Animal &
Plant Health
Agency

Year End Descriptive Epidemiology Report: Bovine TB in the Edge Area of England 2022 County: Cheshire

Contents

Introduction

The Edge Area was originally 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. 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. The current aim is to obtain OTF status for the Edge Area as soon as possible.

This report describes the frequency and geographical distribution of TB in cattle herds in Cheshire, an Edge Area county, in 2022. It examines what factors are likely to be driving TB in this area, and the risks the disease in this county may pose to neighbouring areas.

TB in cattle and other mammals is primarily caused by the bacterium *Mycobacterium bovis* (*M. bovis*), and the disease is subsequently referred to in this report as TB. Although other sources may refer to TB 'breakdowns', this report will use the term 'incidents' throughout.

This report is intended for individuals involved in the control of TB, both locally and nationally. This includes, but it is not limited to, farmers, veterinarians, policy makers and the scientific community.

Details of the data handling methodology used in this report, a glossary of terms, and the TB control measures adopted in the Edge Area, can be found in the explanatory supplement for the annual reports 2022.

Types of TB incident

Unless otherwise specified, this report includes all new TB incidents detected during the reporting period (1 January to 31 December 2022). This includes both 'Officially Tuberculosis-Free Status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free Status Suspended' (OTF-S) incidents.

OTF-W incidents are those involving at least one skin test reactor positive to the Single Intradermal Comparative Cervical Tuberculin or SICCT test, in addition to either typical lesions of TB identified at post-mortem (PM) meat inspection, or at least one animal with an *M. bovis*-positive culture result from tissue samples collected from carcases during the PM inspection (or both).

OTF-S incidents are triggered by reactors to the skin test, but without subsequent detection of TB lesions or positive culture results in any of those animals.

TB incidents in Approved Finishing Units (AFUs) without grazing are not included in the prevalence and incidence calculations in this report due to the limited epidemiological impact of these incidents.

Furthermore, the number of TB incidents and designation of those incidents as OTF-W or OTF-S may differ in this report compared to other official TB statistics due to differences in the information available at the time datasets are accessed.

Cattle industry

Cheshire is predominantly a dairy county with some beef fattener and suckler herds of varying sizes, calf rearers, smallholders and pet cattle. Of all the cattle herds in the county, 52% contained up to 100 animals and 9% had over 500 animals, as shown in Appendix 1. The total number of cattle herds in Cheshire has reduced by 6% since 2020, as indicated in Appendix 2.

In Cheshire there are no livestock markets. The closest markets are in Shropshire and Staffordshire, both in the High Risk Area (HRA), and one in North Wales, all of which are frequently used by Cheshire cattle farmers. There were 4 abattoirs operating in Cheshire in 2022 and several larger throughput abattoirs within 30 miles of Cheshire. There were 34 AFUs without grazing in 2022, compared to 33 in 2021. There was also one exempt finishing unit (EFU).

Cheshire was originally divided between 2 TB risk areas: HRA in the south of the county, adjacent to the border with Shropshire, and the Edge Area, in the north of the county.

The whole of Cheshire was fully incorporated into the Edge Area in January 2018. The whole of the county is under a routine 6-monthly TB surveillance testing regime.

Herds that meet certain criteria and thus are identified as having a lower risk of TB incursion, can benefit from "earned recognition" whereby they are tested annually. In Cheshire, 35% of cattle herds were regarded as having a lower risk of contracting TB, and thus eligible for annual testing

New TB incidents

The number of new TB incidents decreased by 19% in 2022, from 141 in 2021 to 114 in 2022 (Figure 1). This was mainly due to a 26% drop in new OTF-S incidents (down from 69 in 2021, to 51 in 2022). OTF-W incidents reduced by 13% (down from 72 in 2021 to 63 in 2022).

Since 2017, there has been a steady decline in the total number of incidents from 181 to 114 in 2022 (37%) and the 2022 total was the lowest level for the past 10 years.

The majority of this decrease was seen in the original HRA portion (the southern third) of the county. Here there was a 10% decrease in the number of OTF-W incidents, with a 41% decrease in OTF-S incidents. This is likely to be a result of the control measures

aimed at the early detection and removal of infected cattle, alongside badger TB control measures, leading to reduced environmental contamination with *M. bovis*.

Whole Genome Sequencing (WGS) clade B6-83 of *M. bovis* (which includes genotype 22:a) became more prevalent in some areas of the county in 2021, but only 2 incidents were associated with this clade in 2022.

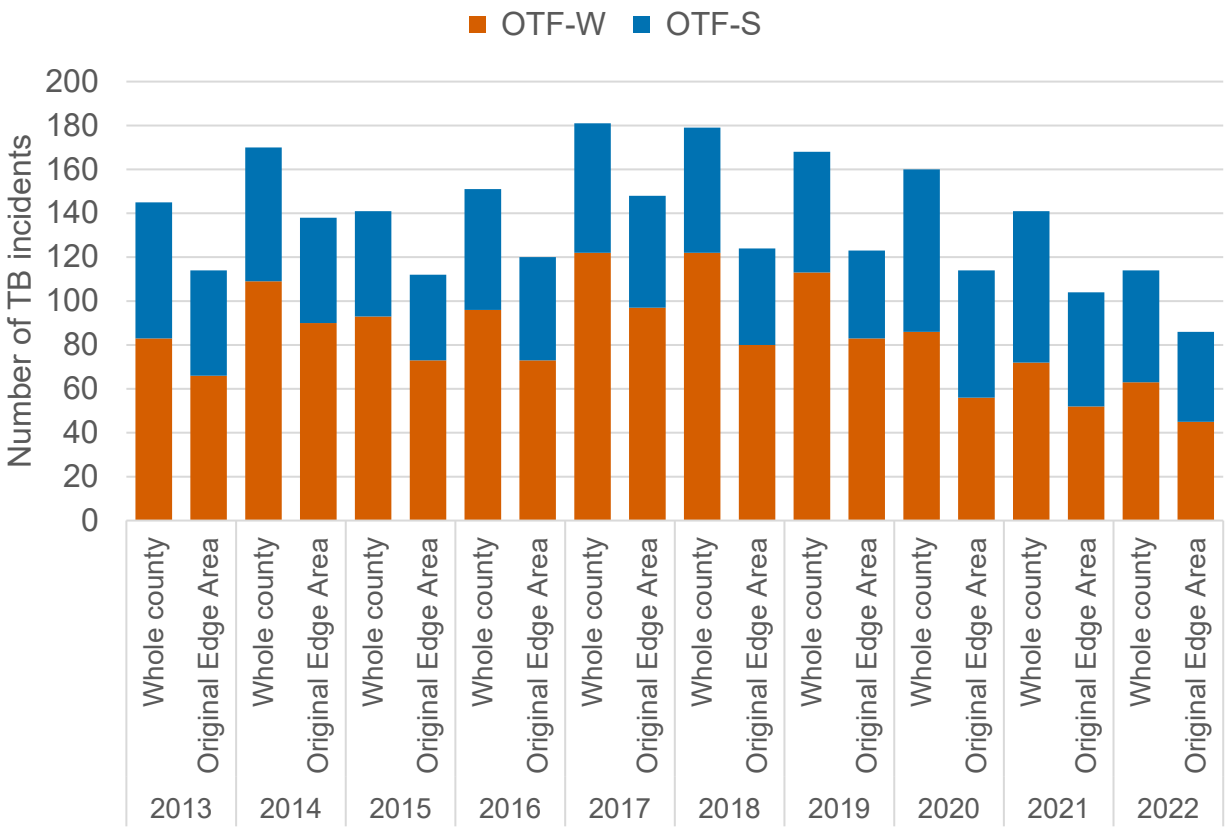

Figure 1: Annual number of new TB incidents in Cheshire, from 2013 to 2022.

In 2022, 80% of the total number of new TB incidents occurred in dairy herds (76% OTF-W incidents and 84% OTF-S incidents). Beef fattener herds (excluding AFUs) accounted for 9% of all new TB incidents and beef suckler herds accounted for 11%.

