AREA (Cattle > 0) (Reference section 10 Surveillance Outputs paragraph 10.6)

	CTQ		CTS		CTT		RI1		Total	
DVO	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)	Nr Tests (%)
Armagh	148 (14.1)	164 (16.0)	60 (15.0)	77 (22.6)	951 (14.8)	952 (15.2)	205 (11.7)	204 (13.0)	1364 (14.2)	1,397 (15.2)
Ballymena	51 (4.9)	66 (6.2)	7 (91.8)	6 (1.8)	327 (5.1)	318 (5.1)	143 (8.2)	101 (6.4)	528 (5.5)	491 (5.3)
Coleraine	114 (10.8)	151 (14.7)	36 (9.0)	35 (10.3)	753 (11.8)	611 (9.8)	299 (17.1)	260 (16.5)	1202 (12.5)	1,057 (11.5)
Dungannon	165 (15.7)	168 (16.4)	63 (15.8)	46 (13.5)	1063 (16.6)	1137 (18.2)	217 (12.4)	215 (13.7)	1508 (15.7)	1,566 (17.0)
Enniskillen	85 (8.1)	45 (4.4)	58 (14.5)	48 (14.1)	546 (8.5)	502 (8.0)	188 (10.7)	133 (8.5)	877 (9.1)	728 (7.9)
Mallusk	76 (7.2)	71 (6.9)	52 (13.0)	44 (12.9)	463 (7.2)	459 (7.3)	125 (7.1)	113 (7.2)	716 (7.5)	687 (7.5)
L'Derry/ Strabane	43 (4.1)	41 (4.0)	9 (2.3)	4 (1.2)	240 (3.7)	232 (3.7)	48 (2.7)	38 (2.4)	340 (3.5)	315 (3.4)
Newry	168 (16.0)	147 (14.4)	50 (12.5)	39 (11.5)	932 (14.5)	880 (14.1)	187 (10.7)	181 (11.5)	1337 (13.9)	1,247 (13.6)
N'Ards	76 (7.2)	81 (7.9)	25 (6.3)	15 (4.4)	467 (7.3)	454 (7.3)	141 (8.0)	126 (8.0)	709 (7.4)	676 (7.4)
Omagh	125 (11.9)	90 (8.8)	39 (9.8)	26 (7.6)	665 (10.4)	705 (11.3)	200 (11.4)	202 (12.8)	1029 (10.7)	1,023 (11.1)
Total	1051 (100)	995 (100)	399 (100)	321 (100)	6407 (100)	5647 (100)	1753 (100)	1567 (100)	9610 (100)	8490 (100)

Figure B: Distribution of the most prevalent bTB strain types in 2015 (Reference section 12 New Herd Breakdowns paragraph 12.3)



Glossary of Terms

Term	Definition
AFBI	Agri-Food and Biosciences Institute.
AHT	Annual Herd Test, a routine herd test carried out on a disease free herd to maintain OTF status.
Animal incidence	Number of reactors divided by the number of animals tested over a specified period of time expressed as a percentage (i.e. one animal with multiple tests is only counted once).
APHIS	Animal and Public Health Information System.
AVS	Approved Veterinary Surgeon. Private Veterinary Practitioner approved under the TB Contract.
bTB	Bovine Tuberculosis.
bTB confirmed	Two or more of the following have a positive result: SICCT (skin test), PME and histology. It can be confirmed on bacteriological culture alone.
Carryover (source of infection)	The herd had infection recently and although it might have passed two clear skin tests and the restrictions were lifted, it is suspected that some infected animals remained in the herd and this residual infection is the cause of the current breakdown.
Confirmation rate for skin test reactors	A reactor is confirmed either at post-mortem inspection (Visible Lesions) or by laboratory examination i.e. histology and/or bacteriology. The confirmation rate is the number of confirmed reactors out of the total number of skin reactors.
DAERA	Department of Agriculture, Environment and Rural Affairs.
Herd incidence	Number of new herd breakdowns divided by the number of herds with a herd level test over a specified period of time expressed as a percentage (i.e. one herd with multiple tests is only counted once).
IFNG	Interferon Gamma blood test.
Local spread (source of infection)	Infection in contiguous or nearby herds is suspected to be the cause of the infection in the herd, either by direct contact between animals or indirect contact (e.g. common contractors or machinery shared by both herds).
LRS	Lesion at Routine Slaughter: Suspect bTB cases identified at post mortem inspection of skin test negative animals slaughtered as part of normal business.

