Animal & Plant Health Agency

Year-end descriptive epidemiology report: Bovine TB in the Edge Area of England

County: Cheshire

Year-end report for: 2020

TB Edge Area - CHESHIRE

TR398 (Rev. 03/21)

Contents

Executive summary

Reporting area

Cheshire is part of the Edge Area that was established in 2013. In 2014, the bovine tuberculosis (TB) surveillance strategy for this area was incorporated into the UK government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. This end of year report describes bovine TB in Cheshire.

Local cattle industry

Cheshire is predominantly a dairy county with some beef fattener and suckler herds of varying sizes, calf rearers, smallholders and pet cattle. There are no livestock markets within Cheshire.

New TB incidents

Overall, for the whole county, there was a decrease of 4.8% in the number of new incidents detected during 2020 (160) compared to 2019 (168). In the original Edge Area portion of Cheshire there was a marked decrease of 7.3% in new incidents in 2020 (114) compared to 2019 (123). In 2020, there were 85 OTF-W incidents (53.1%) compared to 113 (67.3%) in 2019.

In 2020 the herd incidence rate of TB in Cheshire was 14.7 per 100 herd-years at risk, down from 17.1 in 2019. Cheshire dropped to 10th highest incidence rate from 7th highest in 2019 for all counties in the Edge Area and HRA of England, so is showing an improvement in the overall disease picture.

Risk pathways for TB infection

Infected badgers were the most common (64.7%) weighted source of infection for new TB incidents in 2020, followed by unknown source (13%), residual cattle infection (8.6%); cattle movements (8.2%) and contiguous herds (3%).

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement to the 2020 bovine TB epidemiology reports.

Cheshire has two badger TB control areas, one of which has undergone culling since 2017 and the other since 2018. Two different genotypes of *M. bovis* were isolated from those carcases, which correspond with the genotypes most commonly identified in cattle herds in Cheshire.

Disclosing tests

The majority of new incidents in Cheshire in 2020 were disclosed at routine (six-monthly) whole herd testing (WHT) (90, 56.3%); six month post-incident testing (6M) (33, 20.6%); pre-movement TB testing (PRMT) (18, 11.3%), and slaughterhouse surveillance (SLH) (12, 7.5%).

Reactor numbers

In Cheshire in 2020, a total of 1,376 cattle were slaughtered as skin test reactors or as supplementary interferon gamma (IFN-γ) blood test positives due to a TB incident, compared to 2,059 in 2019. This is a decrease of 683 cattle (33.2%).

Of the total in 2020, 38.2% were IFN-γ test positives and 61.8% were skin test reactors. There was a decrease of 13.2% for skin reactors and a decrease of 51.3% of IFN-γ positives compared to 2019.

Risks to the reporting area

The key risks to Cheshire are spread via local cattle movement and contact and gradual spread of TB in local wildlife. Spread from the high incidence parishes in north Staffordshire (HRA), north Shropshire (HRA) and north Wales (Intermediate TB Area) are a particular risk due to there being no major geographical barriers to movements of either cattle or badgers.

In addition, longer range cattle, movements especially from the HRA, continue to be a risk, although an increased focus on more responsible sourcing of cattle may have reduced this slightly.

Risks posed by the reporting area

The risk posed by Cheshire to the Low Risk Area (LRA) via local cattle movement/contact and the gradual geographic spread of TB infection in local wildlife remains. This is particularly along the northern border with Greater Manchester, where the only major physical barrier is the M56 motorway.

However, the impact of cattle movements, both local and longer range, has been mitigated by the introduction of mandatory post-movement TB testing for the LRA in April 2016 and the increased focus on responsible sourcing of cattle.

Forward look

The ratio of OTF-W to OTF-S incidents has improved markedly since 2019, from 67.3% OTF-W in 2019 to 53.1% during 2020, likely indicating a lower burden of infection reflected in reduced reactor and IFN-γ positive numbers.

There has been a significant decrease in new incidents in the original Edge Area of Cheshire compared to 2019 and both the whole county incidence rate and prevalence have decreased. However, OTF status will not be achieved by 2025 which has a requirement for crude incidence of OTF-W incidents to be less than 0.1%.

Endemic infection amongst local badger populations remains a threat to cattle herds.

Introduction

This report describes the level of bovine tuberculosis in cattle herds in Cheshire in 2020. Bovine tuberculosis is caused by the organism *Mycobacterium bovis* (*M. bovis*) and will subsequently be referred to as TB.

This report explores the frequency and geographical distribution of TB in cattle herds. It examines what is likely to be driving TB in this area, and the risks the disease in this county may pose to neighbouring cattle.

Although other sources may refer to TB 'breakdown(s)', this report will use the term 'incident(s)' throughout. This report is intended for individuals involved in the control of TB, both in the local area and nationally. This includes, but is not limited to farmers, veterinarians, policy makers and the scientific community.

In 2014 the Government published its Strategy to achieve Officially TB Free (OTF) status for England by 2038. A key action was to recognise the different levels of TB in different parts of the country and to vary the approach to control accordingly. To this end three management areas were established (refer to Appendix 1).

Cheshire forms part of the Edge Area. Control efforts are seeking to slow down and reverse geographic spread, and to reduce the incidence rate. The aim is to obtain OTF status for the Edge Area as soon as possible.

Changes to the Edge Area

On 1 January 2018 the Edge Area boundary was expanded westwards to absorb the former High Risk Area (HRA) parts of the five previously split counties. Cheshire, Derbyshire, Warwickshire, Oxfordshire, and East Sussex all moved fully into the Edge Area.

Furthermore, the routine TB testing frequency of herds in the counties in the west of the Edge Area adjoining the HRA (or parts thereof) was increased from annual to six-monthly. The respective descriptive TB epidemiology reports for those five counties of the Edge Area will focus on the whole county and key differences between the old and new parts will be highlighted where relevant.

Cheshire was a split HRA and Edge Area county until the beginning of 2018. Prior to that, the majority of the county comprised the Edge Area with a relatively small portion of Cheshire, south of Nantwich, classed as HRA. Since 2015, six monthly herd surveillance testing was undertaken in the original Edge Area part of the county.

In January 2018 annual routine herd surveillance testing was replaced by six monthly herd surveillance testing in the whole county of Cheshire.

Since May 2019, cattle herds in the six-monthly parts of the Edge Area that meet certain criteria are eligible to return to annual surveillance testing (earned recognition). These criteria are either:

1) the herd has been in existence for at least six years and has not had a TB incident in that six year period
   or
2) the herd is registered to a bovine TB health scheme accredited under the Cattle Health Certification Standards (CHeCS) at level one or above

Changes due to COVID-19

During 2020, public health measures adopted by the government to contain the COVID-19 outbreak impacted the ability to carry out some TB testing due to social distancing and self-isolation guidelines, affecting both veterinarians and farmers.

In particular, from 23 March 2020, routine or targeted TB skin tests were not mandatory for cattle under 180 days old where, in the official veterinarian's judgement, the young stock could not be tested safely in line with social distancing guidelines. The temporary amendment allowing calves under 180 days old to be excluded from TB testing did not apply to short interval tests in TB incident herds (required to restore a herds OTF status) or pre- and post-movement testing.

Routine TB skin tests are required within a pre-defined window of time to maintain a herds OTF status. From 23 March 2020, for tests that were allocated until 30 June 2020, the Animal and Plant Health Agency (APHA) permitted an extension to the TB skin testing windows on a case by case basis, where testing had not been completed due to valid reasons associated with COVID-19. The testing window for short interval tests was also extended by up to 30 days, where tests were unable to be completed due to COVID-19.

Furthermore, on-farm epidemiological assessments carried out to establish the route of infection for a TB incident herd were carried out remotely, by telephone, for the majority of 2020.

Cattle industry

Herd types

Cheshire remains a predominant dairy county with 68% of cattle in this classification (Appendix 2). There are also numerous beef enterprises (25%) consisting of fattening herds, calf rearers and fattening units. Most of the dairy units breed their own replacements, but there are still a few ‘flying’ dairy herds where all replacements are purchased.

There are 520 herds (40%) of 50 or fewer cattle, which represent hobby farmers as well as small-scale beef herds, calf rearing units and small-scale pedigree dairy herds. A total of 30% of herds have over 200 cattle, which may include many dairy units and a few beef units (Figure 1).

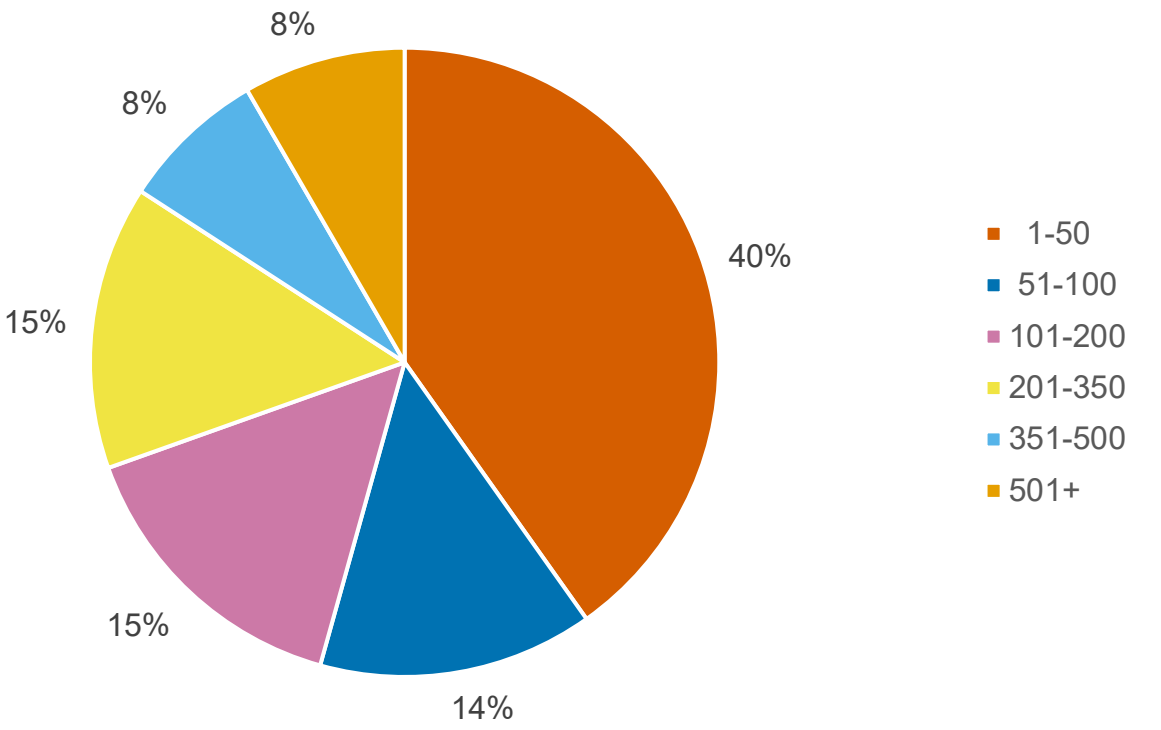


Figure 1: Proportion of cattle holdings in Cheshire, by herd size in 2020 (n=1294). Note: herds of an undetermined size are not shown.

Although there are many traditional family farms in the county, there has been a trend for some dairy herds to increase in size with just over 8% (108) consisting of more than 500 cattle, some with over 4,000 cattle. Some herds are constantly housed and are fed fresh-cut grass. Most herds feed a silage-based diet.

A minority practise ‘New Zealand’ style grazing systems where cattle are kept outdoors all year with densely stocked paddock grazing and minimal input systems. Most herds are still managed traditionally, utilising pasture grazing in summer and feeding conserved forage in winter whilst the cattle are housed.

Some of the larger dairy herds present potential challenges to TB management as they may operate over multiple premises under the same ownership or employ heifer rearers for youngstock.

Each herd management system differs in risk factors for TB infection, with more intensive units potentially more vulnerable to contamination of feedstuffs by wildlife and an increased potential for horizontal spread of infection in cattle housed in high densities.

Markets and abattoirs

There were no livestock markets operating within Cheshire in 2020. The closest markets are in neighbouring, Staffordshire, Shropshire (both HRA), Derbyshire (Edge), and Wales (Intermediate and High TB areas). Some of these offer APHA-approved outlets for TB-restricted cattle (orange markets). Purchases from markets in higher risk areas increase the risk of TB via cattle movements, although all cattle should be pre-movement TB tested before sale.

There are four red meat abattoirs within Cheshire, which provide a choice to farmers and others in nearby - Shropshire, Staffordshire, Derbyshire, and Greater Manchester. There are more livestock agents in Cheshire than in previous years who provide alternative outlets for TB-restricted calves and cull cattle via orange markets, movements direct to slaughter or to approved units. This reduces the need for farmers to travel further to markets and abattoirs outside their area and offers a wider economic choice for businesses.

There are several APHA approved non-grazing TB isolation units in Cheshire, which provide local outlets for calves and young cattle ultimately destined for the open market.

Approved Finishing Units

In 2020, there were 32 non-grazing Approved Finishing Units (AFU) compared to 28 in 2019, which represents an increase of 14%. The increase was a result of conversion from pre-movement testing Exempt Finishing Units (EFU) and the perceived risks of TB testing fat cattle destined for slaughter. As a result of this, the number of EFUs has decreased since 2019. There were three non-grazing and one grazing EFU registered in Cheshire in 2020 compared to six units in 2019.

The non-grazing AFUs present a much-reduced risk of TB transmission to wildlife and to other cattle herds. They also ease some of the financial burden of TB testing for the taxpayer.

Common land

There are no areas of common grazing for cattle in Cheshire.

Descriptive epidemiology of TB

Temporal TB trends

Three analytical measures are used to describe the level of TB infection in these reports.

1. The number of new herd incidents that were disclosed in each year (Figure 2).
2. The annual herd incidence rate, reported as the number of new incidents per 100 herd-years at risk (100 HYR) (Figure 3). This is the number of new TB incidents detected in the year, divided by the time those herds were at risk of contracting TB. The 100 HYR incidence rate is used in this report as it accounts for different intervals between herd tests that other incidence measures do not (such as new TB incidents per number of herds or tests).
3. The annual end of year herd prevalence (Figure 4). This is the number of herds under restriction due to a TB incident, divided by the number of active herds at the same point in time. Prevalence provides a snapshot of the burden of TB on the local cattle industry.

All three measures include Officially Tuberculosis Free Status Withdrawn (OTF-W) incidents, and Officially Tuberculosis Free Status Suspended (OTF-S) incidents.

OTF-W incidents are those in which at least one animal was identified with typical lesions of TB at post-mortem (PM) inspection, and/or positive for *M. bovis* on culture from tissue samples.

OTF-S incidents are those with one or more reactors to the Single Intradermal Comparative Cervical Tuberculin (SICCT) skin test, but without full confirmation of *M. bovis* infection by PM inspection or bacterial culture.

TB incidents in non-grazing AFUs are not included in the prevalence and incidence calculations (excluding Figure 5) in this report due to the limited epidemiological impact of these cases.

Furthermore, herds restricted because of an overdue test rather than a TB incident are also excluded from calculations. Hence measures of incidence and prevalence in this report may be lower than those reported in the official TB statistics.

Cheshire was a split HRA and Edge Area county prior to January 2018. Prior to 2018 the majority of the county was part of the Edge Area and a relatively small area bordering Shropshire and Wales was classed as HRA. The overall number of new TB incidents, as well as the herd incidence and prevalence for the whole county, are shown in Figures 2 to 4.

As shown in Figure 2, for the whole county there were 160 new TB incidents in 2020. This was a decrease of 4.8% compared to 2019 (168) and 11.6% compared to 2017 (181). Separation of the county into the original Edge Area and HRA shows a marked decrease of 7.3% for new TB incidents in the original Edge Area in 2020 (114) compared to 2019 (123) and 23.0% compared to 2017 (148 incidents).

By contrast, in the former HRA area of Cheshire, there was a 66.7% increase in new incidents in 2017 (33) compared to 2018 (55). This was likely due to increased TB surveillance testing introduced in January 2018. Since then, the number of new incidents in the former HRA decreased by 18.2% in 2019 (45) and slightly increased by 2% in 2020 (46).

During 2020, 85 out of 160 incidents were OTF-W (53.1%), compared to 113 of 168 (67.3%) in 2019, which is an improvement.