Herds with 201 or more cattle were responsible for 72% of all new incidents compared to herds of 200 or fewer cattle (28%).

This is similar to the findings in 2020 and 2021 and reflects the fact that there are more large dairy herds than large beef herds and TB incidents are more likely to occur in large herds, as shown in Appendix 1. Additionally, dairy cattle will remain on farm longer than beef fattening cattle. As a result they may be more likely to be exposed to repeated environmental contamination in their lifetime than intensively reared beef fattening herds,

in pasture or at housing. By contrast, intensively reared beef fattening herds tend to stay indoors and consume preserved forage and concentrates.

These findings are consistent with herd size and cattle production type being risk factors for TB in Cheshire.

Disclosing test types

As in previous years, whole herd testing continued to detect the most incidents of TB in Cheshire in 2022. This was followed by slaughterhouse surveillance and 6 month post-incident check testing, as shown in Figure 2. In 2022, there were no incidents disclosed by tracing tests, which may be indicative of a change in risk awareness.

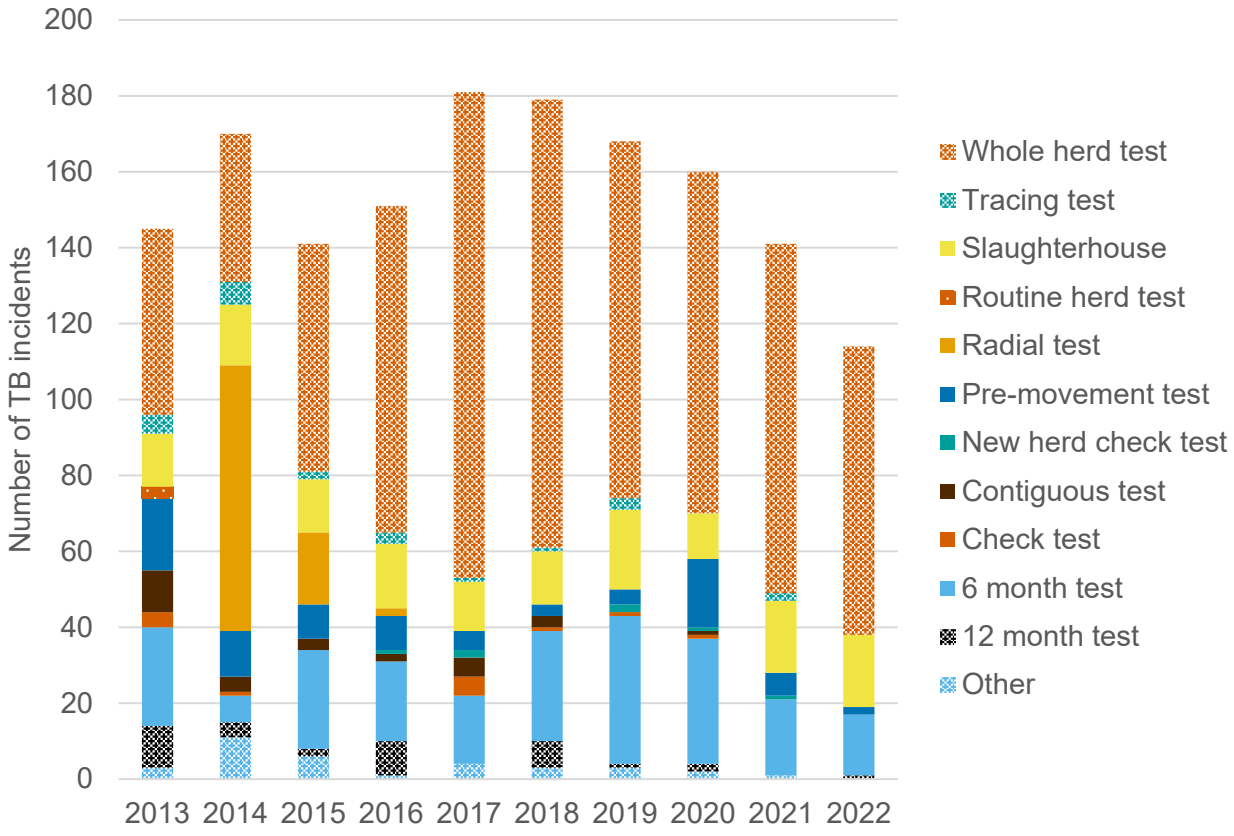

Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Cheshire in 2022, according to the surveillance methods that detected them.

Duration of TB incidents

A total of 124 TB incidents were resolved in Cheshire during 2022. Of these, 55 were new TB incidents that started in 2022, 64 started in 2021, 4 were from 2020 and one started in 2019.

The median duration of OTF-W incidents that ended in 2022 was 189.5 days (interquartile range (IQR) 158 to 257), which is 5% less than 2021. Five OTF-W incidents took over 550 days to resolve, but the majority (63 out of 68) were resolved within 240 days. Most OTF-S incidents that ended in 2022 (47 out of 56) were resolved within 150 days, however 9 took between 240 and 550 days to resolve, and the median was 166 days (IQR 150 to 193.5).

There was one TB incident still open at the end of 2022 that had lasted for more than 550 days, compared to 5 in 2021 and 9 in 2020.

The median duration for all incidents that ended in 2022 in Cheshire was 173 days (IQR 152.5 to 235). This is shorter than the duration of incidents that closed in 2021, with a median of 178 days (IQR 157 to 235). For the whole Edge Area, the median duration of TB incidents that closed in 2022 was 182 days (IQR 157 to 286).

Unusual TB incidents

During 2022, there were a total of 6 incidents which were classed as chronic (under movement restrictions for longer than 12 months). One of these incidents became persistent (under movement restrictions for more than 550 days), triggering enhanced management procedures. These were all dairy farms.

In early 2022, a TB cluster developed around the south Duddon area (West Cheshire) with incidents in the second half of the year, there has since been further spread eastwards with 3 more incidents. Following investigations, local wildlife infections and contiguous infections were the likely risk pathways, supported by home range clade. Half of the farms involved were previously on earned recognition.

In 2022, there were 2 explosive TB incidents involving neighbouring herds in North East Cheshire, which were ongoing at the end of the 2022 reporting period and have subsequently been identified as chronic infections. One was a medium sized dairy herd and the other a closed beef suckler herd. There was no nose-to-nose cattle contact and no shared personnel or equipment. Both farms had large numbers of wild red deer co-grazing with the cattle, and also badger activity at pasture. The size of the dairy herd was reduced by 42% due to the slaughter of skin test reactors and interferon gamma (IFN-γ) test positive cattle. The cattle removed had a high proportion of visible lesions of TB at post-mortem examination (PME). The neighbouring beef herd lost almost 50% of its cattle following TB testing, with a similar high frequency of visible lesions identified in the test reactors. Clade B3-11 was isolated from both herds and there are multiple historical incidents within a 5-mile radius, which are very closely related by WGS (up to 3 single

nucleotide polymorphisms (SNP) difference). Red deer and badgers are both very active in this area, which is outside of the wildlife control programme areas. Despite 2 rounds of IFN-γ parallel testing at each premises and culling of direct contacts, infection persisted. This suggests the presence of ongoing environmental contamination, most likely by infected wildlife. Historical incidents have noted unreported suspect lesions of TB in culled wild red deer in the locality. Phylogenetic analysis would be beneficial in this area, including isolates from local found-dead wildlife.

A newly established dairy herd was expanded by the purchase of 80 cattle from a dispersal sale in Leicestershire. After just over 2 months, the farmer sent one of these cattle to slaughter due to ill thrift and its carcase was condemned by meat inspectors due to multiple suspect lesions of TB, including the lung. Clade B3-11 of *M. bovis* was isolated from those lesions. This is the strain of *M. bovis* most commonly found both in Cheshire and Leicestershire. The herd of origin in Leicestershire also had several slaughterhouse cases of TB at the same time. Bespoke phylogenetic analysis concluded that the index cow had likely become infected at the farm of origin. In total, approximately 30% of the infected herd in Cheshire was removed through a mixture of compulsory slaughter of skin test reactors, IFN-γ test-positive animals and private culls. The purchased cattle had been pre-movement TB tested at the farm of origin in Leicestershire. It was fortunate that the affected cow was removed from the herd shortly after its purchase. This incident illustrates the value of post-mortem TB surveillance at routine slaughter. The Cheshire farmer acted very quickly to reduce the transmission within the herd as soon as they became aware of the situation, but this still resulted in large losses for their business.