Glossary of Terms

Term	Definition
M. bovis	*Mycobacterium bovis* is the main bacterial agent causing bTB
New herd breakdown	A herd with at least one reactor animal where the herd had no other reactor animals during the previous 12 months. NB - In DAERA's routine statistics, herds with bTB confirmed from lesions found at routine slaughter, and no subsequent reactors during the breakdown, are not currently included.
NIC	Negative In Contacts (NICs) are animals that are not positive to a diagnostic test, but are removed on the basis of being at increased disease risk due to the extent of their exposure to disease.
OTF	Officially Tuberculosis Free.
OTS	OTF Suspended.
OTW	OTF Withdrawn.
Patch incidence	The percentage of herds at risk in each patch that were bTB infected during that year.
PME	Post Mortem Examination.
PVPs	Private Veterinary Practitioners.
Reactor	An animal that gives a positive response to the skin test is called a "reactor".
Reactor removal times	Number of working days between the test revealing the reactor animal and the death of that animal.
Restricted Herd Tests	**RHT, RH1, RH2 where: RHT:** Restricted Herd Test, an immediate test/ part test where the first reactor is disclosed at an individual animal test or infection is suspected at PME (LRS) and the herd has not been tested in the previous 60 days; also known as a stabilising test. **RH1:** - First Restricted Herd Test carried out at least 60 days after the removal or isolation of any reactor or LRS; or at least 42 days after a clear RHT.

Glossary of Terms

Term	Definition
	RH2: - Second Restricted Herd Test carried out at least 42 days (usually 60 days+) after completion of an RH1 without reactors in an OTW breakdown, and at least 120 days after removal or isolation of the last reactor or LRS.
Risk herd tests	**BCT; CHT; FCT; HRT, ICT; LCT; OHT & SCT** where: **BCT:** Backward Check Test set following risk assessment for herds that a reactor animal or routine slaughter case from an OTW herd passed through prior to being disclosed. **CHT:** Check Herd Test, to be completed 4-6 months after de-restriction for all herds that have been restricted due to a bTB breakdown and have no additional risk factors. **FCT:** Forward Check Test, herd test for herds into which a forward traced animal moved, and the animal cannot be tested due to its slaughter, death or export. **HRT:** High Risk Test, a test allocated to herds considered high risk, but which do not fall into other categories. **ICT:** Inconclusive Check Test, herd test to be completed at least 60 days after voluntary slaughter of an inconclusive animal by the herd keeper. **LCT:** Lateral Check Test, carried out on herds assessed as being at higher disease risk due to proximity to a diseased herd. **OHT:** Overdue Herd Test, an additional herd test that is required to restore OTF status of a herd that has failed to test within prescribed time limits. **SCT:** Status Check Test, a herd test carried out to restore OTF status following suspension/withdrawal due to the presence of cattle whose origins cannot be determined to the satisfaction of DARD. It may need to be repeated to restore OTF status, at the discretion of the local S/DVO, depending on the particular circumstances.
Risk individual tests	**RI1; CTS & CTT/CTQ**, where: **RI1:** Inconclusive retest, completed on individual animals at least 42 days after an initial inconclusive result. **CTS:** Check Test Status, check test carried out on animal(s) with identity or movement queries or which have missed a bTB test. **CTT/CTQ:** Check Test Trace /Check Test Query, check test of animal(s) forward traced from a breakdown herd. ***Note***: **PCT, PNA** and **PNT** are private tests, described but not included, in the figures presented in this Report. CTI tests are also excluded from the report as they are not a TB Programme requirement:

Glossary of Terms

Term	Definition
	PCT: Private Check Test; pre-movement tests for cattle being exported or moving to an AI Centre or Embryo Transplant clinic; **PNA:** Private Test, Move Not Allowed; automatically set for animals that have moved from an OTS/OTW herd to an OTF herd; **PNT:** Private Test Not Tested for 15 months; unrestricted cattle exceeding a 15 month bTB test interval. **CTI:** Check Test Import allocated for individual or groups of re-imported cattle for Trade Branch purposes. It is completed at least 42 days after any previous pre-export test, and at least 30 days post re-importation to an isolation facility on the farm of origin.
Routine Herd Tests	**AHTs** and **RSTs** (defined in glossary).
RST	Restocking test, herd test carried out when animals move into a herd that has had no stock for at least 2 years.
Sensitivity	Proportion of infected animals that are correctly detected by the test.
SICCT test	Single Intradermal Comparative Cervical Tuberculin test. Also known as skin test.
Skin test	See SICCT above.
Specificity	Proportion of negative animals that are correctly detected by the test.
VL	Visible lesions: Tuberculosis like lesions identified at post mortem inspection.
VO	Veterinary Officer.
12 month moving average incidence	Average incidence over the previous 12 months.

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