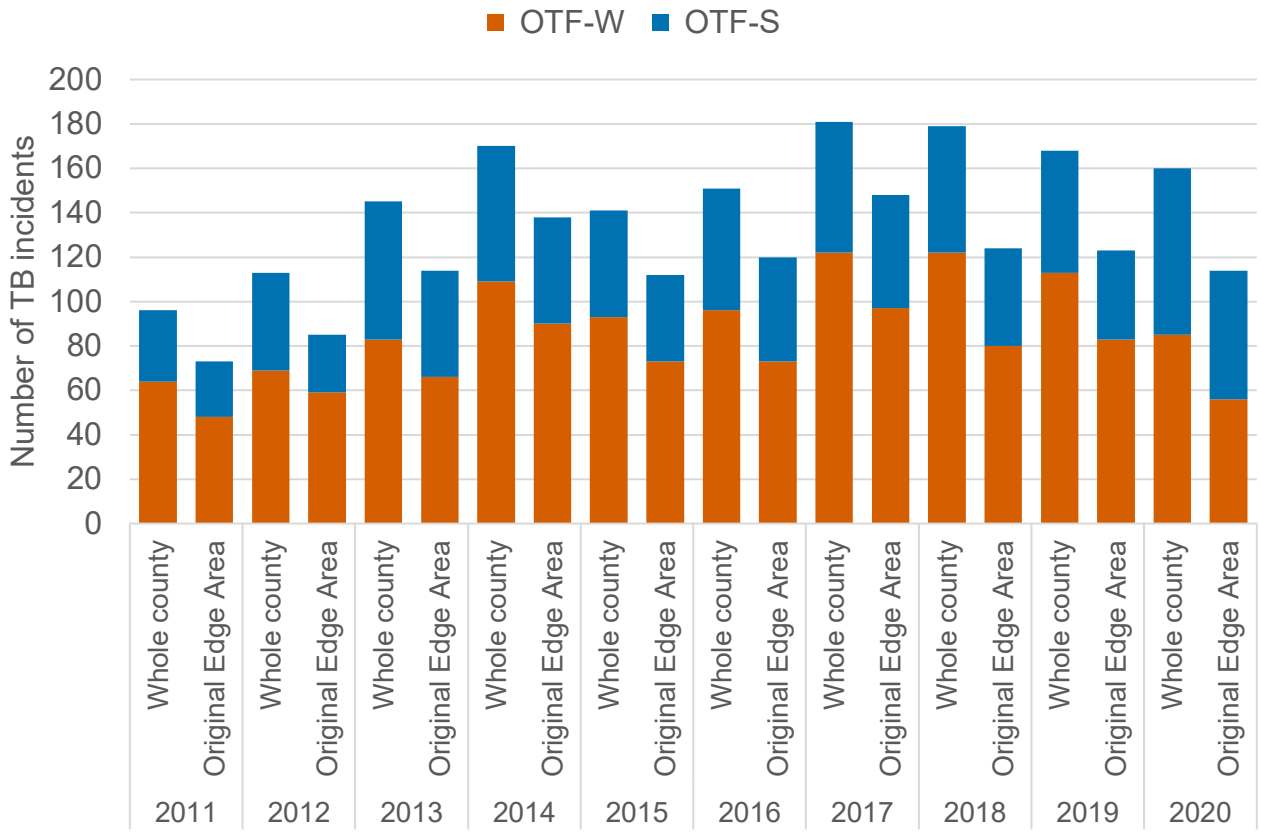


Figure 2: Annual number of new TB incidents in Cheshire, from 2011 to 2020, showing incidents for the whole county and the original Edge Area.

The annual herd incidence rate (incidents per 100 herd-years at risk) in the whole county had, until 2019, maintained a ten year upward trajectory to 17.1 (Figure 3). Positively, during 2020, this incidence rate decreased by 14.0% to 14.7. Earned recognition was introduced in 2019, allowing eligible lower risk herds to undergo annual rather than six-monthly herd testing. This will affect the denominator for this incidence rate measure of 100 herd-years at risk (HYR). A detailed description of the methodology used to calculate incidence per 100 HYR is available in the Explanatory Supplement.

This suggests that the reduction in new incidents in the original Edge Area has influenced the whole county incidence despite the slight increase in the former HRA. Enhanced herd surveillance and IFN-γ testing in the former HRA since 2018 has probably helped minimise cattle to cattle transmission. Other factors such as the reduction in environmental contamination and increased herd biosecurity in these areas add to these effects.

Figure 4 shows the annual end of year prevalence of TB-restricted herds over the past 10 years. The overall trajectory was upwards between 2011 (3.4%) and 2017 (8.5%). In

contrast, there has been a 22.9% decrease in prevalence since 2017, to 6.5% in 2020. The original Edge Area experienced a larger drop in prevalence between 2017 and 2020 of 38.8% (from 8.7% to 5.3%). Increased IFN-γ testing and reduction of environmental contamination may have influenced these figures.

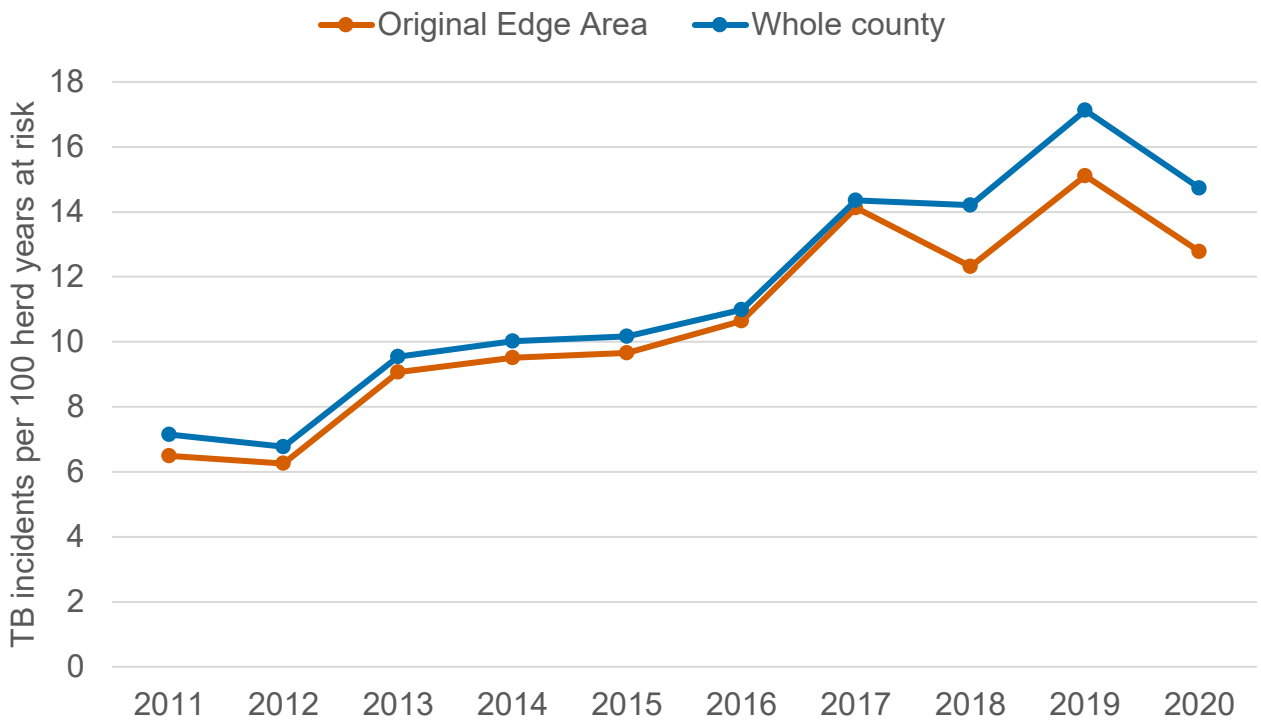


Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Cheshire, from 2011 to 2020, showing incidents for the whole county and the original Edge Area.

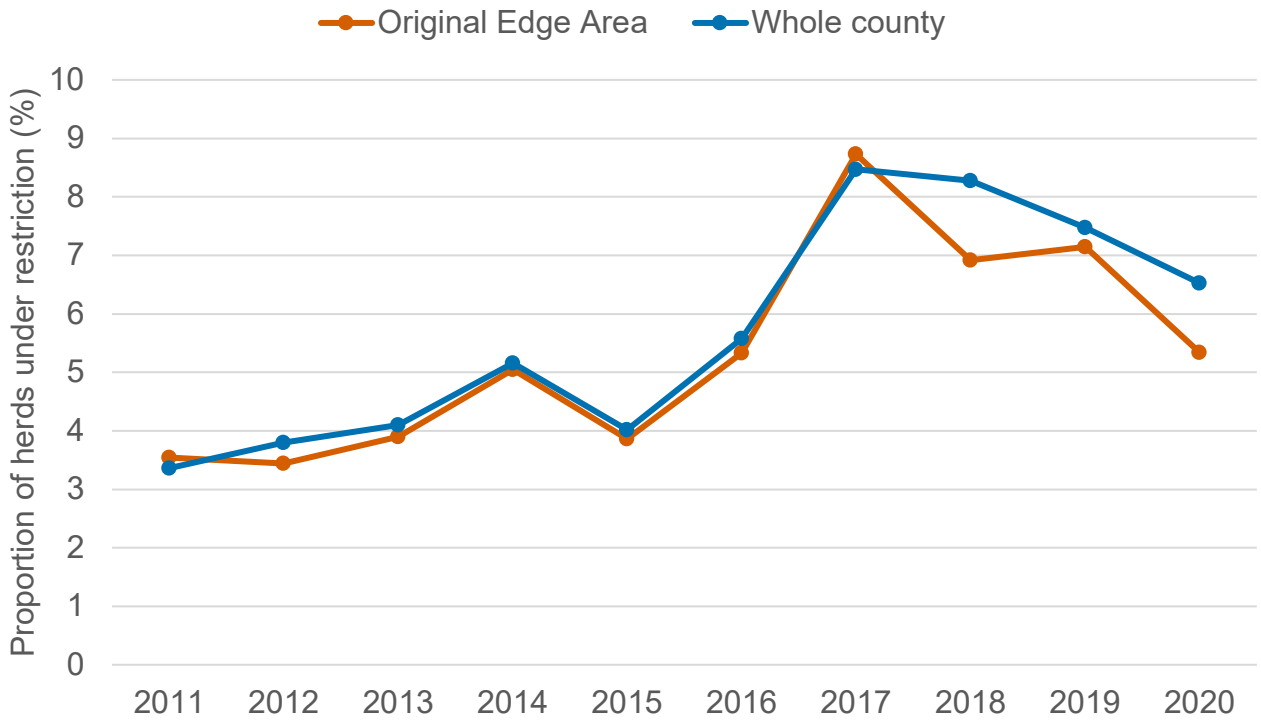


Figure 4: Annual end of year prevalence in Cheshire, from 2011 to 2020, showing incidents for the whole county and the original Edge Area.

With the current measures remaining in place for the near future, there is an optimistic outlook to achieve a sustained reduction of TB in Cheshire. However, OTF status is unlikely to be achievable by 2025 as it requires the crude incidence of OTF-W herd incidents to drop below 0.1%.

Geographical distribution of TB incidents

Figure 5 shows that in 2020 Cheshire dropped to tenth (14.8 incidents per 100 herd-years at risk) from seventh highest incidence in 2019 for all counties in the Edge Area and HRA of England. Shropshire had the highest incidence rate in 2020 (20.9) followed by Oxfordshire (19.7) and Staffordshire (19.1).

Both Staffordshire and Shropshire are in the HRA and contiguous to Cheshire. The total incidence rate for the HRA in 2020 was 16.3 compared to the Edge Area, which was 10.1. Cheshire was below the total incidence for the HRA in 2020, compared to 17.3 in 2019.

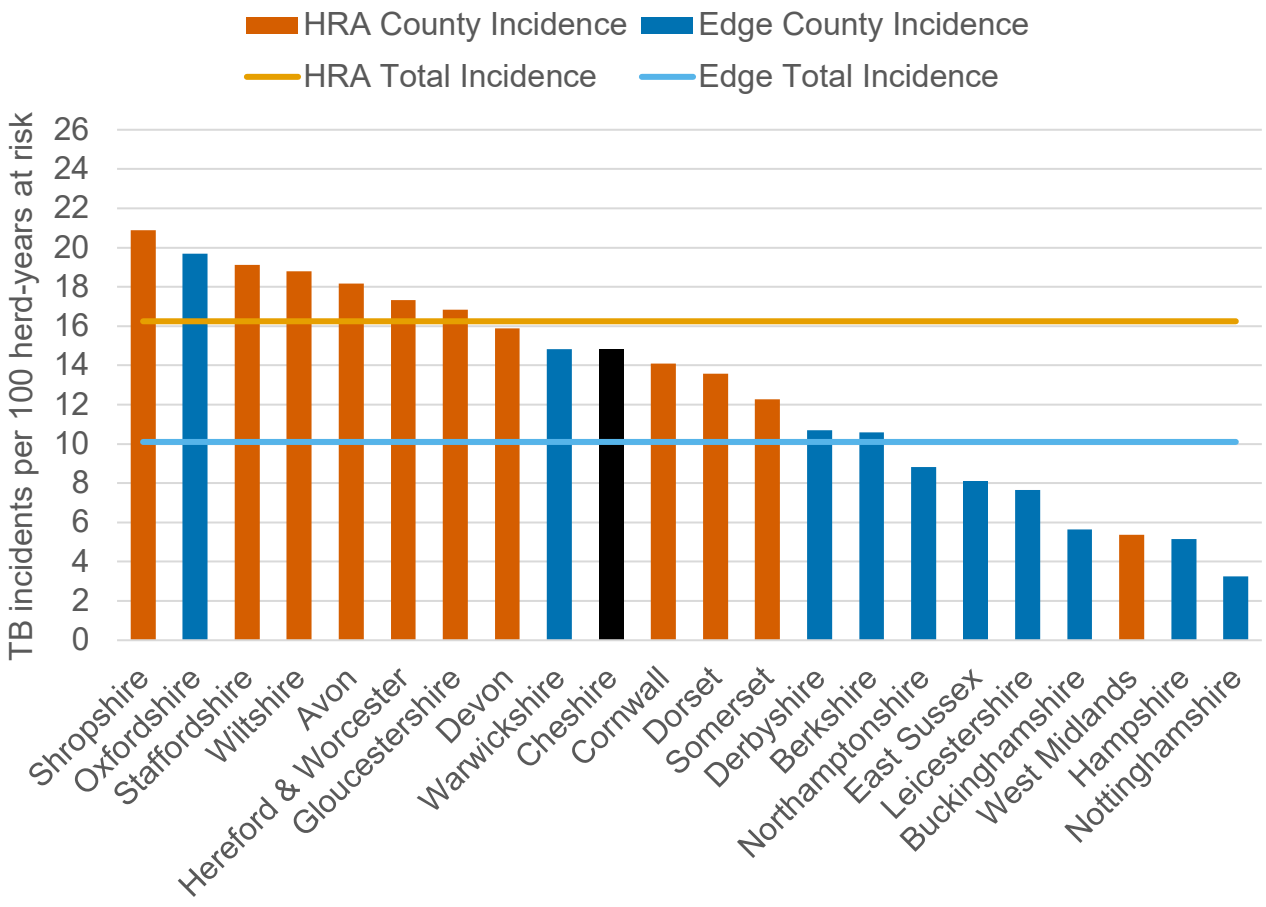


Figure 5: Incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S including finishing units) in 2020, by HRA and Edge Area county, highlighting the county of Cheshire.

Figure 6 shows the location of cattle holdings in Cheshire with new TB incidents (OTF-W and OTF-S) in 2020 and cattle holdings with pre-2020 OTF-W incidents that were still ongoing at the beginning of 2020, overlaid on a cattle density map. Figure 6 also shows incidents in which cattle movements were the most likely source of infection (represented by triangles pointing upwards).

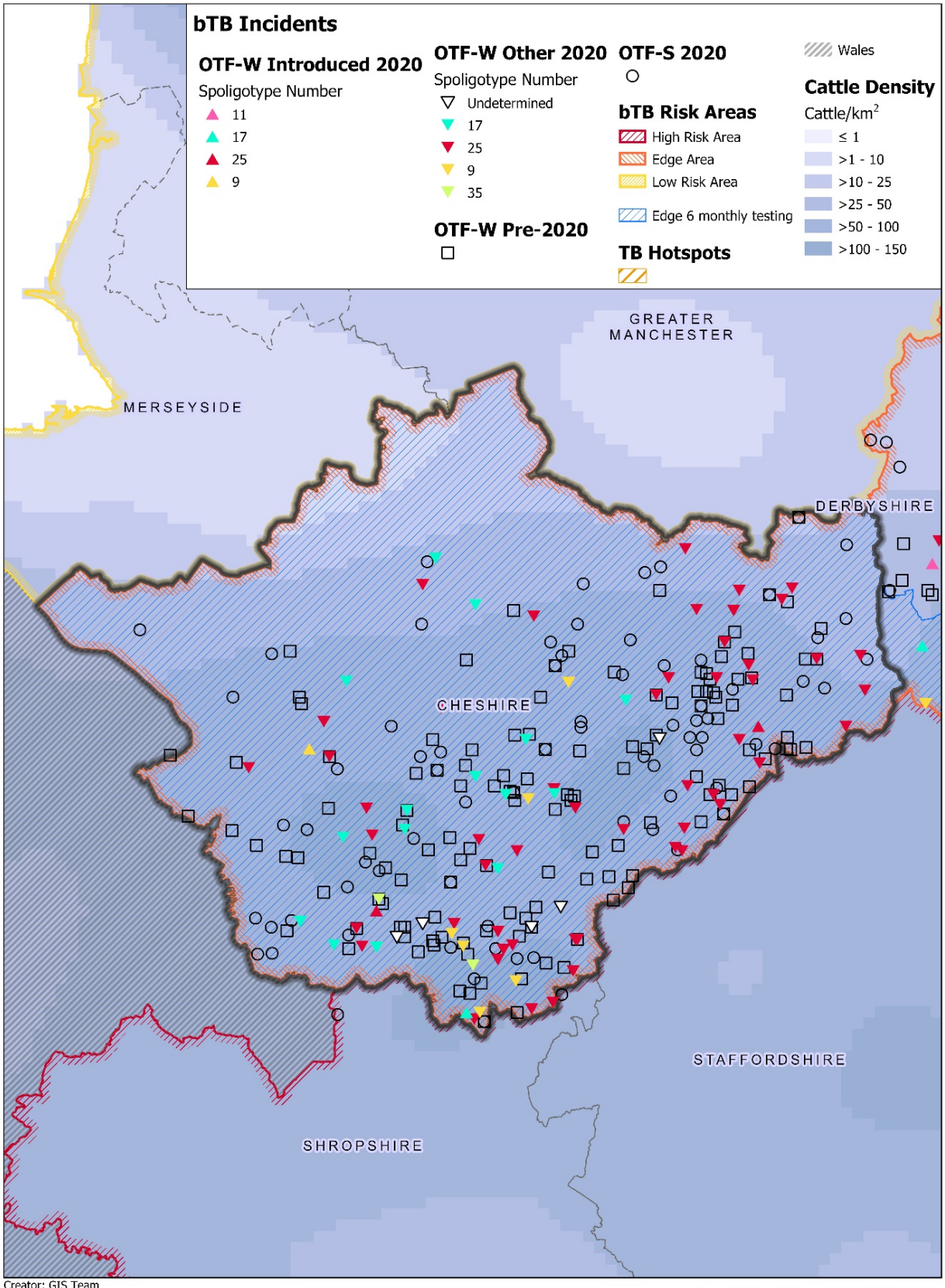
New incidents in 2020 were concentrated mainly in the south and east of the county, as in previous years, and this correlates with the highest cattle density areas. Towards the north and the north-west of the county both the cattle density and number of OTF-W incidents were much lower.