There were no reported incidents of udder TB leading to milk-borne spread.

TB in other species

There is no statutory routine TB surveillance of non-bovine species, apart from PME of animals slaughtered for human consumption. Targeted TB testing takes place in non-bovine herds with laboratory confirmed *M. bovis* infection, and in specific herds of camelids, goats and captive deer at an elevated risk of infection.

There were no new incidents of TB in other non-bovine farmed and captive species in Cheshire in 2022. Anecdotally, there have been culled wild red deer with suspect lesions in north-east Cheshire, which were not notified to APHA.

Incidence of TB

Cheshire had a herd incidence rate of 10.6 new TB incidents per 100 herd-years at risk in 2022, a decrease of 16.5% on the rate recorded in 2021 (12.7). This was the fourth highest out of the 10 Edge Area counties. The herd incidence in Cheshire was also higher than that for the whole of the Edge Area (7.7).

The incidence of TB per 100-herd years at risk decreased in Cheshire in 2022 for the third consecutive year, as shown in Figure 3. This was approaching levels seen almost 10 years ago, especially in the original Edge Area of the county.

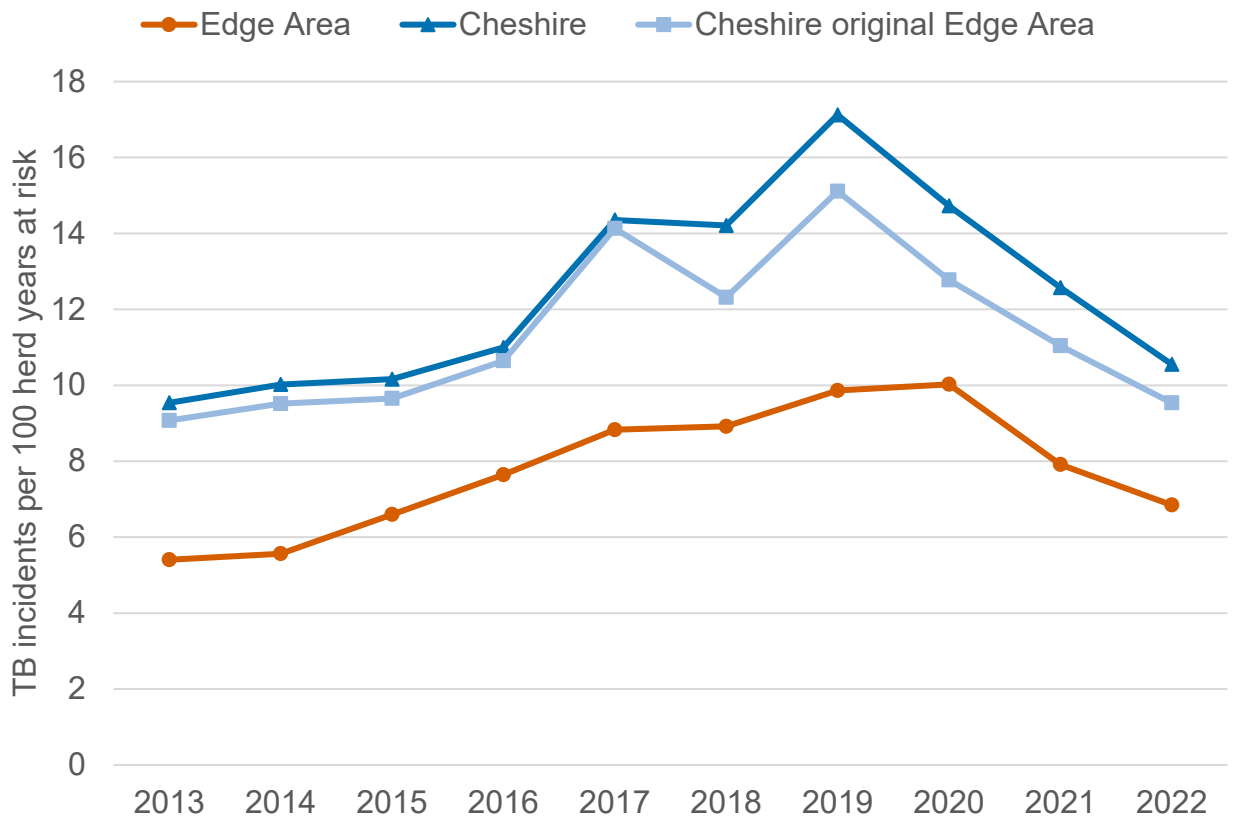

Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Cheshire, from 2013 to 2022.

Prevalence of TB

Herd prevalence has been decreasing since 2017, in both the whole county and its original Edge Area, and this trend continued in 2022 (down to 4.3%, see Figure 4). This represented a decrease of 49% from a peak herd prevalence of 8.5% recorded in 2017. The prevalence in 2022 is the lowest level for 6 years.

A number of factors may have contributed to this, such as:

- the badger TB control measures
- increased awareness of herd biosecurity
- increased knowledge of TB transmission routes (private vets, APHA advice, TB Hub, TB Advisory Service visits)
- more sensitive testing of herds affected by TB incidents
- compliance with TB control measures with prompt removal of infected cattle

- 6 monthly routine herd testing

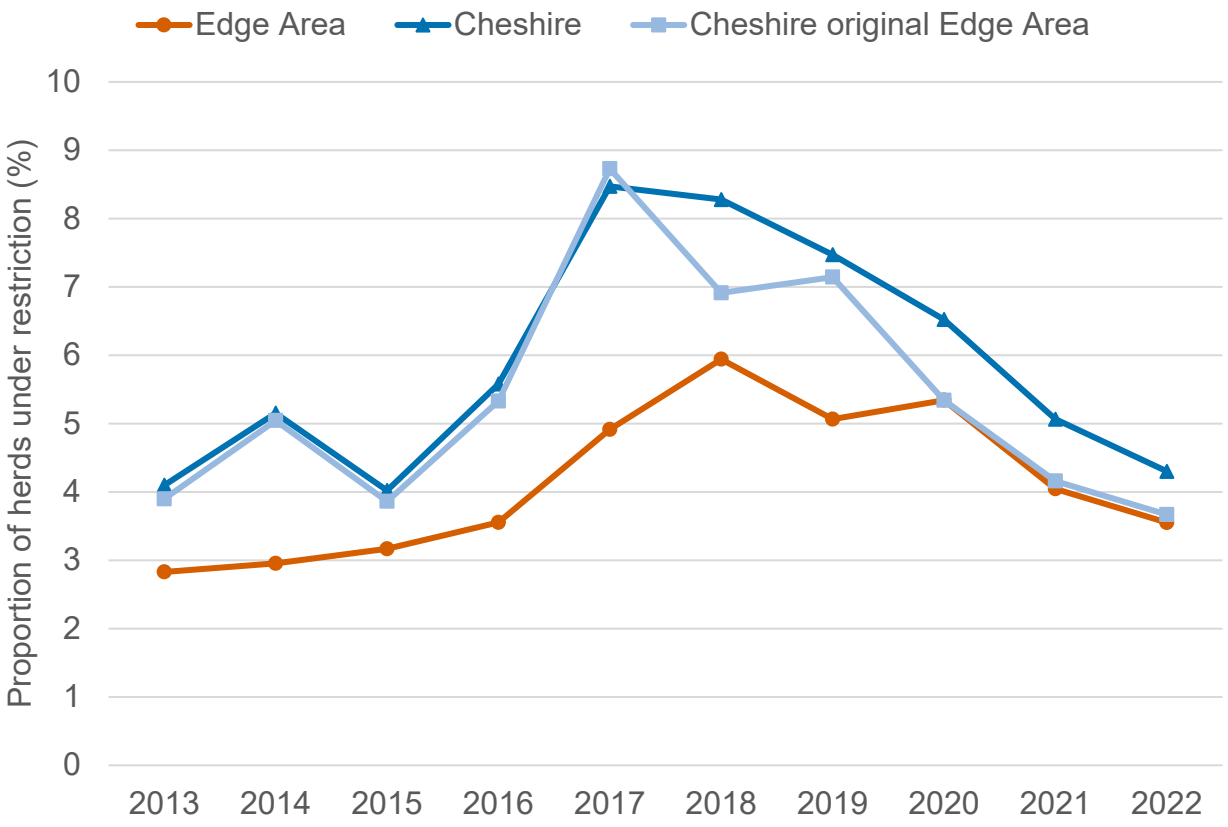

Figure 4: Annual end of year prevalence in Cheshire, from 2013 to 2022.