In eastern Cheshire the predominant spoligotype of *M. bovis* was 25:a, as seen in previous years. Although the number of incidents in this area appears similar to 2019, incidents in 2020 were more evenly divided between OTF-W and OTF-S rather than being predominantly OTF-W.

This could be due to multiple factors such as, but not limited to: increased knowledge of badger ecology and biosecurity on farms, awareness of the risks from cattle movements, and the established TB control programme in badgers, which has just completed its fourth season in this area. OTF-W incidents ongoing from previous years seemed to be concentrated in the central area and along the southern border of Cheshire.

The distribution of less frequently isolated spoligotypes 17 and 9 was similar to 2019. Spoligotype 17 is found centrally, extending to the south and south-west. Spoligotype 9 clusters south of Nantwich, although there are a few incidents further north. Low numbers of spoligotype 35 have been disclosed in the south-west of the county. This spoligotype has been seen in low numbers in the south and west of the county in previous years.

As in previous years, most incidents are not thought to have been introduced by cattle movements.



Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210701
Date: 01/07/2021

TB Cattle Density - Cheshire

0 3.75 7.5 15 Kilometers

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Information gathered by APHA at the incident investigation visit, looking at farm management, wildlife activity and cattle movements is used to rank possible risk pathways for the source of the TB infection. Analysis of this data is then carried out and Figure 7a displays the TB incidents in 2019 and 2020 in which a wildlife source of infection was attributed with 75% or greater certainty. This gives an indication of endemic infection within local wildlife populations.

Clustering of TB incidents to the east and south of Cheshire corresponds with the highest cattle densities, and with previous findings of TB infection in 15 to 21% of Cheshire badgers submitted during two studies in 2014 (badger found dead survey 2014) and 2016-2017 (badger found dead survey 2017). In these surveys the same genotypes of TB were found in cattle and badgers, however, the direction of transmission could not be determined.

TB incidents caused by genotypes 25:a, 17:a and 9:d of *M. bovis* were all within the homeranges of those strains, which span the south of Cheshire. The distribution of genotype 25:a was similar to previous years and this remains the predominant genotype in Cheshire.

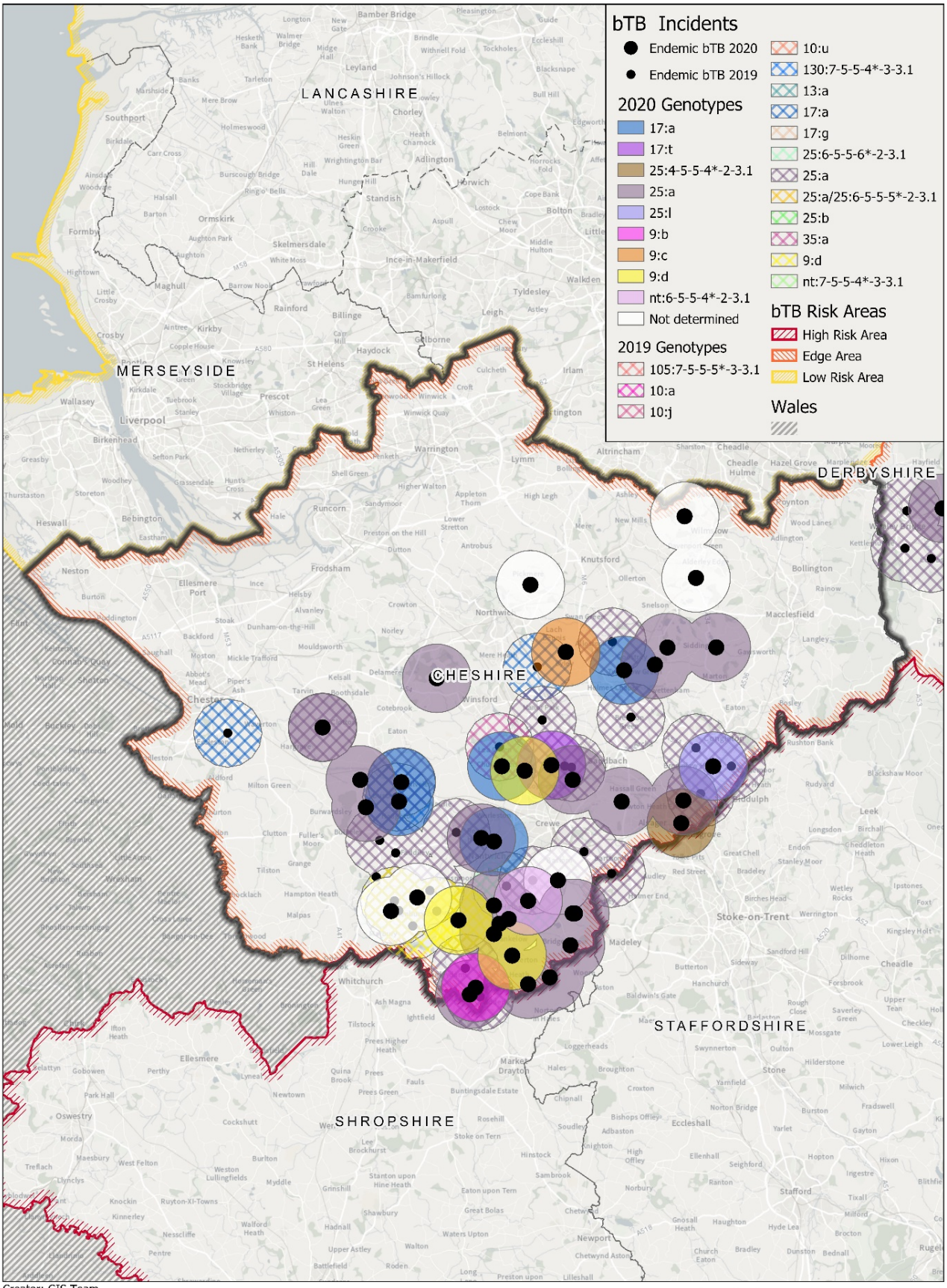
The distribution of 17:a was more dispersed than that of 25:a, but again similar to previous years. The original 9:d cluster, which was first seen in 2015, has stayed within the same area, south of Nantwich, however an additional cluster has appeared north of Crewe. These two clusters are not thought to be related by cattle movements.

A cluster of a new genotype nt:6-5-5-4*-2-3.1 appeared just south of Nantwich in 2020. In addition, genotype 25:l and another new one 25:4-5-5-4*-2-3.1 appeared on the border with Staffordshire (Figure 7b).

This area, in south-west Cheshire, has become a concern as it borders the Wrexham spur of north-east Wales. A sharp rise in TB incidence and prevalence across adjacent parts of rural Wrexham and Shropshire at the end of 2016 led to the inception of the so-called ‘cross-border cluster’, which now includes the nine Cheshire parishes.

The nine Cheshire parishes of the cross-border cluster continue to have a relatively low incidence, but recently there has been an increase in new incidents, some of which are recurrent.

Prevalence in the Shropshire part of the cluster (which is not adjacent to Cheshire) reached a peak in 2018 and then fell in 2019, rising again in 2020. The predominant genotypes found in all parts of the border cluster area are 17:a and 25:a.



Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20210611
Date: 11/06/2021

Endemicity - Cheshire

0 3.75 7.5 15 Kilometers

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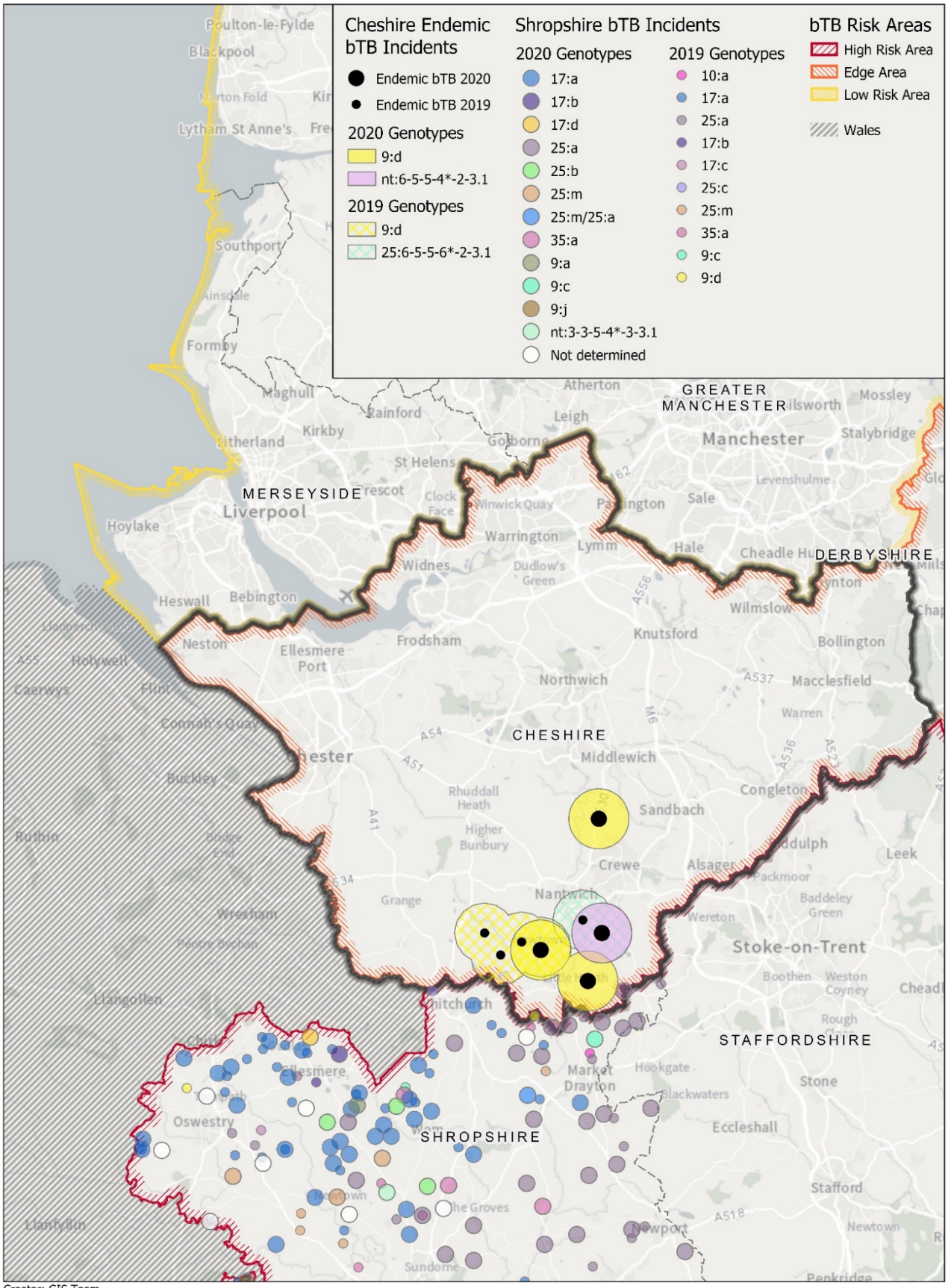
Cheshire Endemic bTB Incidents
Endemic bTB 2020
Endemic bTB 2019
2020 Genotypes
9:d
nt:6-5-5-4*-2-3.1
2019 Genotypes
9:d
25:6-5-5-6*-2-3.1
Shropshire bTB Incidents
2020 Genotypes
17:a
17:b
17:d
25:a
25:b
25:m
25:m/25:a
35:a
9:a
9:c
9:j
nt:3-3-5-4*-3-3.1
Not determined
2019 Genotypes
10:a
17:a
25:a
17:b
17:c
25:c
25:m
35:a
9:c
9:d
bTB Risk Areas
High Risk Area
Edge Area
Low Risk Area
Wales
MERSEYSIDE
GREATER MANCHESTER
DERBYSHIRE
CHESHIRE
STAFFORDSHIRE
SHROPSHIRE
Liverpool
Manchester
Stoke-on-Trent
Crewe
Chester
Wrexham
Shrewsbury
Oswestry
Nantwich
Sandbach
Middlewich
Northwich
Warrington
Widnes
Frodsham
Ellesmere Port
Neston
Southport
Blackpool
Poulton-le-Fylde
Formby
Kirkby
St Helens
Leigh
Atherton
Wilmslow
Knutsford
Macclesfield
Congleton
Alsager
Stone
Stafford
Newport
Market Drayton
Eccleshall
Hoylake
Heswall
Bebington
Runcorn
Holywell
Flint
Buckley
Llangollen
Whitchurch
Ellesmere
Hale
Sale
Altrincham
Bollington
Leek
Rhuddall Heath
Higher Bunbury
Grange
Wereton
Baddeley Green
Packmoor
Rough
Hookgate
Blackwaters
Boothen
Weston Coyney
Newtown
Penkridge
Llanfyllin
Creator: GIS Team
Source: Sam
OTFW data as at 15th of April 2021
Ref: 20211117
Date: 17/11/2021
Cheshire Endemic bTB Incidents and Shropshire bTB Incidents
0 4.25 8.5 17 Kilometers
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Historically TB has spread into south-east Cheshire from north Shropshire and north-east Staffordshire. As shown in Figure 8, the number of new incidents in the bordering parishes of Shropshire and Staffordshire are higher (darker shading) compared to other Cheshire parishes.

Genotyping of both badger and cattle isolates from the 2014 found dead badger survey suggest that the main Cheshire epidemic is an expansion from counties to the south and east, and not the result of distantly imported strains of *M. bovis*.

There are no physical barriers between Cheshire and Wales other than the River Dee, which makes up part of the border and is traversed by several bridges. There are no major physical barriers between Cheshire and Shropshire. The border with Derbyshire is where the Cheshire plain joins the hills at the edge of the Peak District. There are fewer large dairy farms in this area and more extensively grazed smaller herds mixed with sheep.

The M6 and the A500 are the only physical barriers between Cheshire and Staffordshire and may explain why the Cheshire parishes bordering Audley in Staffordshire, have had no TB incidents in 2020.

In addition, there are fewer cattle in this area. Two other bordering Staffordshire parishes have a high incidence. Biddulph, which adjoins Buglawton in Cheshire, which is an area with mostly smaller herds with a history of recurrent incidents going back many years. Both badgers and deer infected with TB were found in this area by a farmer approximately 10 years ago.

Also, Rushton Spencer and Swythamley in Staffordshire which borders Sutton and Macclesfield Forest. Farms in this area of Cheshire tend to be smaller and more extensively grazed and both badgers and deer are known to be present.

As shown in Figure 8, there is a continuing risk to Stockport,Greater Manchester (Low Risk Area) from north-east Cheshire, particularly in the bordering parishes of Mobberley, Wilmslow and Poynton. Apart from the M56 there are no significant geographical barriers or flood plains between North Cheshire and the LRA that would prevent wildlife movement. Increased urbanisation of land to the south of Greater Manchester and the loss of some farms and small holdings in this area may have reduced cattle density.

In 2020 four incidents were identified in these three parishes, three OTF-S incidents all in beef herds and one OTF-W incident in a dairy herd. This is an increase from 2019 when there were only two OTF-S incidents. All the herds were reported to be closed and three of the incidents were recurrent. Risk pathways included exposure to infected badgers via grazing or accessible feed and residual infection. The OTF-W incident had a spoligotype of 25.

In 2016, an NFU-funded badger survey disclosed eight *M. bovis* infected badgers out of 30 sampled in the bordering LRA parishes of Stockport and Greater Manchester. Cattle may also move to the LRA from Cheshire via livestock markets (although there are no longer any markets in Cheshire) or directly from farm to farm. Post-movement TB testing is mandatory in the LRA and so this, combined with compulsory pre-movement TB testing of eligible cattle

reduces the risk of undetected TB infected cattle entering the LRA. Although there are many large (mainly dairy) enterprises in Cheshire that have multiple premises across the county there are not known to be any that have business links or temporary County Parish Holding numbers (CPHs) with the LRA.

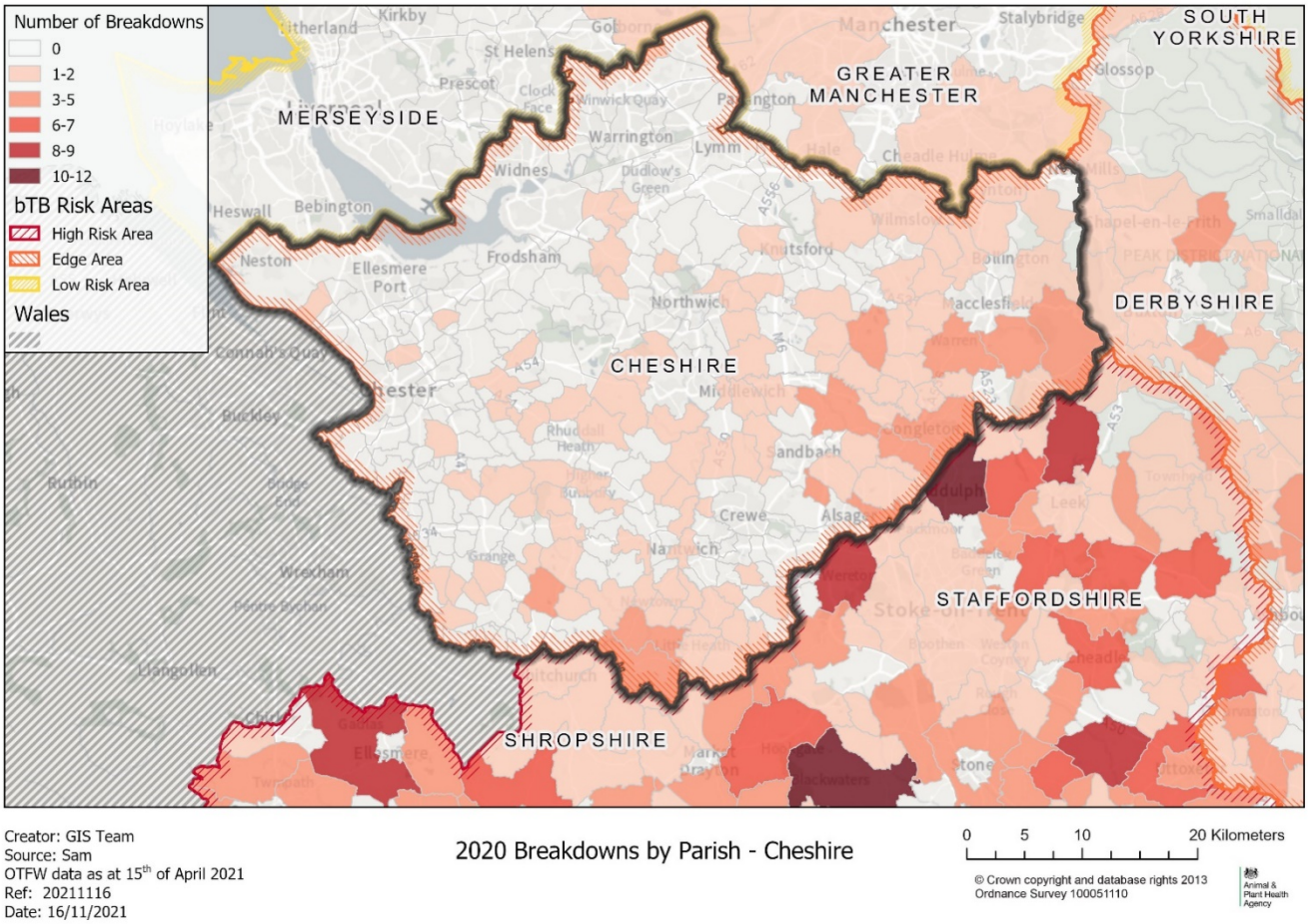


Figure 8: Map showing the TB incidents in Cheshire in 2020 and the surrounding counties.

Other characteristics of TB incidents

Incidents by herd type

Figure 9 below shows that in 2020, 68.1% of the total number of new incidents occurred in dairy herds. Herds with 201 or more cattle were responsible for 63.1% of all new incidents compared to herds of 200 or fewer cattle (36.9%). This is similar to the findings in 2019 and is an inversion of the demographic herd size of Cheshire (see Appendix 1).

This finding is consistent with herd size being a risk factor for TB. In Cheshire, the majority of larger herds are dairy . Beef fattener herds (excluding AFUs) accounted for 20.6% of all new incidents and beef suckler herds for 9.4%.

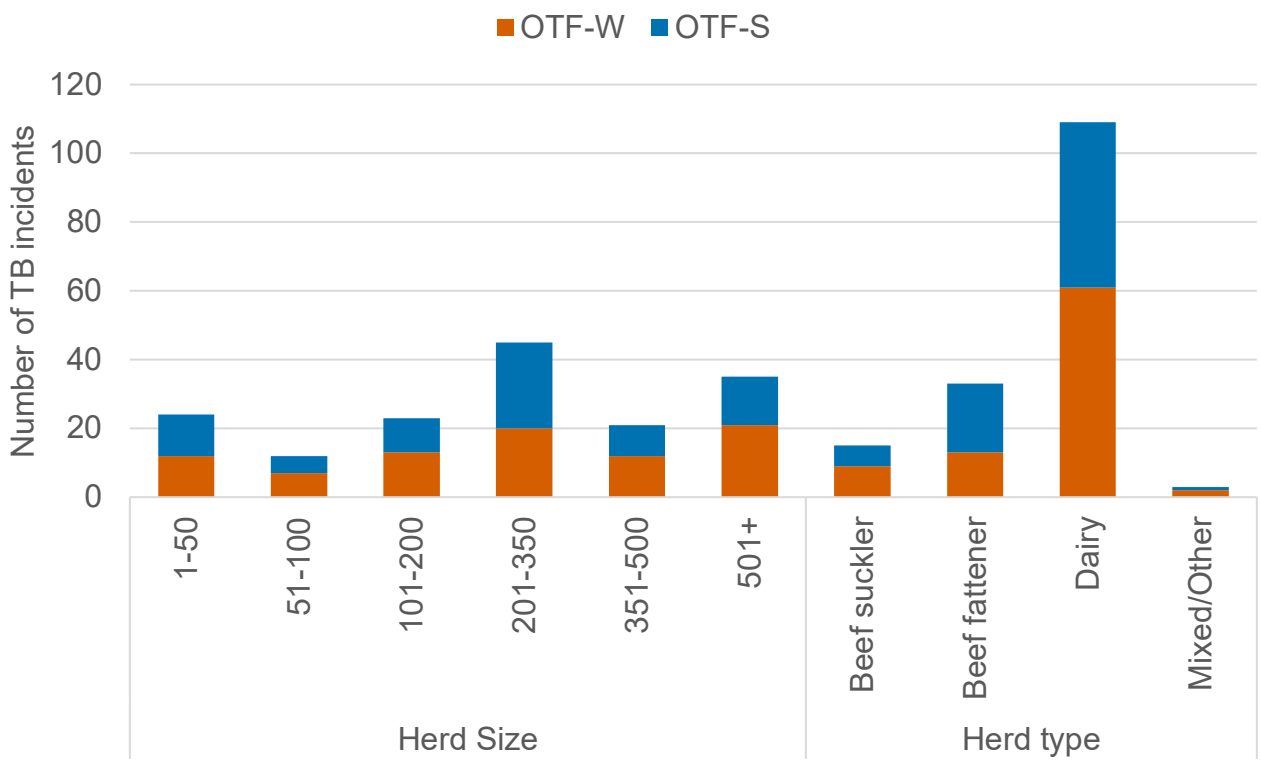


Figure 9: Number of TB incidents (OTF-W and OTF-S) in Cheshire in 2020, by cattle herd size and type.

TB has a varying impact on different sectors. Dairy herds in Cheshire are often the worst affected by TB movement restrictions, as they are unable to sell calves other than to approved finishing units or to slaughter. This has a marked impact on farm income, in particular financial penalties if they fail to meet milk quotas, all of which is a major cause of stress to many dairy farmers in Cheshire.

Suitable replacement dairy cattle can be difficult to source (organic status, calving pattern) and this is especially difficult for herds which are normally closed, as purchases can introduce other disease risks into the herds.

Beef suckler herds are affected to a lesser degree. However, many rely on annual sales of cattle and outlets which may not be available to cattle from TB-restricted herds. Sourcing replacement cattle may also be an issue.

Beef fattener herds are the least affected as they can continue to send fat cattle direct to slaughter. They may experience a hiatus in production through not being able to move cattle on before the first short interval test, which has a longer-term effect. Many will be encouraged to convert to non-grazing AFUs but may be bound by contracts that specify that cattle must be grazed in a certain time period before slaughter which prevents conversion.

Incidents by month of disclosure

Figure 10 shows the number of new incidents detected in each month during 2020. The peak months for disclosure were January (18 incidents), April and July (both 19), followed by March, August, and October (15 each). There does not seem to be any particular seasonal pattern in Cheshire.

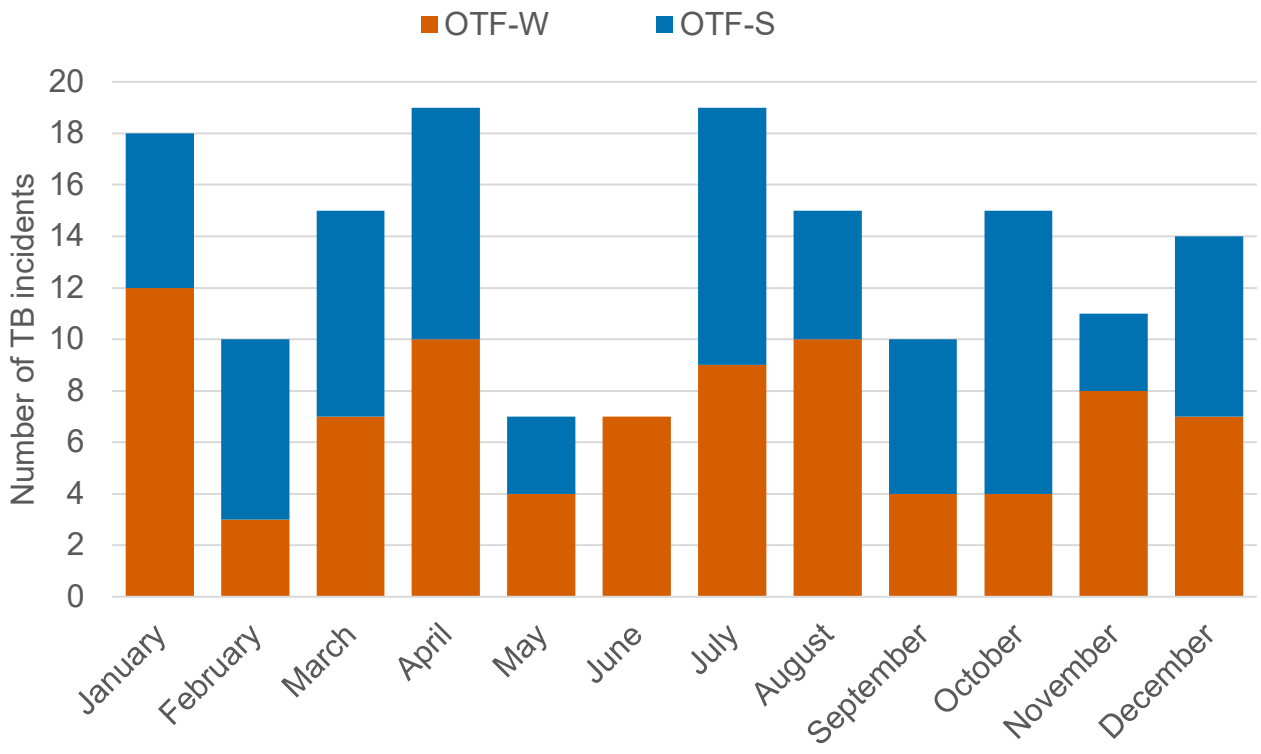


Figure 10: Number of TB incidents (OTF-W and OTF-S) in Cheshire in 2020, by month of disclosure.

The observed decreases in the number of incidents does not reflect the actual numbers of TB tests being done over the year (Figure 11). Peak testing tends to occur in spring before cattle are turned out and again in October and November at the start of winter housing. However, the peak testing volumes observed in March and November did not correlate with the number of new incidents observed in those months, so there are likely to be other factors involved.

TB testing continued mostly as normal despite the COVID-19 restrictions, with a few exceptions and delays due to shielding and official veterinarian's discretion to exempt cattle under 180 days of age on some farms in routine herd tests.

However, the total volume of testing was as expected, with a decrease year on year (see Table A3.2 in Appendix 3). Earned recognition of individual herds as having a lower risk of contracting TB could also be a factor in reduced testing volumes, as more cattle farms in Cheshire qualified for annual TB testing compared to previous years.

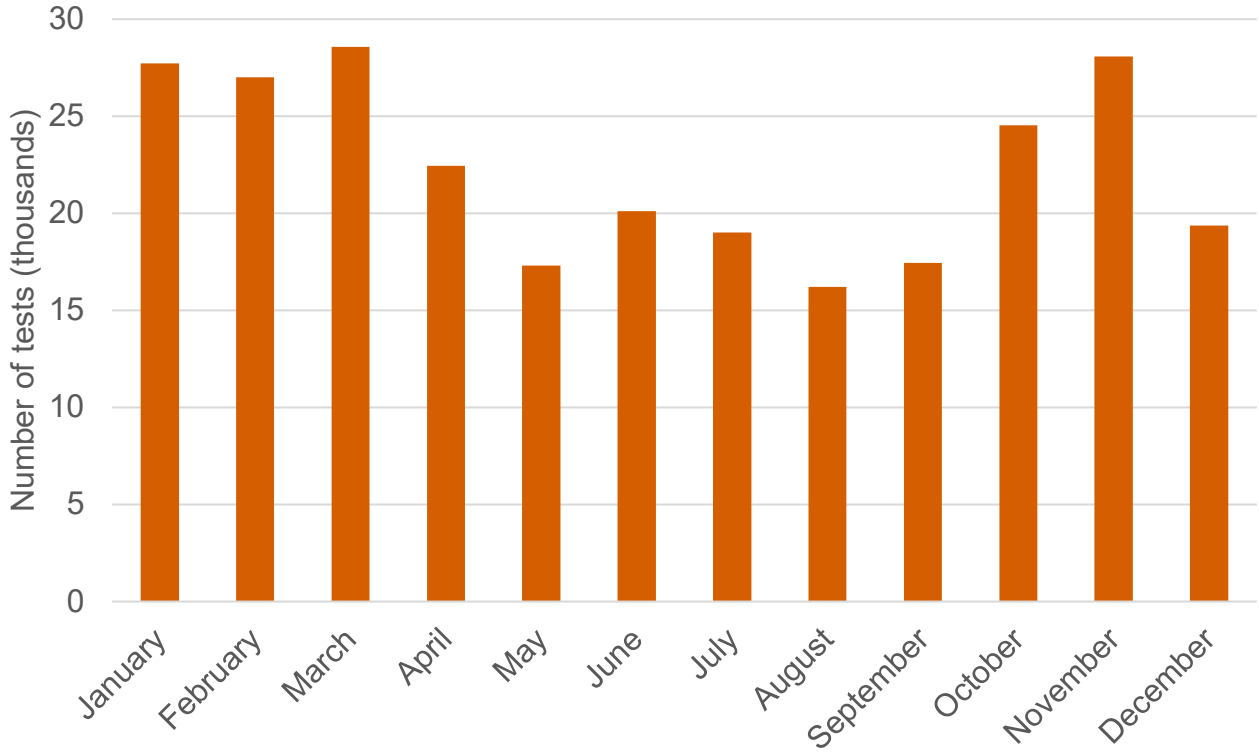


Figure 11: Number of tests undertaken in OTF herds in Cheshire in 2020, by month.

Duration of incidents

The distribution of the durations of TB incidents which concluded in 2020 can be seen in Figure 12. This pattern is similar to previous years and includes active incidents from previous years. The majority of incidents which closed in 2020 lasted up to 240 days (66.7%).

The mean duration of all incidents which concluded in 2020 was 313 days for OTF-W incidents, a 4.8% decrease compared to 2019, and 173 days for OTF-S incidents, a decrease of 23.5% compared to 2019. The median duration of OTF-W incidents was 233 days, which is a decrease of 14.3% compared to 2019.