Re-occurring TB incidents

In Cheshire in 2022, there was a total of 47 TB incidents with no history of TB in the previous 3 years, 20 were OTF-S and 27 OTF-W, as shown in Figure 5. Incidents in herds which had any history of TB in the previous 3 years reoccured in 66 herds in 2022, with 30 OTF-S incidents and 36 OTF-W incidents. One herd (OTF-S) had 2 incidents in 2022, and was only counted once in the figures for re-occurring incidents.

For herds with only a history of OTF-W in the previous years, there were 43 incidents in 2022 (24 OTF-W and 19 OTF-S). For herds with no history of an OTF-W incident within the past 3 years there were 70 incidents (39 OTF-W and 31 OTF-S).

New incidents with no history of TB in the previous 3 years were higher in Cheshire (42%) than the overall Edge Area (50%). However, there was higher re-occurrence in Cheshire (58%) compared to the overall Edge Area (50%) for herds with any history of TB. The reasons for this are unclear and may be multi-factorial. They include the demographic population of cattle by stocking density and herd type. Cheshire has a relatively high density of dairy cattle with a large herd size. Dairy cattle have already been identified as

being at higher risk of contracting TB in Cheshire due to their longevity and herd size compared to beef cattle, which may be more commonly seen in other Edge Area counties. Other factors may include wildlife populations and farming practices.

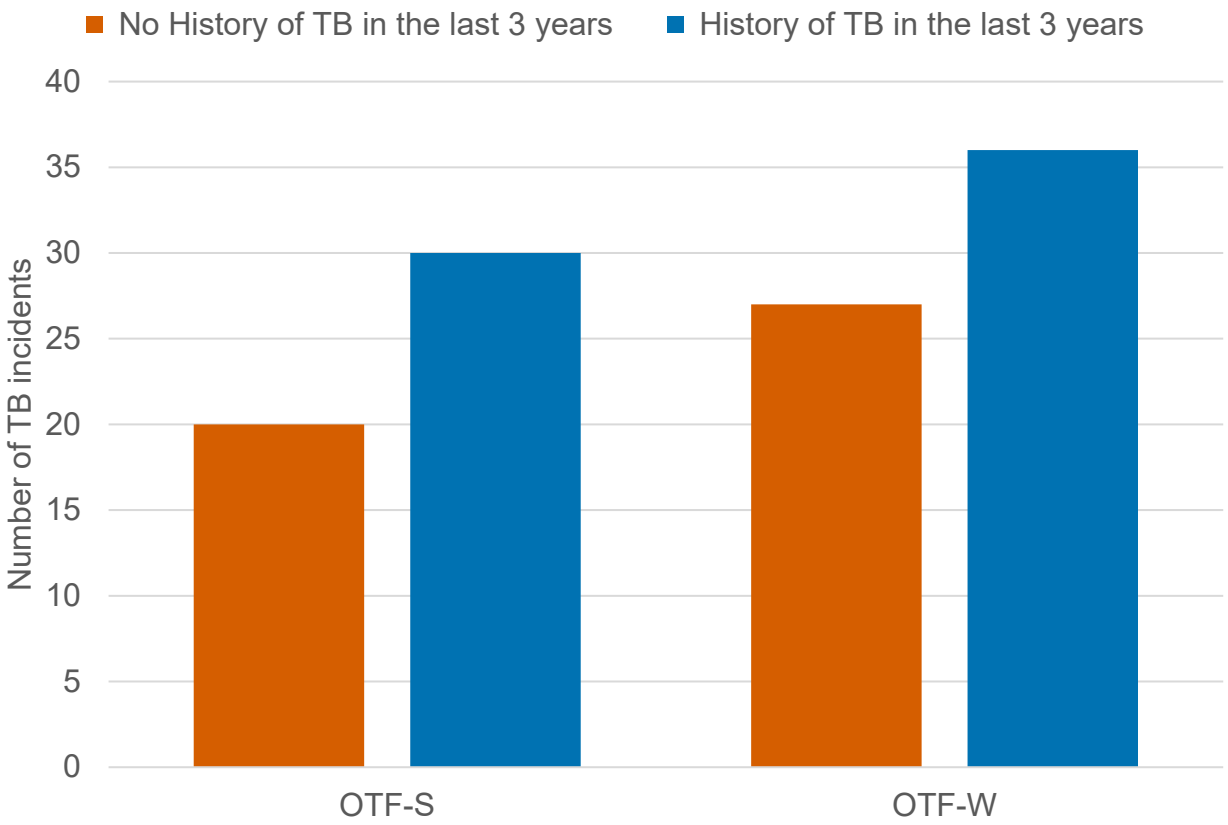

Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Cheshire in 2022, with and without a history of any TB incident in the previous 3 years.

Geographical distribution of TB incidents

As stated above the incidence rate in Cheshire for 2022 was 10.6 incidents per 100 herd years at risk (fourth highest in the Edge Area), comparable to the contiguous HRA counties of Shropshire (16.7) and Staffordshire (11.5), and higher than the contiguous Edge Area county of Derbyshire (6.5). Shropshire and Staffordshire remain a potential risk to Cheshire via cattle movements from those areas and potential movements of wildlife across the county borders.

There were clusters of incidents in several locations in Cheshire, but these appeared to emerge in different locations from previous years. In 2022, a cluster developed along the A51 between Tarporley and Tarvin (South Duddon). There are also small clusters of incidents centred on the parishes of Siddington, Brereton, Gawsworth, Sutton, Little Budworth and Wilmslow. These are all areas of high cattle density.

North Cheshire remains clear of TB incidents in 2022 (Figure 6), but this is probably due to the lower cattle herd stocking density.

The predominant clades of *M. bovis* isolated from cattle in Cheshire continued to be: B3-11 (72%, which includes isolates of spoligotype 25 such as genotype 25:a); B6-11 (18%, which includes isolates of spoligotype 17 such as 17:a) and B6-83 (3%, which includes isolates such as 22:a, 9:d and 9:a) (Figure 6). There was one incident south of Nantwich in a closed dairy herd of B1-11 (which includes isolates such as genotype 35:a). This clade is commonly found in Shropshire and has been seen in recent years in small numbers in the same area. It is suspected that there are still infected badgers with this strain although in much reduced numbers than previously.

Figure 6 shows the likelihood that cattle movements were associated with the source of the TB infection, according to the cattle movement algorithm. This algorithm is explained in more detail in the section 'main risk pathways and key drivers for TB infection' and in the explanatory supplement for the annual reports 2022. Most incidents appear to be assessed as having a low to medium cattle movement likelihood.