These results suggest that overall, the duration of TB incidents is decreasing in Cheshire compared to previous years. This may be as a result of increased use of the IFN-γ blood test to supplement the skin test in herds with OTF-W incidents, which helps to maximise the detection of infected animals. Other factors influencing duration may include timely, meticulous tuberculin skin testing and increased herd biosecurity compared to previous years.

Earlier identification of infected cattle through six-monthly TB testing intervals may also be a factor in decreasing the rate of cattle-to-cattle transmission within herds. Reduction in environmental contamination with *M. bovis* as a result of badger TB control measures may also have played a role, as well as greater awareness of areas of the farm posing a risk of contact with TB-infected wildlife.

Only one of the TB incidents that were still open at the end of 2020 was classed as persistent, lasting over 18 months in 2020, compared to nine in 2019.

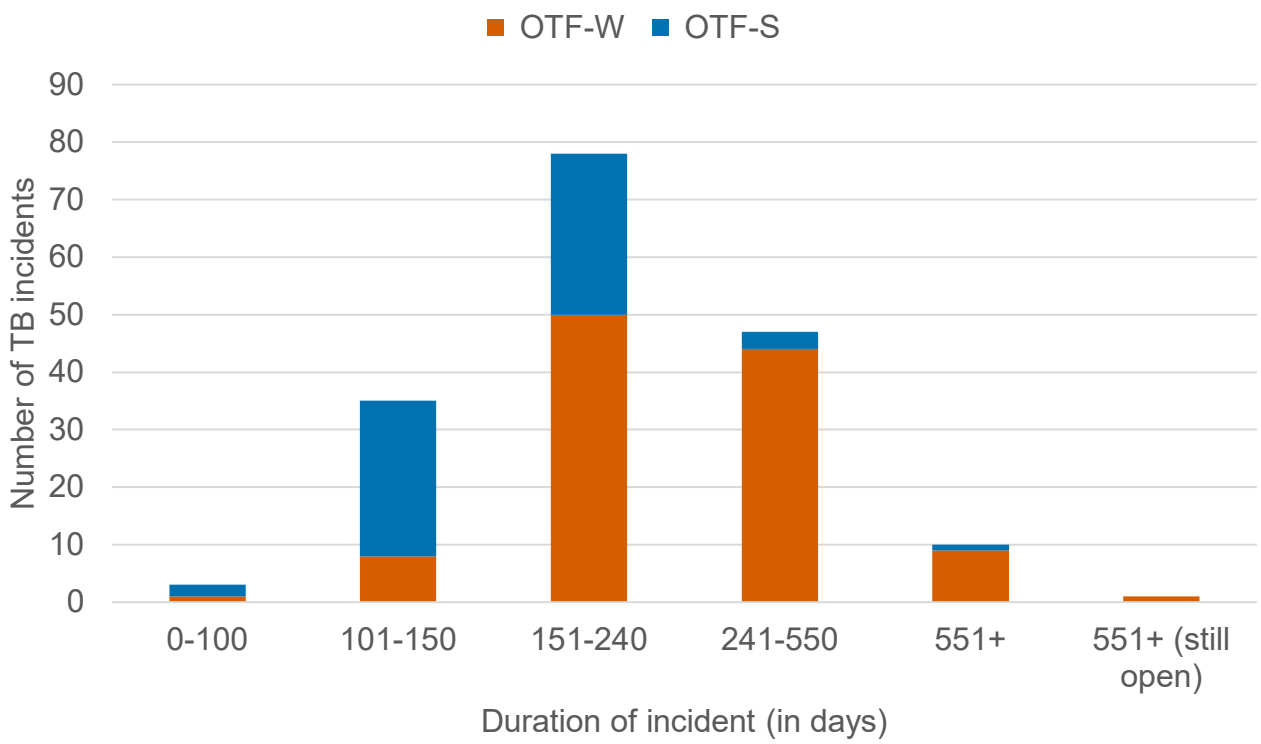


Figure 12: Duration of all TB incidents (OTF-W and OTF-S) that ended in 2020, and the number of persistent TB incidents (551+ days) that were unresolved at the end of 2020 in Cheshire. Note that Approved Finishing Units (AFUs) have been excluded.

Genotypes associated with TB incidents

Genotyping of *M. bovis* isolates has been used to trace the origin of TB infection. It is particularly useful in identifying where spread has occurred through cattle movements. Stable genotype clusters tend to be found in areas where there is a persistent local reservoir of infection.

APHA implemented whole genome sequencing (WGS) in place of genotyping from April 2021. During 2020 however, genotyping was still performed on *M. bovis* samples isolated from all OTF-W herds in the Edge Area.

As shown in Figure 13, the most commonly isolated genotype in Cheshire continued to be 25:a (63%), followed by 17:a (17%) and 9:d (5%), which is similar to 2019. The homeranges of genotypes 25:a and 17:a span much of Cheshire, whereas 9:d is more restricted to the south of the county. The homerange for Genotype 25:a also covers Staffordshire, North Shropshire, and Derbyshire, which border Cheshire. Genotype 17:a is often identified in Shropshire.

Genotype 9:d is associated with Wiltshire, but a cluster of incidents has developed in south Cheshire in recent years with evidence of local spread, most likely involving infected badgers in this area due to the lack of cattle movements between the affected herds. It is unclear how this genotype established in Cheshire but is likely to be via cattle or badger relocations.

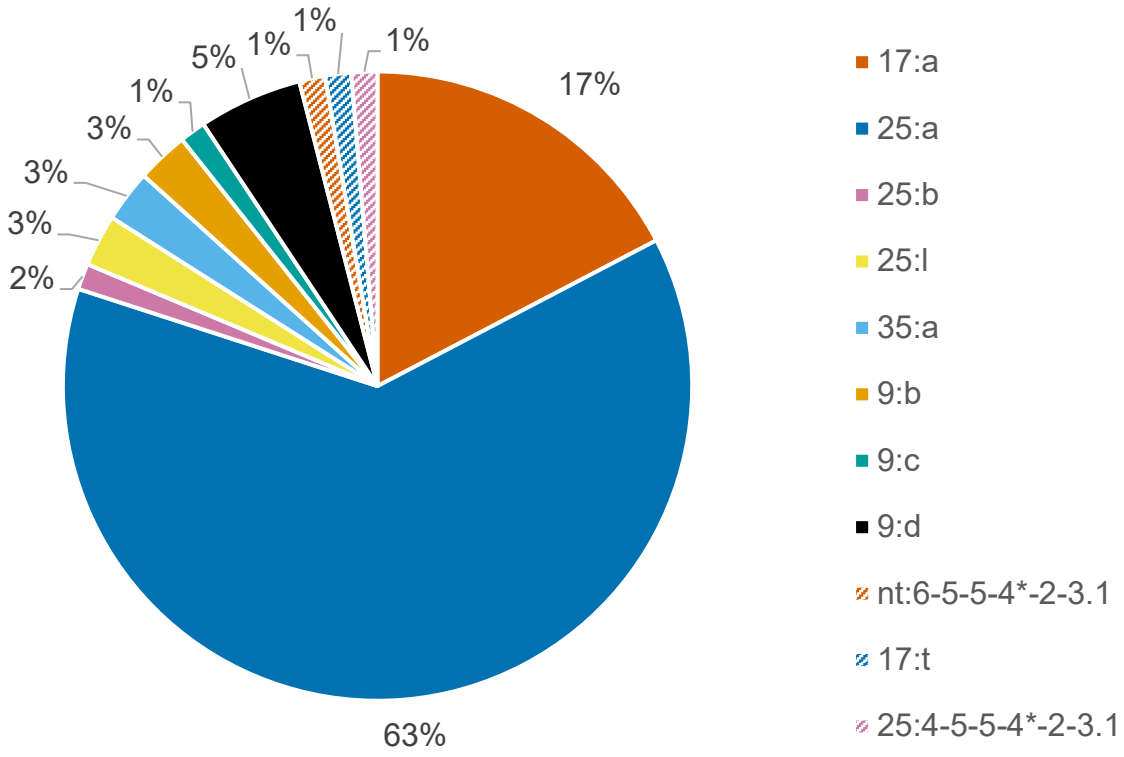


Figure 13: Genotypes of *M. bovis* identified in herds with OTF-W incidents in Cheshire that began in 2020 (n=75).

Prior to 2020, several herds have been infected with both genotype 9:d and 25:a, either during the same or different incidents. It appears that both genotypes are endemic within the badger population in this area as there were no cattle movements linking these herds. It is likely that increased sampling and genetic analysis would reveal more mixed infections.

An increasing but low number of incidents with genotype 35:a have occurred over the past few years in Cheshire. These are mainly in the south of the county near the border with Shropshire. The main homerange for genotype 35:a is central and southern Shropshire, but some incidents have also been disclosed in the parishes in north Shropshire near the border with Cheshire.

The Cheshire incidents of 35:a could be due to local cattle movements from north Shropshire or a gradual spread of the 35:a genotype in badgers in this area where there is no identified linked cattle movement.

Two new genotypes were isolated during 2020. The genotype 25:4-5-5-4*-2-3.1 was isolated on one farm in south-east Cheshire. There is only a total of 18 isolates of this genotype on the APHA database, most of which are from one parish in north Staffordshire, three in Shropshire, one in Derbyshire and one in Leicestershire and Rutland. The Cheshire incident was in a closed dairy herd which had previously had genotype 25:a.

The farm was located near the Staffordshire border and had a linked premises in north Staffordshire, which suggests that the infection may have originated from infected badgers around the linked premises.

Genotype nt:6-5-5-4*-2-3.1 is a completely new spoligotype pattern that has not been seen before anywhere in the UK. This spoligotype is similar to spoligotype 9. This was isolated in south Cheshire in a closed dairy herd. Interestingly, a previous incident in this same herd in 2019 disclosed another new type 25:6-5-5-6*-2-3.1, which was also found in a cluster on several other farms within the area in 2018 and 2019. New genotypes occur due to mutations in the bacterial DNA.

Unusual TB incidents

There were two incidents with a very high percentage of reactors, both caused by infection with genotype 25:a of *M. bovis*. They were both in small beef suckler herds managed separately for most of the time but located on the same holding. One had a percentage of TB test reactors of 67.2% and the other 41.2%. Also notable was the extremely high percentage of reactors with visible lesions of TB (79.1% and 85.7% respectively).

Both herds had been closed for 10 years and bred their own bulls and there was no opportunity for contact with other cattle. The herds had no previous TB history and so had reverted to annual TB testing in February 2019. The most likely risk pathway for both herds was exposure to TB from infected badgers via grazing or feed.

There were a total of eight herds (five dairy herds and three beef suckler herds) in Cheshire with between 10 and 22% of TB reactors, including a dairy herd with 106 reactors. Two herds with a percentage between 20 and 30% (both small beef herds) and one herd with a percentage between 30 and 40%, which was also a small beef herd. In one of these incidents the most likely risk pathway was a cattle purchase from the HRA. In all the others the most likely risk pathways were direct or indirect contact with infected badgers mainly at grazing or contamination of feed at housing.

No partial or whole herd slaughters of TB incident herds were carried out in 2020, although a small number of beef herds depopulated whilst under TB restrictions by their own choice.

There were no TB incidents in Cheshire in 2020 involving producer-retailers of raw milk, unpasteurised cheesemakers, farm gate raw milk sellers or open farms.

Suspected sources, risk pathways and key drivers for TB infection

Key drivers of infection

The key drivers of the TB epidemic in Cheshire during 2020 were as follows:

- Infected wildlife
- Infected cattle

M. bovis-infected badgers have been detected in two surveys of found dead badgers: one conducted in Cheshire in 2014 (badger found dead survey 2014) and the Defra funded survey conducted by Nottingham University in 2016-2017 (badger found dead survey 2017),

with an estimated prevalence of 15 to 21% in the carcases sampled. It is highly important to reduce the risk of indirect transmission from badgers and to promote awareness of the risks to farmers for improved biosecurity and for utilising all available controls.

Movement (translocation) of badgers from other risk areas should be discouraged as far as possible to reduce the risk of introduction of new *M. bovis* genotypes.

Infected wild deer have been found historically near Congleton, but none were reported in 2020.

Residual cattle infection in TB incident herds can result from the imperfect sensitivity of the skin test, but the mandatory use of the IFN-γ blood test in OTF-W herds is maximising the chances of detecting infected animals missed by the skin test and this test combination appears to be working well.

Many farmers prefer IFN-γ testing to skin testing as they recognise that it helps to remove undisclosed infection from their herd. Six-monthly routine herd testing is also useful in detecting cattle infection earlier and has been well accepted by Cheshire farmers after its adoption in this county in 2015.

The minority of herds that remain on annual TB testing should be carefully monitored, especially in higher risk areas of Cheshire, and particularly in badger control areas where undisclosed cattle infection could be a risk to wildlife.

Cattle movements appear to be less commonly involved as the origin of new TB incidents in Cheshire in 2020 than in previous years and many dairy replacements are being sourced from outside the UK from OTF countries. Farmers using markets outside Cheshire are become more TB risk-aware and this appears to be reflected in the range of genotypes isolated in Cheshire with the majority being within homerange.

Flying dairy herds are also sourcing replacements from lower risk areas compared to previous years.

Cross-border cattle movements have become much less common than previously, with many fragmented large farms now remaining within the same risk area. Promotion of contingency planning in the event of a TB incident would be useful, particularly for heifer rearers where problems have occurred in recent years. The use of a dedicated heifer rearer should be advocated.

Links to the main premises within the same risk area should be created to avoid potential welfare issues through prohibited cattle movements and lack of milking facilities at the rearer premises in the event of a TB incident.

Further reducing the risk of moving cattle from the HRA may be achievable using post-movement TB testing as it appears to have worked well in the LRA.

It is important to maintain and promote education surrounding good herd biosecurity and to maintain the use of all available control methods with the ultimate outcome of achieving a healthier cattle and badger population in Cheshire.

Sources of infection and risk pathways

It can be challenging to retrospectively establish the route of infection for a TB incident herd. APHA aims to complete an epidemiological assessment for all TB incidents in the Edge Area (both OTF-W and OTF-S).

This includes a thorough on-farm investigation and scrutiny of routinely collected data, such as cattle movement records, and the results of molecular analyses where available. This information is captured on the Disease Report Form (DRF).

During the assessment up to three risk pathways of infection are selected for each herd. Each risk pathway is given a score that reflects the likelihood of that pathway bringing TB into the herd.

The score is recorded as either definite (score 8), most likely (score 6), likely (score 4) or possible (score 1). Risk pathway data are explored both at the herd and county level.

The most likely source of infection in individual TB incidents

The most likely source identified by the APHA veterinary assessment is explored spatially for individual TB incidents. The most likely source of infection for individual TB incidents discounts additional risk pathways identified with a lower level of certainty.

Where two sources were ranked equally as the most likely source for an incident, both sources are reported for the incident using a split symbol in the map.

The most commonly attributed source of infection for TB incident herds in Cheshire was infected wildlife, as shown in Figure 14. These incidents were mainly concentrated in east Cheshire, south Cheshire (former HRA) and part of mid Cheshire and this reflects the locations of TB-infected badgers found in the badger surveys.

Incidents related to purchased cattle sources were sporadic and more randomly distributed, as would be expected.

There are a few incidents concentrated in east Cheshire attributed to local cattle or contiguous contact. Most cattle farmers erect double fencing or have an arable break between their property and their neighbours. Consequently, nose to nose contact of cattle has become a less frequent source of infection.

In 2020, there were proportionally many more OTF-S incidents than in 2019. This proportion was 31.8% in 2018, 32.7% in 2019 and 46.9% in 2020. Reasons for this include less environmental contamination, fewer cattle movements, fewer infected badgers interacting with cattle, and improved biosecurity. Bacterial genotyping for OTF-S incidents is not available, so often the exact source of these incidents cannot be attributed.

Undetermined sources are usually due to equal weighting being given to several risk pathways such as residual infection, badgers, or local cattle movements if the herd has the same genotype of *M. bovis* as a recent incident or if it is OTF-S.

Out of 160 new incidents in 2020, 20 Disease Report Forms (DRFs) were not completed. Eight were not selected under a triage system, and the remaining 12 were not completed possibly due to factors relating to COVID-19 and having to conduct remote interviews with farmers.

Of the DRFs that were completed (all by trained APHA veterinary staff), the risk pathways were carefully considered and then reviewed at the end of the incident in order to draw conclusions. In addition, these findings undergo peer review plus further analysis as described above.