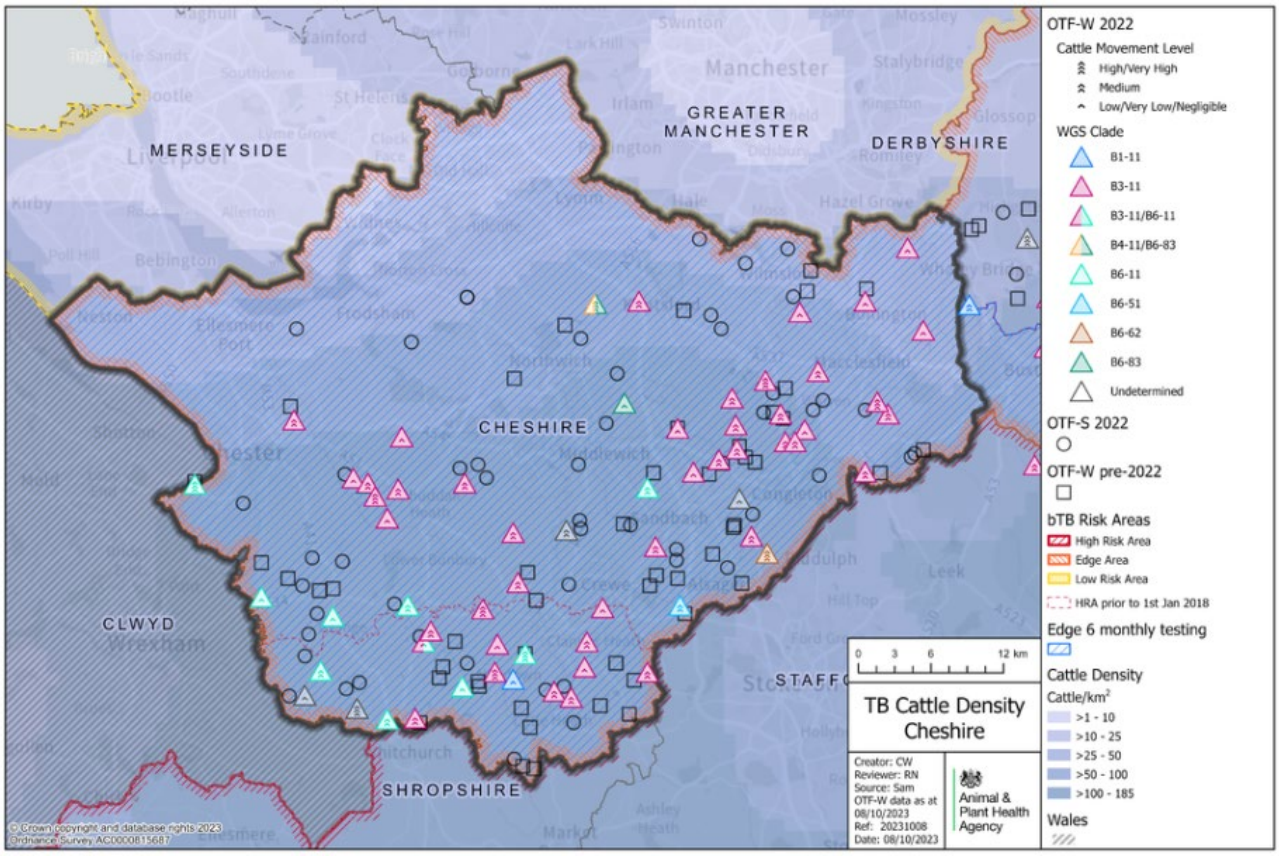

Figure 6: Location of cattle holdings in Cheshire with new TB incidents (OTF-W and OTF-S) in 2022 and cattle holdings with pre-2022 OTF-W incidents still ongoing at the beginning of 2022, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle movements associated with a high likelihood of infection, 2 chevrons for a medium likelihood and one chevron for a low likelihood.

Skin test reactors and interferon gamma test positive animals removed

In 2022, there was a total of 995 test positive animals in Cheshire, as shown in Figure 7. This was the lowest total number of test positive animals removed from herds in Cheshire since 2014 where there were 1,526 positive animals. Of the 995 test positive animals in 2022, 753 (76%) were skin test reactors, compared to 59% in 2021. Only 24% of animals removed in 2022 were IFN-γ test positive, compared to 43% in 2021. This reduction is mainly due to the change in IFN-γ testing policy introduced in the Cheshire Edge Area in July 2021, whereby only re-occurrent and persistent OTF-W incidents are automatically eligible for mandatory sampling. This includes herds which have had a new incident within 18 months of a previous incident. Previously, all new OTF-W incidents in Cheshire were eligible for sampling. APHA may consider ad hoc IFN-γ testing in TB incident herds where testing is likely to be beneficial, such as those with explosive numbers of reactors, or where there are particular groups affected. As in previous years, exemptions may apply under veterinary risk assessment.

Furthermore, the decrease in IFN-γ test positive animals may have been influenced by the diversion of field resource to the large highly pathogenic avian influenza (AI) outbreak which occurred in 2021 and 2022.

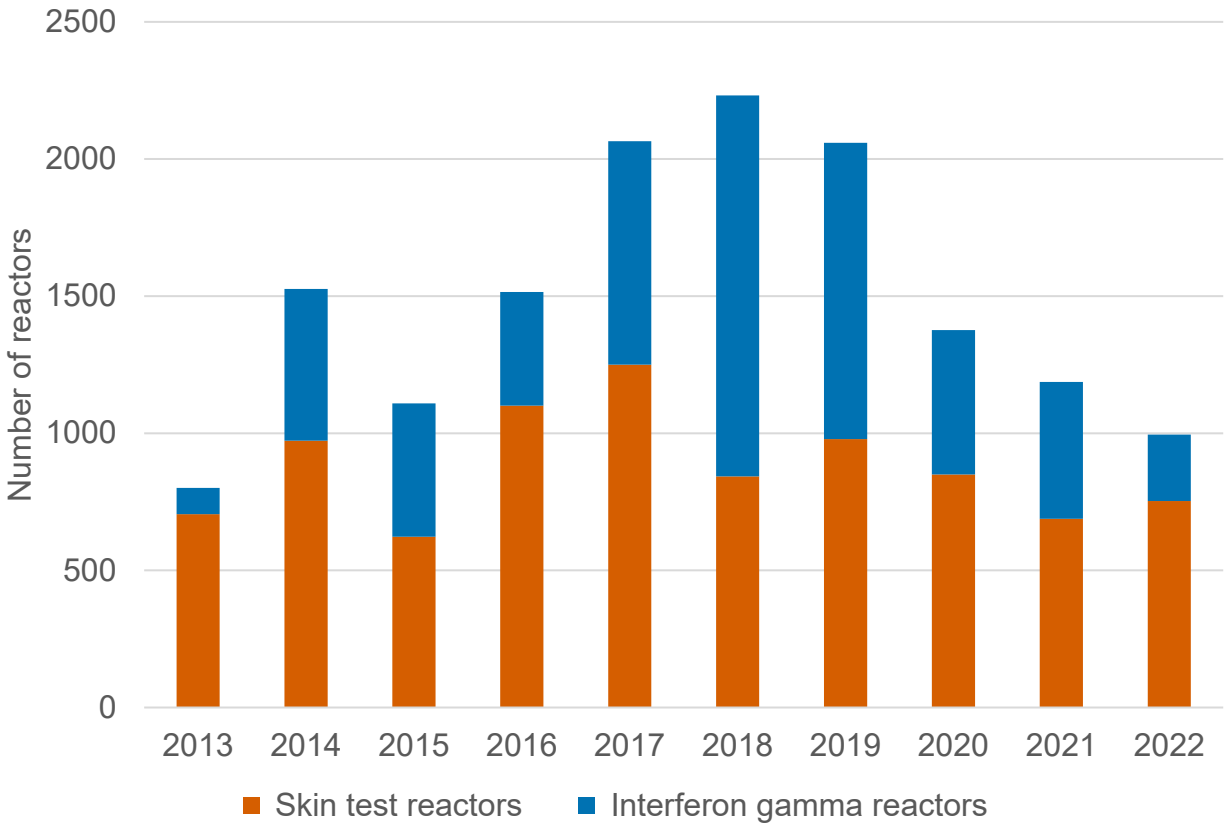

Figure 7: Number of skin test reactors (SICCT) and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Cheshire, from 2013 to 2022.

Main risk pathways and key drivers for TB infection

It is important to try to understand the risk pathways and key drivers that are likely to have introduced TB infection into a herd. This information can help identify mitigations that may reduce TB risk for individual businesses.

Implementing practical measures can help to reduce the risk of TB incursion into a herd that is TB free (biosecurity), as well slowing disease spread within a herd where TB is present (biocontainment).

Furthermore, the ibTB online tool can be used to inform purchasing choices, reducing the risk of introducing undetected infection when moving cattle into a herd.

In 2022, 51 out of 114 (45%) new TB incidents in Cheshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The results of these investigations can be seen in Appendix 3. The small number of investigations carried out in 2022 was mainly due to the diversion of field resource to the large AI outbreak which occurred in 2021 and 2022.

New data driven methods to quantify the likelihood of risk pathways for TB infection have been developed by APHA. These include the:

- Cattle Movement Algorithm
- WGS Local Reservoir Indicator

The Cattle Movement Algorithm uses cattle movement data to identify individual animals that were moved into a herd as having a negligible, very low, low, medium, high or very high likelihood of being the source of the TB infection. At the herd level, the cattle movement score is dictated by the animal with the highest ranked movement into that herd. Herd are classified as having either:

- cattle movements associated with high likelihood of infection (a herd with any movements scored as a high or very high likelihood)
- no cattle movements with a high likelihood of infection (the highest likelihood score was negligible, very low, low or medium).

The WGS Local Reservoir Indicator uses WGS data from cattle *M. bovis* isolates to identify TB incidents that are linked by genetics, time and space. A TB incident where at least one other TB incident is identified that satisfies all the following 3 criteria is considered to have evidence of a local reservoir of infection:

- it has a WGS with no more than 3 single nucleotide polymorphism (SNP) differences relative to the TB incident of interest
- it is within 4 years before or 6 months after the start date of the incident of interest
- it is within a 9km radius of the incident of interest.

Further details about the methodology used can be found in the explanatory supplement to the annual reports 2022.

There is always a variable degree of uncertainty about the estimated true routes of TB infection into a herd. The absence of a local reservoir, or cattle movements associated with a high likelihood of infection does not completely negate these pathways. Nonetheless, the evidence provided by the cattle movement and WGS data, when combined, can provide valuable insights into the possible risk pathways. Figure 8 provides the percentage of herds where each risk pathway combination was identified. The spatial distribution of these categories are presented in Figure 9. Each category is described in greater detail in the following text.

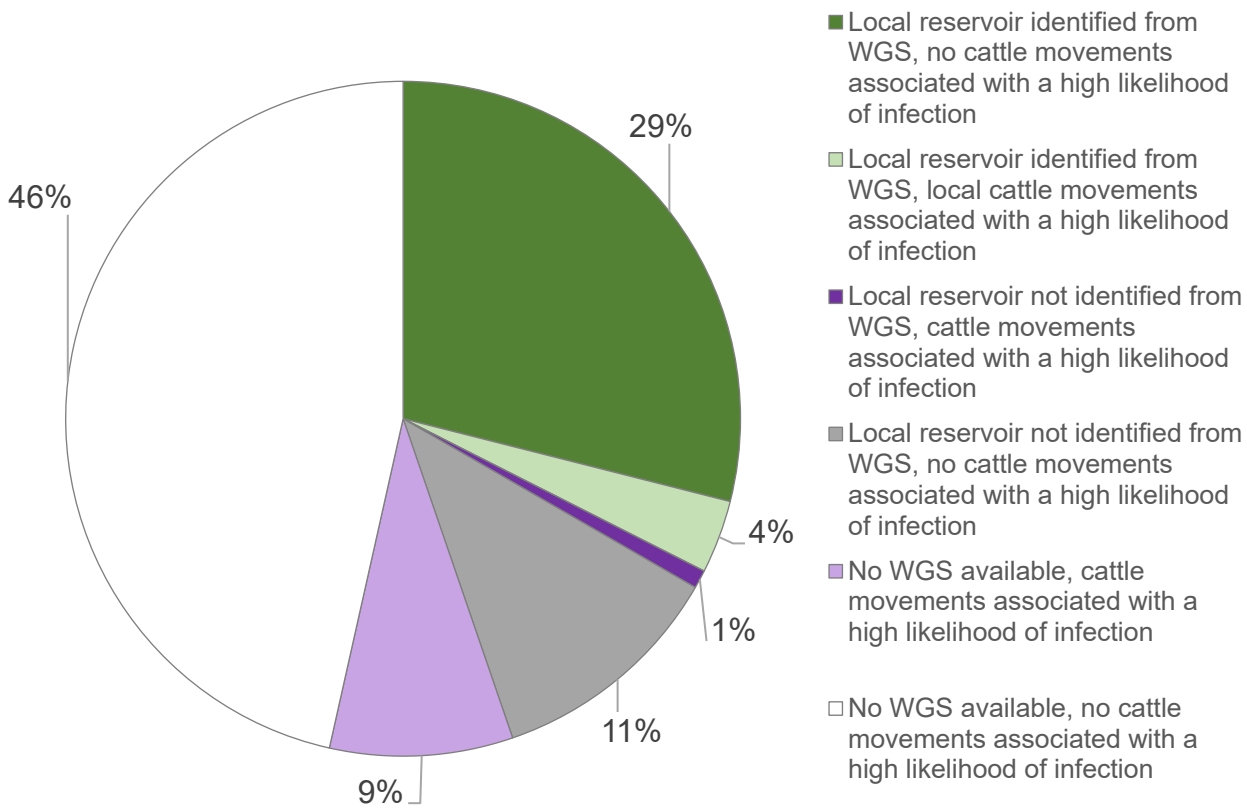

Figure 8: Risk pathway combinations identified by the WGS local reservoir indicator and cattle movement algorithm for all 114 new TB incidents in Cheshire in 2022.

WGS data was available for 51 (44%) of all new TB incidents in Cheshire. The WGS Local Reservoir Indicator identified a local reservoir of infection for 37 new TB incidents in 2022.

Of TB incidents with WGS data available, 33 (29%) had a local reservoir identified without strong evidence of cattle movements. These are dark green symbols in Figure 9. For these incidents, a broad spectrum of local pathways cannot be ruled out, including:

- residual infection in the herd
- contiguous contact with infected cattle
- direct or indirect contact with potentially infected wildlife

A further 4 (4%) TB incidents had evidence of both a local reservoir and local cattle movements (within 25km) associated with a high likelihood of TB infection. For these TB incidents, local cattle movements may have played a part in the spread of this local infection, in addition to the previously listed local pathways. These incidents are symbolised in light green in Figure 9.