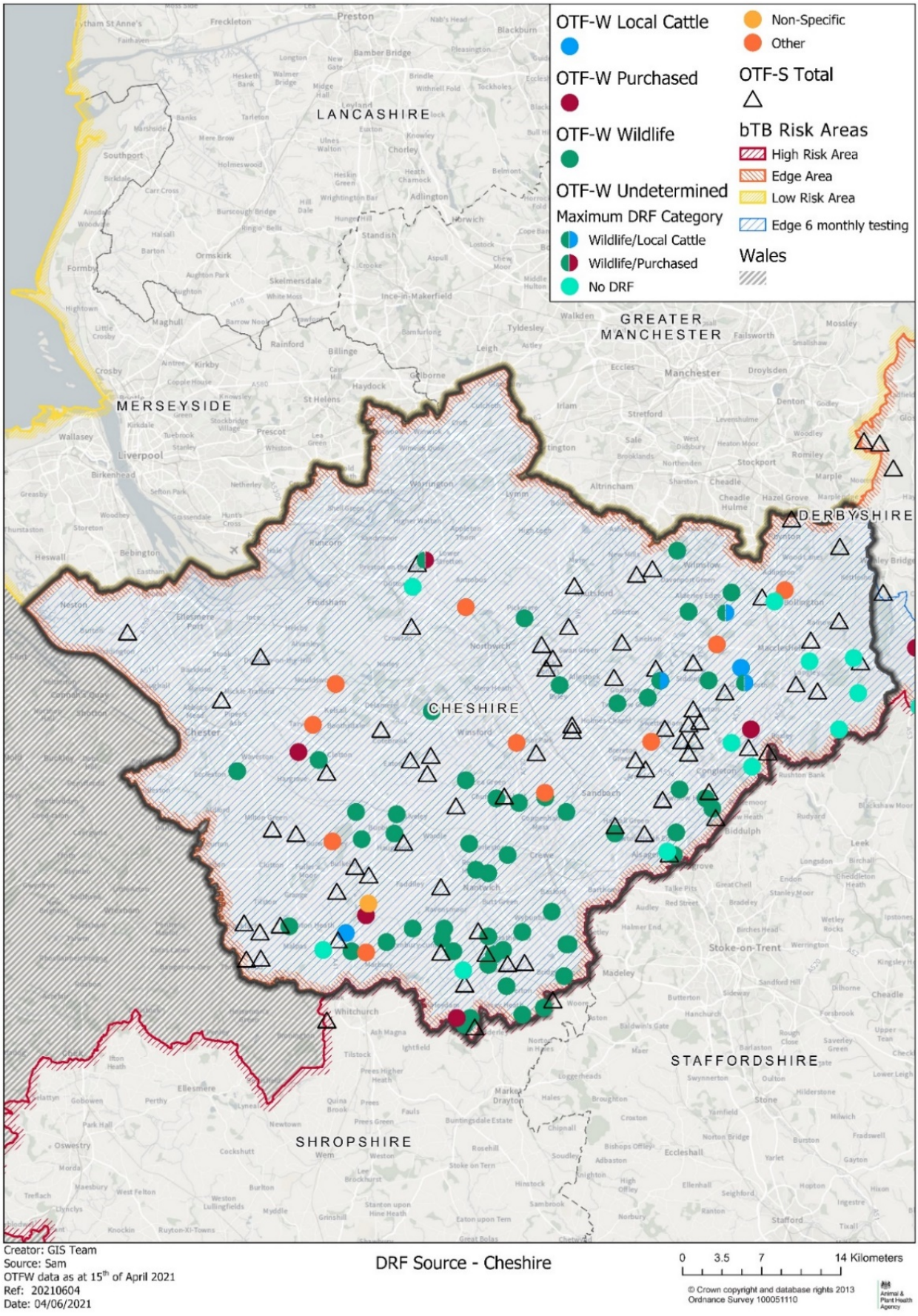


Figure 14: Map of the source of infection pathway recorded with the highest level of certainty, for all TB incidents (OTF-W and OTF-S) in Cheshire which started in 2020. Where none of the sources of infection were identified with greater than 50% certainty, the highest ranking source is displayed with an OTF-W undetermined 'maximum DRF category' symbol.

The weighted source of infection at county level

To consider the contribution of all sources of infection within an area, the source(s) for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely, or possible sources can contribute towards the overall picture for possible routes of introduction into a herd.

If the overall score for a herd is less than six, then the score is made up to six using the 'Other/Unknown Source' option. Buffering up to six in this way helps to reflect the uncertainty in assessments where only 'likely' or 'possible' sources are identified.

The weight of infection outputs in Appendix 4 are produced by combining the data from multiple herds. This presents the overall proportion of pathways in which each source was identified, weighted by the level of certainty each source caused the introduction of TB. The outputs do not show the proportion of herds where each pathway was identified (this is skewed by the certainty calculation).

Genotyping of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however genotypes are not determined for OTF-S herds. The inclusion of OTF-S herds in these calculations increases the uncertainty in the outputs. As a result, the relative proportions of each risk pathway are very approximate and only broad generalisations should be made from these data. A more detailed description of this methodology is provided in the Explanatory Supplement.

Figures 15a and 15b show weighted source of infection pathways for OTF-W and OTF-S incidents, respectively. Both charts show very similar findings for both types of incident except for the unknown category, which is larger for OTF-S incidents (16.06%) than OTF-W incidents (10.11%) as would be expected.

Data on *M. bovis* isolates from badgers have not yet been added to the WGS database and would be useful for comparison of local genotypes found in cattle or other species.

However, based on genotype alone, the uncertainty is reduced in the absence of other factors, such as no record of inward cattle movements (closed herds); lack of out of homerange genotypes; no previous history of TB in that herd; lack of contiguous contact; badger activity on farm and relatedness to other infected herds in a local area, which result in more certainty in our conclusions.

The APHA WGS database for *M. bovis* is increasing in size and future reporting will involve WGS data. Ongoing wildlife surveillance of found dead badgers and deer would be very useful.

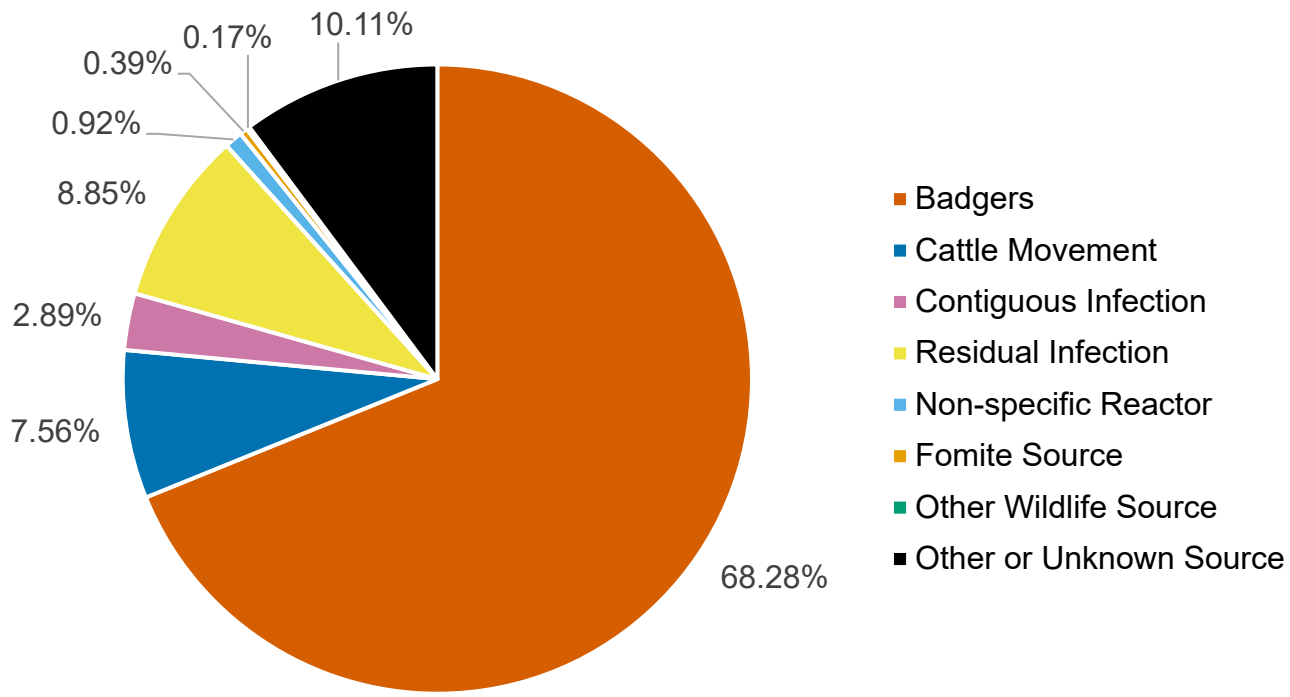


Figure 15a: Summary of the weighted source of infection pathways attributed for OTF-W TB incidents that started in 2020 in Cheshire, that had a completed DRF (n=72).

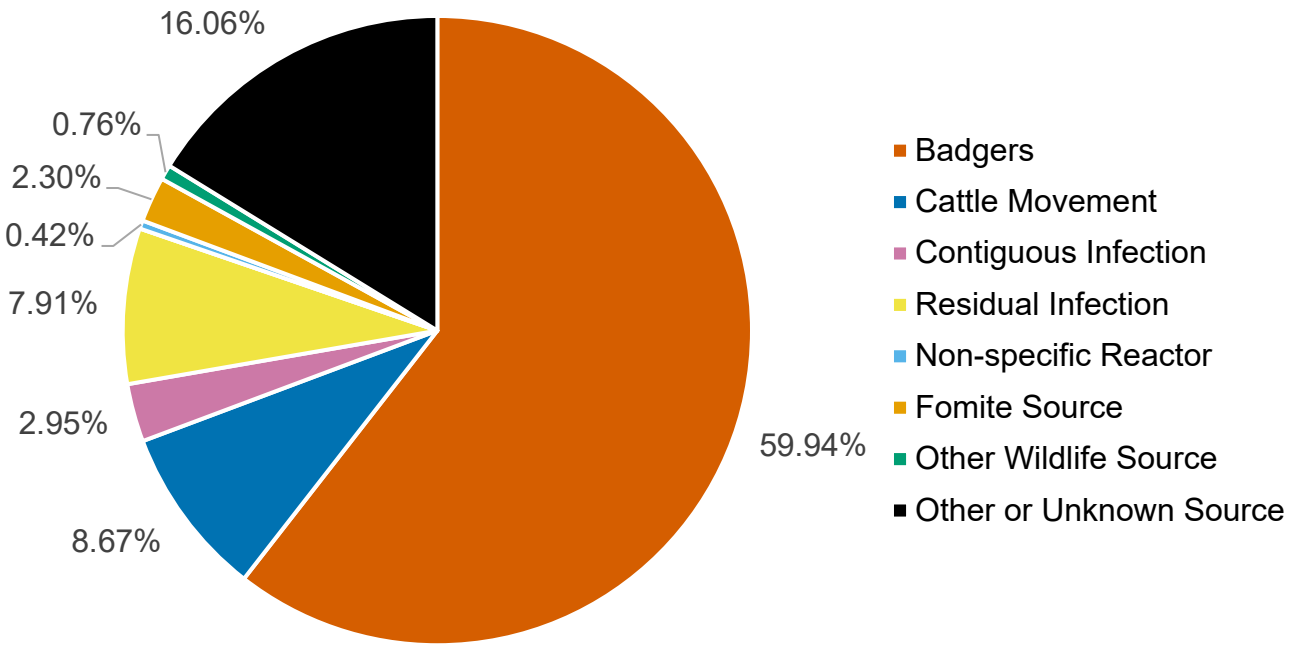


Figure 15b: Summary of the weighted source of infection pathways attributed for OTF-S TB incidents that started in 2020 in Cheshire, that had a completed DRF (n=66).

TB in other species

There is no statutory routine TB surveillance of live non-bovine species. Post-mortem examination (PME) is performed on suspected clinical cases reported to APHA. Furthermore, post mortem meat inspection is carried out on all captive animals (for example, sheep, goats, pigs or deer) slaughtered for human consumption.

There were two incidents of laboratory-confirmed *M. bovis* infection in Cheshire in 2020 involving non-bovine species. Public Health England were informed of both incidents due to the potential risk of zoonotic infection and investigations have been carried out. There were no known confirmed or suspicious incidents of human *M. bovis* infection in 2020.

Cats

There was an incident in a cat approximately 3-5 years old that became unwell in Autumn 2020. Histopathology was highly suggestive of mycobacterial infection. Subsequent IFN-γ testing results were strongly indicative of a highly pathogenic mycobacterial infection. The cat was euthanised and following a post-mortem examination, infection with *M. bovis* was confirmed by bacteriological culture.

The genotype of the cat isolate was 25:a, the most common in Cheshire. Epidemiological investigations by the APHA case veterinarian identified direct or indirect contact with infected badgers as a likely source, and direct or indirect contact with infected cattle as a possible source although there have been no recent identified incidents in cattle in that location.

Alpacas

There was a serious TB incident in an alpaca herd consisting of 41 animals. The incident started in April 2020 with the death of an alpaca, which at a post-mortem inspection was found to have lesions suspicious of TB that were positive for genotype 25:a of *M. bovis*. After four rounds of skin and antibody parallel testing, with private culling of some additional animals with suspected clinical signs of TB, only nine animals remained in the herd. The incident was still ongoing at the end of 2020.

Detection of TB incidents

Six-monthly routine surveillance testing of herds has been in place in the original Edge Area of Cheshire since 2015 and since January 2018 in the former HRA of Cheshire as well. TB infection is likely to be detected earlier in herds tested six-monthly, than in herds on less frequent TB testing intervals in other counties.

This results in reduced spread of infection within TB incident herds and reduces the chance of transmission to other cattle herds and wildlife. Farmers in Cheshire have adapted very well to more frequent TB testing with many reluctant to return to annual TB testing if given a choice through earned recognition (ER).

Figure 16a and Figure 16b show the distribution of new TB incidents in 2020 and in the last ten years (respectively), according to the type of surveillance method that detected them.

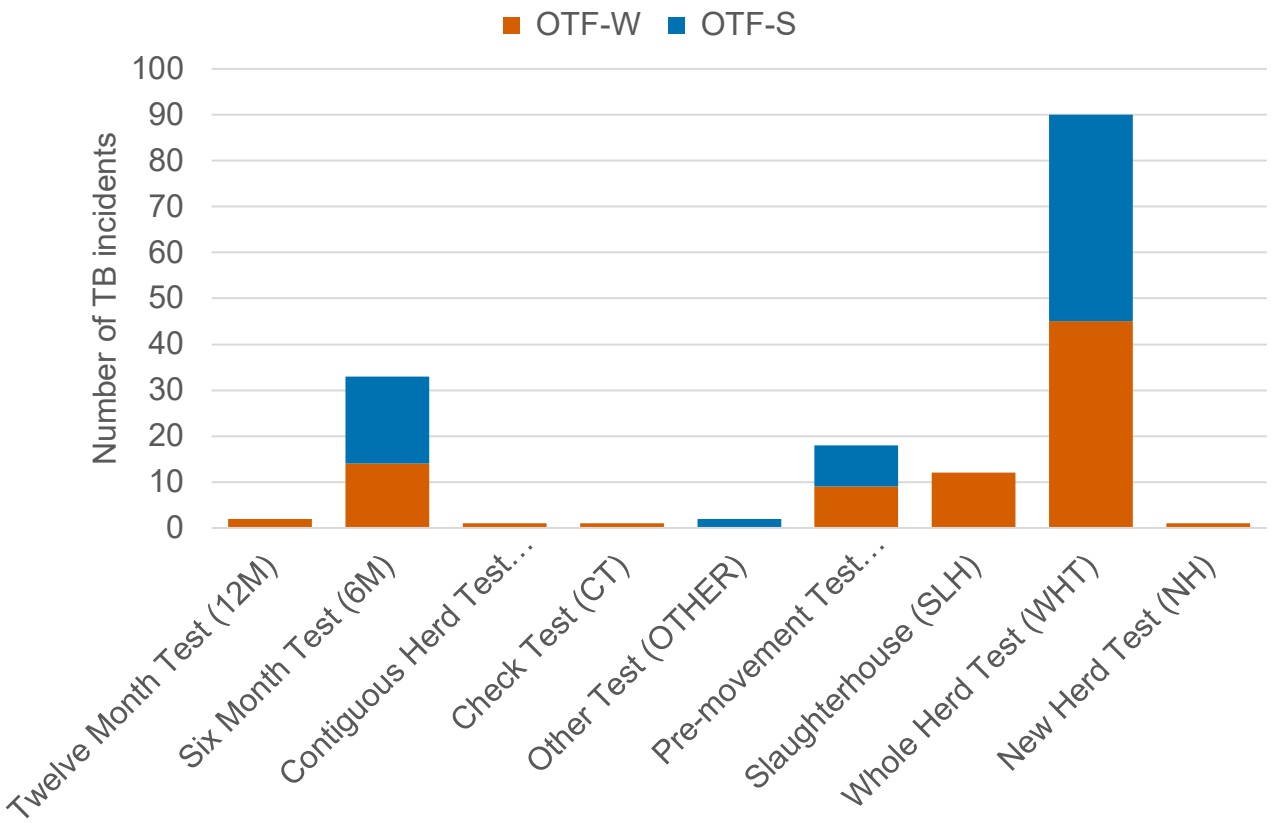


Figure 16a: Number of TB incidents (OTF-W and OTF-S) in Cheshire in 2020, disclosed by different surveillance methods.

As in previous years, the majority of new incidents in 2020 were detected through whole herd testing (WHT, 90, 56.3%), six-monthly post-incident (6M) testing (33, 20.6%), bespoke pre-movement TB testing (PRMT, 18, 11.3%) and slaughterhouse surveillance (SLH, 12, 7.5%). There were fewer slaughterhouse cases compared to 2019.

This may be due to increased detection via herd testing; mandatory IFN-γ parallel testing of OTF-W herds removing infected cattle; reduced environmental infection or fewer infected badgers and cattle. Nevertheless, SLH still remains an important method for surveillance.

A total of 15 incidents (9.4%) were disclosed from Inconclusive Reactor (IR) retests following other skin tests and of these, 46.6% were OTF-W incidents, which indicates the risks of IRs. It is important to keep these cattle isolated once identified as the retest takes place a minimum of 60 days later.

Approximately a quarter of all new incidents in Cheshire were on annual TB testing through Earned Recognition (ER). Even though these herds had not had an incident in the previous six years to qualify for annual testing, a further six months of potentially incubating and propagating infection within the herd may result in a more complex and widespread TB herd incident.

Some farmers in Cheshire have objected to being granted ER. A total of 45% of the new incidents in annually tested herds through ER were detected using non-routine tests such a PRMT, CT or SLH, so this illustrates the importance of utilising these testing methods for surveillance. Of all new incidents on ER, almost 60% were OTF-W compared to 51% on six-monthly herd testing.

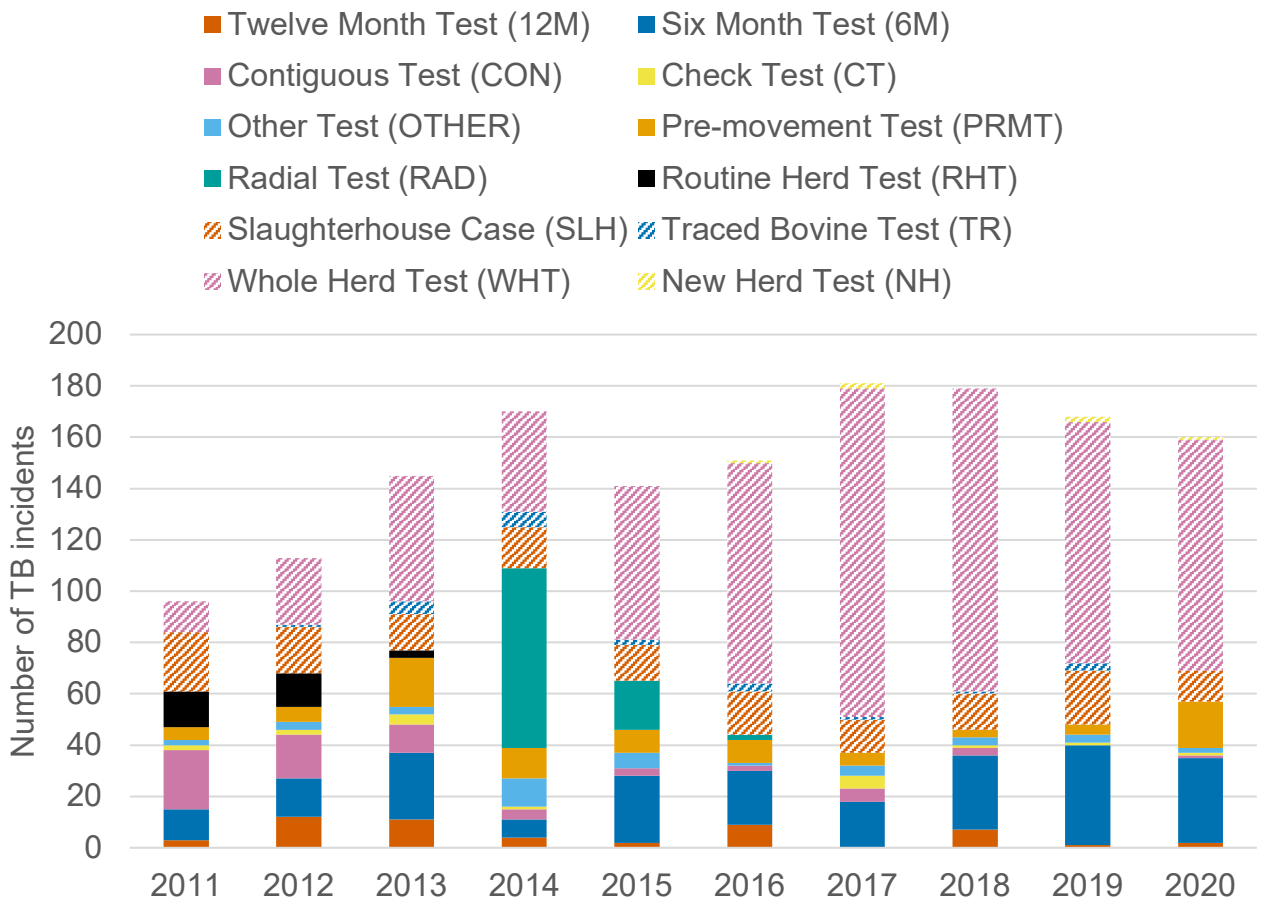


Figure 16b: Number of TB incidents (OTF-W and OTF-S) in Cheshire, 2011 to 2020 disclosed by different surveillance methods by year.

A total of 21% of new incidents were disclosed at 6M tests, which may indicate residual infection, especially in herds not subjected to IFN-γ testing such as OTF-S incidents. New introduction of TB, or an ongoing source of infection on the premises (environment, cattle, or badgers) could also be the cause of new incident disclosed by 6M tests.

The largest increase in the contribution to the detection of new incidents was for PRMT, which went up by 9% compared to 2019. Similar levels were observed in 2013 (Figure 16b). This method of detection does not rely on waiting for the annual or six-monthly whole-herd test.

Likewise, ad hoc Check Testing of herds, is an important method of detection as it can be requested at short notice to assess the herd at any point in time before the routine herd test is due.

In contrast to other years, no incidents were disclosed using trace testing in 2020, which may be indicative of improved biosecurity and purchase behaviour. Many farmers are now actively looking on the ibTB online tool prior to purchasing from other farms.

Figure 17 shows the number of new OTF-W and OTF-S incidents in 2020, that had experienced an OTF-W incident in the previous three years. It excludes new incidents that were also on restrictions in the first four or more months of 2020 due to an incident that started before 2020.

The Explanatory Supplement (see section 4.3) provides more details on the reporting of recurrent TB incidents.

Figure 17 shows that of the 160 new incidents in 2020, 50% had a history of TB in the previous three years, which appears to be less than 2019 (57%). A total of 47% incidents (75 herds) had no history of TB in the previous three years. However, there were 262 herds in Cheshire which remained OTF and had a history of TB in the previous three years.

Of the new incidents in 2020, 64 (40%) had a history of OTF-W and 16 (10%) had a history of OTF-S in the previous three years. Nevertheless, a history of TB in the previous three years is still a recognised risk factor for recurrence.

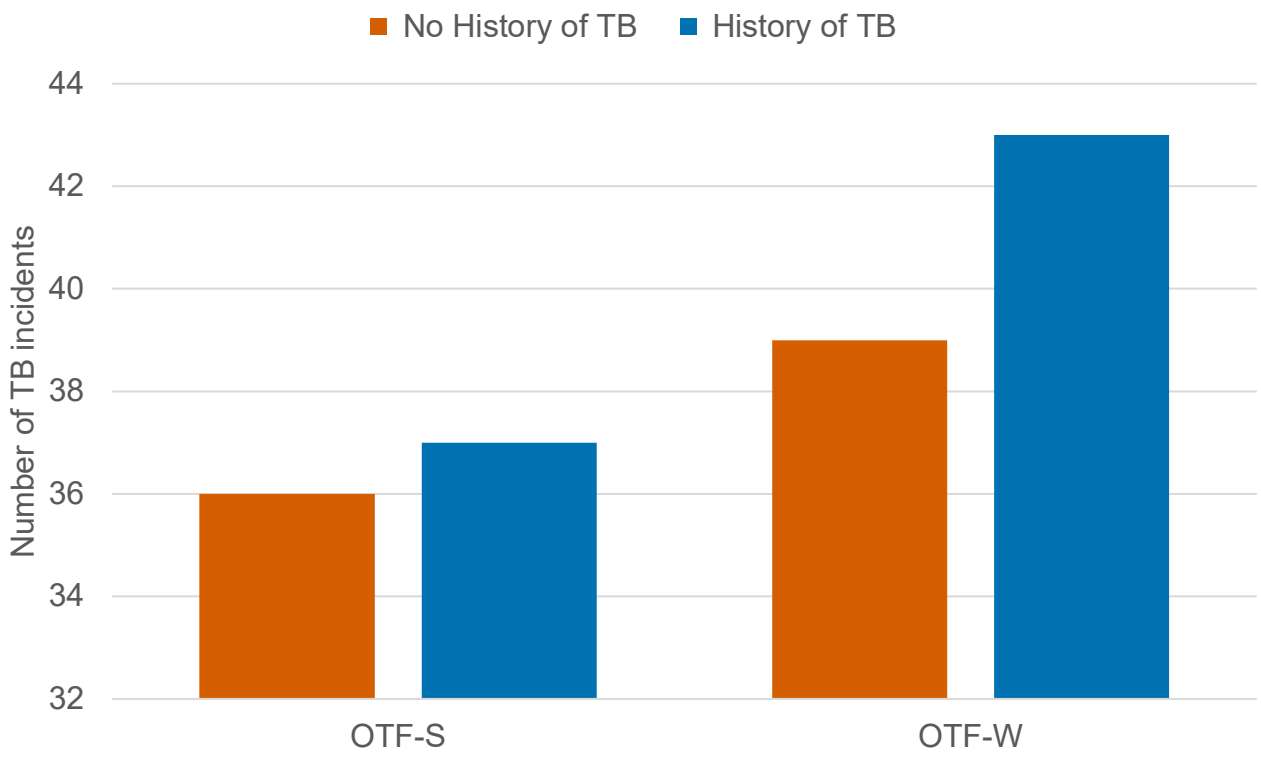


Figure 17: Number of herds with a TB incident (OTF-W and OTF-S) in Cheshire in 2020, with a history of TB (herds that experienced an OTF-W incident in the previous three years), and holdings without a history of TB in the previous three years.

Using more than one round of combined skin and IFN-γ testing will significantly reduce the level of cattle infection present that may remain on the farm until the next herd test. In areas of high incidence of TB, badgers or deer can contribute to re-infection in a herd despite

multiple rounds of IFN-γ testing if there is still opportunity for cross-contamination of feed or the environment.

Likewise, at the end of an incident, cattle movements may increase in a few herds where replacement cattle are needed due to losses incurred or where heifers return from other rearing premises.

Skin test reactors and interferon gamma test positive animals removed

Figure 18 shows the number of skin test reactors and IFN-γ test positives removed by APHA over the past 10 years from herds in Cheshire.

The peak in 2018 may be explained by the incorporation of the Cheshire HRA into the Edge Area and the change onto six-monthly herd testing, which resulted in an increase of new incidents.

Since then, both skin and IFN-γ test positive numbers have decreased by 38% from 2,232 cattle slaughtered in 2018 to 1,376 in 2020. The number of cattle slaughtered for TB control in Cheshire compared to 2019 decreased by 683 cattle (33%).

Of the 1,376 animals removed in 2020, 38% were IFN-γ test positives and 62% were skin reactors, representing a decrease of 13% for skin reactors and 51% of IFN-γ positives compared to 2019.

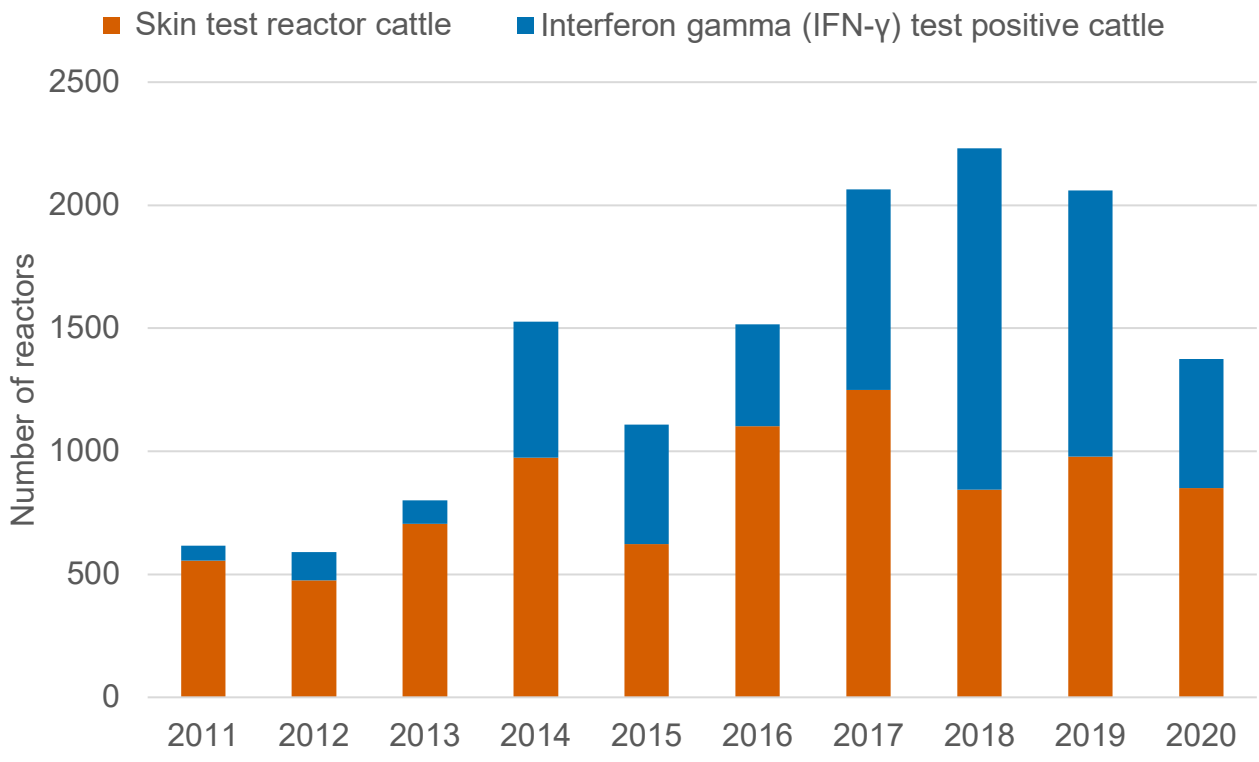


Figure 18: Number of skin test reactors and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Cheshire, 2011 to 2020.

The total number of cattle IFN-γ tested decreased by 45% this may partly be due to re-prioritisation of IFN-γ testing in the England HRA. The proportion of OTF-S incidents, which do not trigger IFN-γ testing, was much higher in 2020 (47%) than in 2019 (33%), which would also reduce the number of cattle IFN-γ tested. Furthermore, the skin test may be detecting enough infected cattle or there may be less undetected cattle infection than in previous years.

Overall, the trend is showing a decreasing number of cattle slaughtered for TB control reasons in Cheshire since 2017 (32%).

Similarly, there was a reduction of 30% of the average number of reactors per incident from 12.3 in 2019 to 8.6 in 2020 (see Table A3.2). There has also been a reduction in the number of reactors per 100 animal tests from 3.8 in 2018 to 2.6 in 2020 (32% decrease).

These findings probably reflect a decreasing environmental burden of disease and decreased residual infection in cattle in the Cheshire population. Increased biosecurity practices through the use of the TB Advisory Service (TBAS), advice from private or APHA vets, the TB Hub website and ibTB interactive mapping when researching sources of cattle or potential grazing areas may also be important factors.

All these reductions will have an impact on the financial burden to the taxpayer compared to previous years. Since 2018, 67,762 fewer cattle have been skin and or IFN-γ tested, which may be reflected in slightly fewer herds as some have dispersed or decreased frequency of TB testing through earned recognition. It is unlikely to be due to cattle not being tested at all as very few herds go overdue in Cheshire due to zero tolerance. Any breaches tend to represent very small numbers of cattle.

The overall duration of restrictions may differ very slightly for OTF-W and OTF-S incidents, as both require two consecutive skin herd tests with negative results before restrictions are lifted. However, the use of the IFN-γ test is considered by many to reduce the length of restrictions by removal of undisclosed cattle infection in the absence of significant environmental contamination.

In 2020 there was no suspicion of fraudulent test reactors in any of the incidents.

Summary of risks to Cheshire

The key risks to Cheshire are local spread via cattle contact and movements, spread of endemic infection in wildlife reservoirs and longer-range cattle movement, especially from higher risk areas of the country. Cheshire is bordered by Wales (Intermediate TB area) to the west and south-west, Shropshire (HRA) to the south, Staffordshire (HRA) to the south-east, Derbyshire (Edge Area) to the west and Greater Manchester, and Lancashire (LRA) to the north.

Historically TB has spread into south-east Cheshire from north Shropshire and north-east Staffordshire, and TB incidents remained more common in adjacent parishes of Cheshire in 2020 (Figure 8). Other than the River Dee, there are no physical barriers between Cheshire and Wales and there are no major physical barriers between Cheshire and Shropshire. The M6 and the A500 are the only physical barriers between Cheshire and Staffordshire.