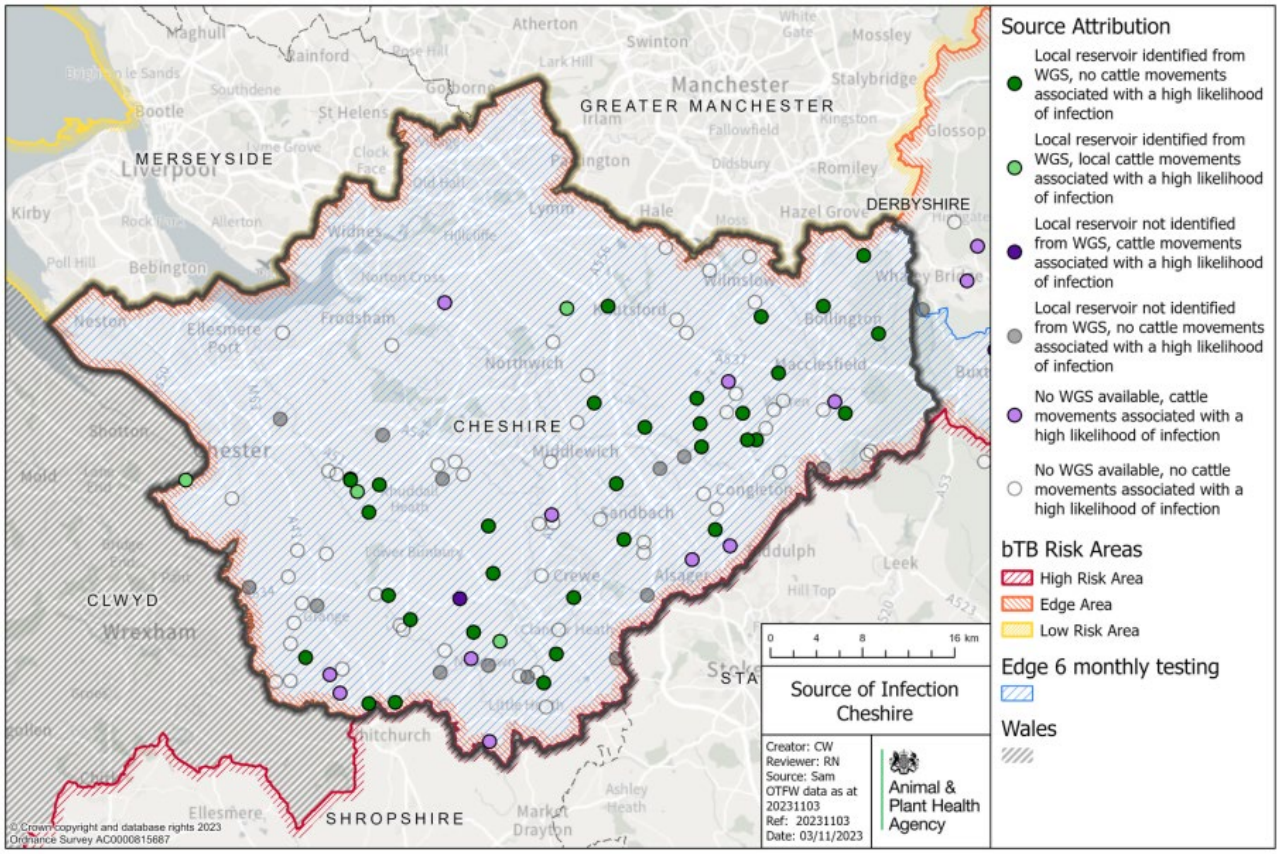

Figure 9: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Cheshire that started in 2022.

In Cheshire, one TB incident (1%) had evidence of cattle movements associated with a high or very high likelihood of TB infection , and no evidence of a local reservoir where

WGS was available. For this herd it was considered more likely than not that cattle movements played a part in the introduction of infection (dark purple symbols, Figure 9).

For a further 10 (9%) TB incidents, there was evidence of cattle movements associated with a high likelihood of TB infection, but WGS data was not available to look for a local reservoir. These are depicted in light purple in Figure 9 due to the lack of genetic evidence.

For 13 (11%) TB incidents, the WGS Local Reservoir Indicator did not find evidence of a local reservoir, and there was no evidence of cattle movements associated with a high likelihood of TB infection. The source of infection was unclear for these TB incidents (grey symbols).

There was no evidence of cattle movements associated with a high likelihood of TB infection and no WGS available to explore the presence of a local reservoir for 53 of the 114 (46%) TB incidents. These are shown as white dots in Figure 9, as there is insufficient evidence to determine a likely infection pathway.

In Appendix 3, Table 5 shows the suspected sources from completed DRF analysis of risk pathways for those incidents that were investigated in 2022. Similar to 2021, the weighted contribution of badgers is 65% followed by other or unknown (10.8%), cattle movements (10.5%), residual cattle infection (7.8%), deer (3%) and contiguous (2.5%). Badgers are still considered to be an important reservoir of infection in Cheshire with deer increasing in importance in East Cheshire. Continued vigilance is needed to reduce the levels of cattle movements from higher risk areas, encouraging the use of online mapping tools such as ibTB and encouraging research by farmers into the TB history of cattle. The farm level TB reports provided to all incidents are beneficial to illustrate purchase risks and the local TB situation.

Suspicion of residual infection remains similar to 2021. It can be difficult to differentiate between residual cattle infection in the herd, suspected local wildlife infection or local cattle movements. Local WGS clades may not differentiate between them but more detailed phylogenetic analysis plus the use of algorithms linking cattle movement data will be of great benefit in future analyses.

TB incidents that were detected in Cheshire between 2019 and 2022, where the WGS Local Reservoir Indicator identified another infected herd within 3 SNPs, 9km and the past 4 years or within 6 months after are visualised in Figure 9. This shows the accumulation of local reservoirs over time. The WGS clade is provided to identify clusters of related infection. In Cheshire, clade B3-11 has historically clustered, and continues to cluster along the border with the HRA counties of Shropshire and Staffordshire. Clade B6-11 is more predominantly found towards the centre of Cheshire, but still localised to the southern half of the county.

There were 2 new incidents with WGS clade B6-83 in the centre of Cheshire.

Except for the ongoing cluster of B3-11 in the north-east of Cheshire, around the Low Risk Area (LRA) border with the Stockport area of Greater Manchester, the northern border of Cheshire continued to be free of a local reservoir of infection in 2022 (Figure 10).

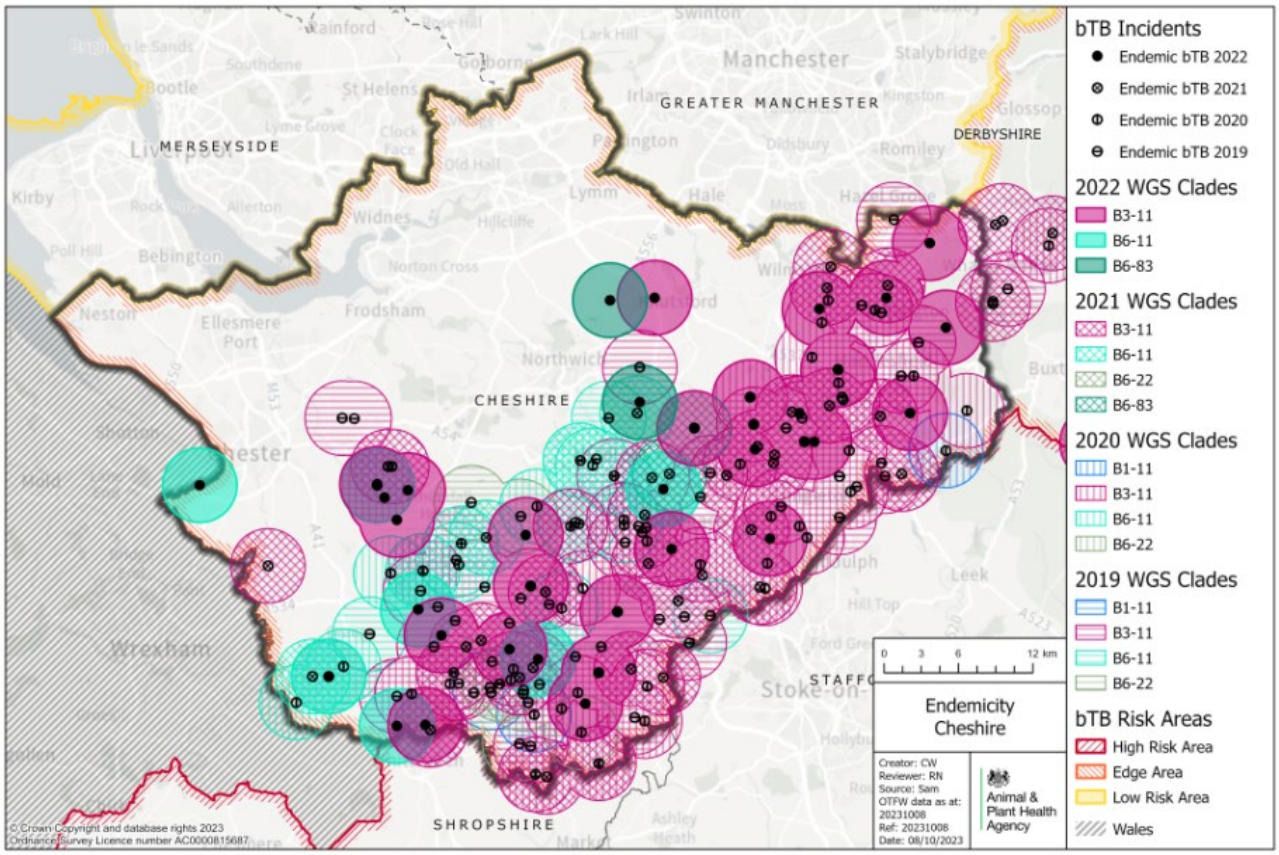

Figure 10: WGS clades of *M. bovis* detected in Cheshire between 2019 and 2022, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and within 9km (OTF-W incidents only).

Forward look

The ratio of OTF-W to OTF-S incidents went up slightly in 2022 (55% of all incidents were OTF-W) compared to 2021 (51% of all incidents were OTF-W). However, this remained lower than in 2018 (68% of all incidents were OTF-W). Although the whole county incidence rate (10.6 incidents per 100 herd-years at risk) and prevalence (4.3%) continued to decrease in 2022, OTF county status will not be achieved by 2025.

There was a 9% increase in the number of skin test reactors and a 52% decrease in IFN- γ test positives compared to 2021. Since 2017, there has been a 40% reduction in the number of skin test reactors and 70% decrease in the number of IFN-γ test positives. Various factors are likely to have influenced this including an IFN-γ testing policy change in 2021 as already described.

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.

In 2022, 116 badgers were vaccinated in Cheshire, a 50% reduction compared to 2021 (232) and represented 4.8% of all badger vaccination in England in 2022. Badger vaccination activities should look to increase with the completion of culling operations if the overall incidence of bovine TB is to continue to decrease in Cheshire. In 2022, 846 badgers were culled under licence in Cheshire. Increased awareness and incentivised reporting of TB in deer would be beneficial.

The importance of maintaining all the available tools for reducing bovine TB cannot be underestimated in order to achieve longer term control.

There are several measures that could help to address the most common risk pathways for TB infection in Cheshire. These include:

- badger TB control measures to reduce the risk of transmission to cattle, including the further expansion of badger vaccination
- 6M herd testing in higher risk herds to enable earlier detection of disease within herds
- IFN-γ blood testing in OTF-W herds
- encouragement to use TB Advisory Service (visits, badger sett surveys and advice)
- increase awareness of biosecurity within and between farms through use of the TB Hub, APHA visits, TB Advisory Service and private vets
- increase risk awareness when purchasing cattle and use of ibTB tool to aid this
- wild animal surveillance

Appendix 1: cattle industry demographics

Table 1: Number of cattle herds by size category in Cheshire as of 31 December 2022 (RADAR data).

Size of herds	Number of herds in Cheshire
Undetermined	7
1 to 50	469
51 to 100	164
101 to 200	186
201 to 350	173
351 to 500	101
Greater than 500	113
Total number of herds	1,213
Mean herd size	194
Median herd size	87

Table 2: Number (and percentage of total) of animals by breed purpose in Cheshire as of 31 December 2022.

Breed purpose	Number (and percentage of total) cattle in Cheshire
Beef	61,849 (26%)
Dairy	161,723 (68%)
Dual purpose	12,055 (5%)
Unknown	4 (0.002%)
Total	235,631

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Cheshire between 2020 and 2022.

Herd-level statistics	2020	2021	2022
(a) Total number of cattle herds live on Sam at the end of the reporting period	1,519	1,436	1,431
(b) Total number of whole herd skin tests carried out at any time in the period	2,155	2,177	2,026
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	1,178	1,204	1,172
(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)	1,331	1,285	1,292
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	1,412	1,354	1,359
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period (including all Finishing Units)	74	69	51
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period (including all Finishing Units)	86	72	63
(g.1) Of the new 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?	5	0	N/A
(g.2) Of the new OTF-W herd incidents, how many were triggered by skin test Reactors or 2xIRs at routine herd tests?	45	44	N/A

Herd-level statistics	2020	2021	2022
(g.3) Of the new OTF-W herd incidents, how many were triggered by skin test Reactors or 2xIRs at other TB test types (such as forward and back-tracings, contiguous or check tests)?	28	10	N/A
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine slaughterhouse TB surveillance?	12	19	19
(h.1) Number of new OTF-W incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	0	0	0
(h.2) Number of new OTF-S incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	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)	63	39	33
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	2	1	0
(k.1) Number of grazing approved finishing units active at end of the period	0	0	0
(k.2) Number of non-grazing approved finishing units active at end of the period	32	34	34
(k.3) Number of grazing exempt finishing units active at end of the period	1	1	1
(k.4) Number of non-grazing exempt finishing units active at end of the period	1	0	0

Table 4: Animal-level summary statistics for TB in cattle in Cheshire between 2020 and 2022.

Animal-level statistics (cattle)	2020	2021	2022
(a) Total number of cattle tested in the period (animal tests)	520,140	499,941	496,107
(b.1) Reactors detected by tuberculin skin tests during the year	850	688	753
(b.2) Reactors detected by additional IFN-γ blood tests (skin-test negative or IR animals) during the year	526	499	242
(c) Reactors detected during year per incidents disclosed during year	8.6	8.4	8.7
(d) Reactors per 1,000 animal tests	2.6	2.4	2.0
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	20	17	28
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughters)	11	4	5
(f) Slaughterhouse (SLH) cases (suspect tuberculous carcases) reported by Food Standards Agency (FSA) during routine meat inspection	42	39	59
(g) SLH cases confirmed by culture of *M. bovis*	21	24	20

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 incidents reported are submitted for culture analysis. All incidents reported are from any period prior to or during restrictions.

Appendix 3: suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in the report period

In 2022, 51 out of 114 (45%) new TB incidents in Cheshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The small number of investigations carried out in 2022 was mainly due to the diversion of field resource to the large AI outbreak which occurred in 2021 to 2022.

Each TB incident could have up to 3 potential risk pathways identified. 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)
- possible (score 1)

The sources for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely, or possible can contribute towards the overall picture for possible routes of introduction into a herd.

If the overall score for a herd is less than 6, then the score is made up to 6 using the 'Other or unknown source' option. Buffering up to 6 in this way helps to reflect the uncertainty in assessments where only 'likely' or 'possible' sources are identified.

Table 5 combines the data from multiple herds and provides the proportion of pathways in which each source was identified, weighted by the certainty that each source caused the introduction of TB. The output does not show the proportion of herds where each pathway was identified (this is skewed by the certainty calculation). WGS of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however WGS clades are not determined for OTF-S herds. As a result of varying levels of uncertainty, only broad generalisations should be made from these data. A more detailed description of this methodology is provided in the explanatory supplement for the annual reports 2022.

Table 5: Suspected sources of *M. bovis* infection for the 51 incidents with a preliminary or a final veterinary assessment in Cheshire, in 2022.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	26	30	20	0	65.1%

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Cattle movements	6	5	4	0	10.5%
Contiguous	5	1	0	0	2.5%
Residual cattle infection	14	3	1	0	7.8%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	0	0	0	0	0.0%
Fomites	1	0	0	0	0.3%
Other wildlife	2	2	1	0	3.0%
Other or unknown source	1	0	0	0	10.8%

Please note that each TB incident could have up to 3 potential pathways so totals may not equate to the number of actual incidents that have occurred.

Data Protection:
For information on how we handle personal data visit www.gov.uk and search Animal and Plant Health Agency Personal Information Charter.

This publication is available Bovine TB epidemiology and surveillance in Great Britain.

Any enquiries regarding this publication should be sent to us at the National TB Epi Mailbox.

www.gov.uk/apha

APHA is an Executive Agency of the Department for Environment, Food and Rural Affairs and also works on behalf of the Scottish Government, Welsh Government and Food Standards Agency to safeguard animal and plant health for the benefit of people, the environment, and the economy.