More recently an area in the south-west of Cheshire has become a concern (Figure 19). This area comprises nine parishes bordering the Wrexham spur of north-east Wales. A sharp rise in TB incidence and prevalence across adjacent parts of rural Wrexham and Shropshire at the end of 2016 led to the inception of the so-called ‘cross- border cluster’, which now includes the nine Cheshire parishes.

Summary of risks from Cheshire to surrounding areas

There is a continuing risk to the Stockport area of Greater Manchester (Low Risk Area) from north-east Cheshire, particularly in the bordering parishes of Mobberley, Wilmslow and Poynton. Apart from the M56 there are no significant geographical barriers or flood plains between North Cheshire and the LRA that could hold back wildlife movement.

In 2016, an NFU funded badger survey detected *M. bovis* in badgers in the bordering LRA parishes of Stockport and Greater Manchester. Increased urbanisation of the land to the south of Greater Manchester and the loss of some farms and small holdings in this area may have reduced cattle density and limit the risk of contiguous spread.

Cattle may also move to the LRA from Cheshire via livestock markets (although there are no longer any markets in Cheshire) or directly from farm to farm. Post-movement TB testing is mandatory in the LRA and so this combined with compulsory pre-movement TB testing of eligible cattle reduces the risk of undetected TB infected cattle entering the LRA.

Assessment of effectiveness of controls and forward look

Effectiveness of controls

Continuation of the increased TB surveillance and control measures in cattle and appropriate badger TB control measures are required to reduce TB infection in the county. There has been a marked improvement in 2020, which should be sustained if all measures remain available, with the aim of reducing the burden of infection in both cattle and badger populations.

Biosecurity awareness has increased through the provision of advice via the TB Hub, via veterinary services and the Defra-funded TB Advisory Service. Awareness of risks has also improved through the badger culls, with increased knowledge of badger behaviour, locations, and the likely risks to and from livestock.

A total of 195 badgers were vaccinated in Cheshire in 2020 over 43.7km^2, which was an increase of 44% from the previous year, when 135 badgers were vaccinated over 38.3km^2. The total land area of Cheshire is 2081.7km^2. The COVID-19 pandemic lockdowns resulted in vastly reduced road traffic, so the badger populations are likely to have been less disturbed by road kills.

Cheshire has two licensed badger TB control areas, which have been ongoing for three and four years respectively. The target number of badgers were removed from both areas, as described in the summary of 2020 badger control operations.

Skin and IFN-γ testing continued with little disruption throughout 2020 despite COVID-19 restrictions and it is estimated that approximately 1,000 eligible cattle were not sampled for IFN-γ blood testing due to delays and restrictions during the COVID-19 pandemic. There was a reduction in IFN-γ testing in Cheshire in 2020 (45%).

This was thought to be due to the expansion of IFN-γ testing across the HRA of England, prioritisation of herd testing and eligibility, and also due to the increase in OTF-S incidents compared to previous years.

In 2020, OTF-W herds were subjected to one round of IFN-γ testing with subsequent testing being based on a risk assessment, which appeared to be effective and well accepted.

APHA and private technical and veterinary personnel worked throughout the COVID-19 pandemic, so this had little negative impact on TB case management and herd testing.

Forward look

There was a significant decrease in new incidents in the original Edge Area of Cheshire in 2020 compared to 2019 and both the county herd incidence rate (per 100 herd years at risk) and herd prevalence decreased. Despite this, OTF status will not be achieved by 2025, which has a requirement for crude incidence of OTF-W incidents to be less than 0.1%.

However, there is optimism that a sustained decrease in the burden of disease would be expected in the longer term with continuation of the increased TB control measures in cattle and appropriate badger TB control measures.

The increasing ratio of OTF-S incidents compared to OTF-W incidents has been positive in 2020, plus the reduction in reactor and IFN-γ test positive numbers confirms these recommendations.

Infected badgers remain a threat to cattle herds as it is impossible to completely remove the risk from shared pasture access. Badger vaccination has increased compared to previous years, which is commendable, but the number of roadkill badgers observed and the likely population remaining in Cheshire reflects that there is a still a large badger population present with an unknown infection status.

Monitoring of found dead badgers and the continuation of badger control measures will complement the increased control measures in cattle, to ultimately achieve a healthier population of both. Utilising badger vaccination in areas deemed to be lower risk will be more effective in the long term in reducing spread from endemically infected areas.

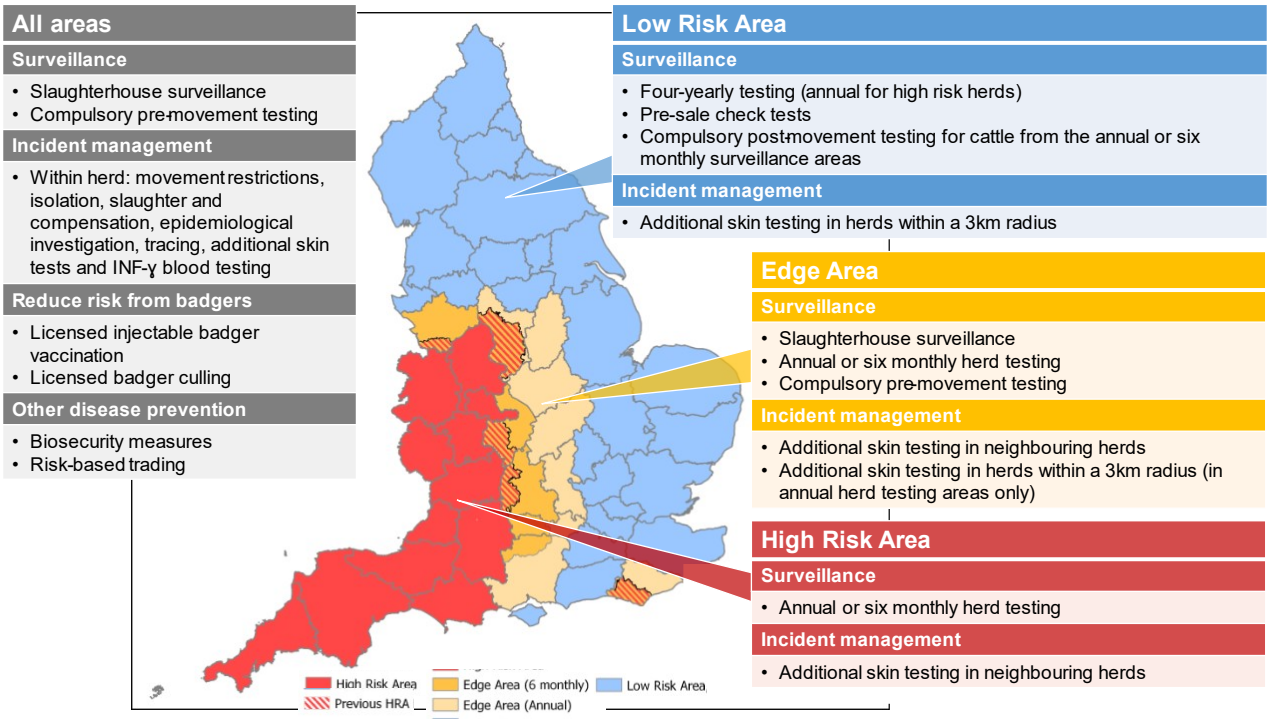
Biosecurity awareness has increased with badger control by ensuring that farmers are aware of the risks on their farms and the proximity to cattle.

Communications with private vets, advice services, NFU and the use of social media and websites such as the TB Hub and ibTB have also helped to raise awareness of biosecurity. However, physical inspection of affected farms and the provision of bespoke advice is invaluable and has not been possible during the COVID-19 outbreak. It is anticipated that this valuable service will resume in late 2021.

Regular liaison meetings between local TB eradication stakeholders should be encouraged to engage with all interested parties to ultimately reduce the burden of disease in Cheshire.

Appendices

Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls



Explanatory Supplement for England 2020.

Policy objectives for the Edge Area

Short to medium term:

- slow down geographic spread of endemic infection
- maintain crude herd incidence of OTF-W incidents less than 2% overall by 2019
- begin to reduce the incidence rate

Longer term:

- reduce geographic spread of TB and push the Edge Area boundaries westward
- reduce OTF-W herd incidence to less than 1% by 2025
- attain OTF status (crude incidence of indigenous OTF-W herd incidents less than 0.1%) for the lowest incidence counties in the Edge Area

For more information about the governments approach to controlling TB, visit the strategy for achieving Officially Bovine Tuberculosis Free status for England, published in 2014 and independently reviewed in 2018, see:

- A strategy for achieving officially bovine tuberculosis free status for England
- Government sets out next phase of strategy to combat bovine tuberculosis

Key Control Measures

Surveillance:

- six monthly or annual routine whole herd testing
- additional targeted surveillance of cattle herds located within a 3km radius of new OTF-W incidents in annual testing sections of the Edge Area (radial testing)
- slaughterhouse (SLH) surveillance

Management of cases ('incidents'):

- increased sensitivity of incident herd testing:
- all incident herds must pass two consecutive short interval skin tests at severe interpretation to regain OTF status, irrespective of PM and bacteriological findings
- mandatory IFN-γ parallel testing of herds with OTF-W incidents
- enhanced management of herds with persistent incidents
- enhanced epidemiological investigation and data analysis
- information sharing - location of incident herds publicly available (using ibTB online interactive mapping tool)
- restriction for life of all inconclusive reactors (IRs) that give a negative result on a re-test was introduced in November 2017 ('resolved IRs' policy). The only permitted movements of these animals are to slaughter or an Approved Finishing Unit, or after being subjected to a private IFN- γ test with negative results.

TB controls in the wildlife reservoir (badgers):

- licensed badger culling in high incidence sections of the Edge Area
- Government grants for licensed voluntary badger vaccination projects using injectable badger BCG (Badger Edge Vaccination Scheme (BEVS))

Other measures:

- compulsory pre-movement skin testing of cattle moved between herds
- promotion of herd biosecurity measures to reduce the risk of new incidents

Summary of enhanced TB control measures in Cheshire

Edge Area testing policy

- Six-monthly herd surveillance testing is now effective across the whole county of Cheshire. Previously herds in the original Edge Area had been subject to six-monthly testing since 2015, but those in the former HRA portion in the south of the county were annually tested until January 2018. From May 2019 some cattle herds

have been able to gain Earned Recognition Status, whereby they are eligible for annual surveillance testing if they meet either of the following criteria:
    - The herd has been in existence for at least six years and not had a TB incident in that six-year period. A single break from keeping cattle of less than four months during that six-year period is permitted
    - The herd is registered to a bovine TB health scheme accredited under the Cattle Heath Certification Standards (CHeCS) at level 1 or above
- All incident herds in Cheshire require a minimum of two consecutive short interval tests with negative results at severe interpretation before they are eligible to regain OTF status
- Mandatory IFN-γ testing is deployed in all new OTF-W incidents. Additional IFN-γ test rounds can take place on a risk-based assessment following the disclosure of further standard reactors at later tests, up to a maximum of three blood herd tests per incident
- Risk-based exemptions to subsequent IFN-γ testing are applied where there is clear epidemiological separation of certain groups of cattle, therefore making it more targeted and cost effective
- Ad hoc IFN-γ may be carried out in OTF-S herds where it may be beneficial subject to a veterinary risk assessment completed by the case vet
- Private slaughter of inconclusive reactors is encouraged in OTF-W incident herds along with the removal of higher risk in contact cattle as direct contacts (DCs) where appropriate
- No radial testing is carried out in Cheshire, following the adoption of routine six monthly herd testing
- Only one herd was classed as persistent in 2020 and subject to enhanced case management measure compared to nine in 2019.

Other testing measures

- Any fattening herds exempted from routine surveillance testing must meet a strict set of criteria:
    - All animals sold direct to slaughter or via a slaughter gathering
    - No animals to be resident on the holding for more than 12 months
    - No births on the holding
    - No breeding activity on the holding
    - All cattle must be permanently housed
- No routine contiguous testing is carried out in Cheshire as most farms are on six-monthly surveillance testing. However, on occasion, contiguous testing will be required on herds with Earned Recognition (routine annual testing) or in other contiguous risk areas.
- Compliance with TB testing in Cheshire is good

Other control measures

- Farmers are encouraged to take advantage of free of charge Defra funded TB Advisory Service visits which assess TB risk areas and make recommendations of ways to reduce the TB risk on the farm
- Targeted auditing of Official Veterinarian (OV) delivery of skin testing is undertaken by OVs and APHA. Approved Tuberculin Testers (ATTs) who are veterinary paraprofessionals qualified to carry out TB testing. They are audited by the XL Farmcare UK Audit team. Corrective actions are taken if necessary.
- The Cheshire TB Eradication Board is a regional board with input from farmers, the NFU, APHA, local wildlife groups and other stakeholders. Due to COVID-19 they were unable to meet in 2020, but are planning to meet in 2021
- APHA liaison with the local health protection teams of Public Health England is carried out when required for example in cases where there is believed to be a heightened risk of *M. bovis* transmission to a particular farmer, his family and/or employees
- There is a good working relationship between APHA in Cheshire and the Local Authority officers regarding any TB compliance and cattle identity issues
- Licensed badger culling took place in two areas
- Licensed badger vaccination took place in several undisclosed areas

Appendix 2: Cattle industry in Cheshire

Table A2.1. Number of cattle premises by size band in Cheshire at 1 January 2020. (RADAR data)

Size of herds	Un*	1-50	51-100	101-200	201-350	351-500	501+	Total number of herds	Mean herd size	Median herd size
Number of herds	13	520	183	197	189	97	108	1,307	179	81

***The number of herds with an undetermined size.**

Table A2.2 Number of animals by breed purpose in Cheshire at 1 January 2020.

Breed purpose	Beef	Dairy	Dual purpose	Unknown	Total
Number of cattle	60,438 (25%)	161,141 (68%)	12,474 (5%)	18 (less than 0.01%)	23,4071

Appendix 3: Summary of headline cattle TB statistics

Table A3.1 Herd-level summary statistics for TB in cattle in Cheshire between 2018 and 2020.

Herd-level statistics	2018	2019	2020
(a) Total number of cattle herds live on Sam at the end of the reporting period	1,537	1,527	1,519
(b) Total number of whole herd skin tests carried out at any time in the period	2,770	2,324	2,159
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	1,276	1,242	1,178
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of Notice Prohibiting the Movement of Bovine Animals (TB02) restrictions)	1,336	1,344	1,331
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	1,403	1,405	1,412
(f) Total number of new TB incidents detected in cattle herds during the report period, (including all FUs)	179	168	160
• OTF-S	57	55	75
• OTF-W	122	113	85
(g) Of the OTF-W herd incidents:			
• How many can be considered the result of movement, purchase or contact from or with an existing incident based on current evidence?	6	9	5

Herd-level statistics	2018	2019	2020
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at routine herd tests	81	82	45
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at other TB test types (such as, forward and back-tracings, contiguous, check tests)	26	10	28
• New OTF-W incidents first detected through routine slaughterhouse TB surveillance	14	20	12
(h) Number of new incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds			
• OTF-S	0	0	0
• OTF-W	0	0	0
(i) Number of OTF-W herds still open at the end of the period (including any ongoing OTF-W incidents that began in a previous reporting period, but not including non-grazing Approved Finishing Units)	99	91	62
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	2
(k) Number and type of finishing units active at end of the period:			
• Approved Finishing Units: Grazing	0	0	0
• Approved Finishing Units: Non-Grazing	27	28	32
• Exempt Finishing Units: Grazing	3	3	1
• Exempt Finishing Units: Non-Grazing	4	3	3

Table A3.2 Animal-level summary statistics for TB in cattle in Cheshire between 2018 and 2020.

Animal-level statistics (cattle)	2018	2019	2020
(a) Total number of cattle tested in the period (animal tests)	587,898	568,204	520,136
(b) Reactors detected in tests during the year:			
• Tuberculin skin test	843	979	850
• Additional IFN-γ blood test reactors (skin-test negative or IR animals)	1,389	1,080	526
(c) Reactors detected during year per incidents disclosed during year	12.5	12.3	8.6
(d) Reactors per 1000 animal tests	3.8	3.6	2.6
(e) Additional animals slaughtered during the year for TB control reasons:			
• DCs, including any first-time IRs	41	33	20
• Private slaughters	12	10	11
(f) SLH cases (tuberculous carcases) reported by Food Standards Agency (FSA)	37	53	42
(g) SLH cases confirmed by culture of *M. bovis*	19	30	21

Note: (c) Reactors detected during year per incidents disclosed during year, reactors may be from incidents disclosed in earlier years, as any found through testing during the report year count here.

Note: (g) SLH cases confirmed by culture of *M. bovis*, not all cases reported are submitted for culture analysis. All cases reported are from any period prior to or during restrictions.

Appendix 4: Suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in the report period

Table A4 Suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in Cheshire, in 2020.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	58	77	69	0	64.7%
Cattle movements	24	9	3	1	8.2%
Contiguous	19	3	1	0	3.0%
Residual infection	38	6	8	0	8.6%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	2	1	0	0	0.7%
Fomites	4	1	1	0	1.3%
Other wildlife	5	0	0	0	0.5%
Other or unknown source	1	1	0	0	13.0%

Please note that each TB incident could have up to three potential pathways so totals may not equate to the number of actual incidents that have occurred.

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the **Explanatory Supplement**.

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