



Animal &
Plant Health
Agency

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

TB Edge Area - WARWICKSHIRE



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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 Warwickshire, 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 This includes both 'Officially Tuberculosis-Free Status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free Status Suspended' (OTF-S) incidents.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 carcasses 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

Small herds of up to 50 cattle continued to predominate in the county and beef animals accounted for 73% of the total cattle population of Warwickshire in 2022, as shown in Appendix 1. There were 14 AFUs in total, the latest one licensed by APHA in 2022.

Warwickshire was originally divided between 2 TB risk areas. The High Risk Area (HRA) in the south and west, and the Edge Area in the north and east of the county.

The whole of Warwickshire was fully incorporated into the Edge Area in January 2018. Herds in the original HRA part of the county undergo routine surveillance TB testing every 6 months, whilst herds in the original Edge Area of the county are routinely tested annually.

Cattle herds in Warwickshire routinely undergo 6-monthly (6M) surveillance TB testing. However, 32% of cattle herds were regarded as having a lower risk of contracting TB and thus eligible for annual testing, under the [earned recognition scheme](#), in 2022.

There is a single livestock auction market in the county (Rugby Farmers' Market). This market is also licenced to trade TB-restricted cattle. Other markets used are Thrapston and Thame in the adjoining Edge Area counties of Northamptonshire and Oxfordshire, respectively.

Two cattle abattoirs operate in Warwickshire.

There are 30 pieces of common land registered in the county. However, they were all relatively small and no links were identified to any TB incidents in 2022. Grazing common land can be a high-risk strategy as cattle from multiple herds can mix freely.

New TB incidents

The number of new TB incidents continued to decrease in 2022, compared to 2021: 54, down from 57 (Figure 1). This was the fifth consecutive annual decrease in the number of new incidents in Warwickshire.

Proportionately, OTF-S incidents represented the biggest decline, to 21 in 2022 from 27 in 2021. The number of OTF-W incidents increased to 33 in 2022 from 30 in 2021.

In the original Edge Area, the number of OTF-W incidents increased from 11 in 2021 to 13 in 2022, and the number of OTF-S incidents disclosed fell to 4 in 2022 compared to 13 in the previous year.

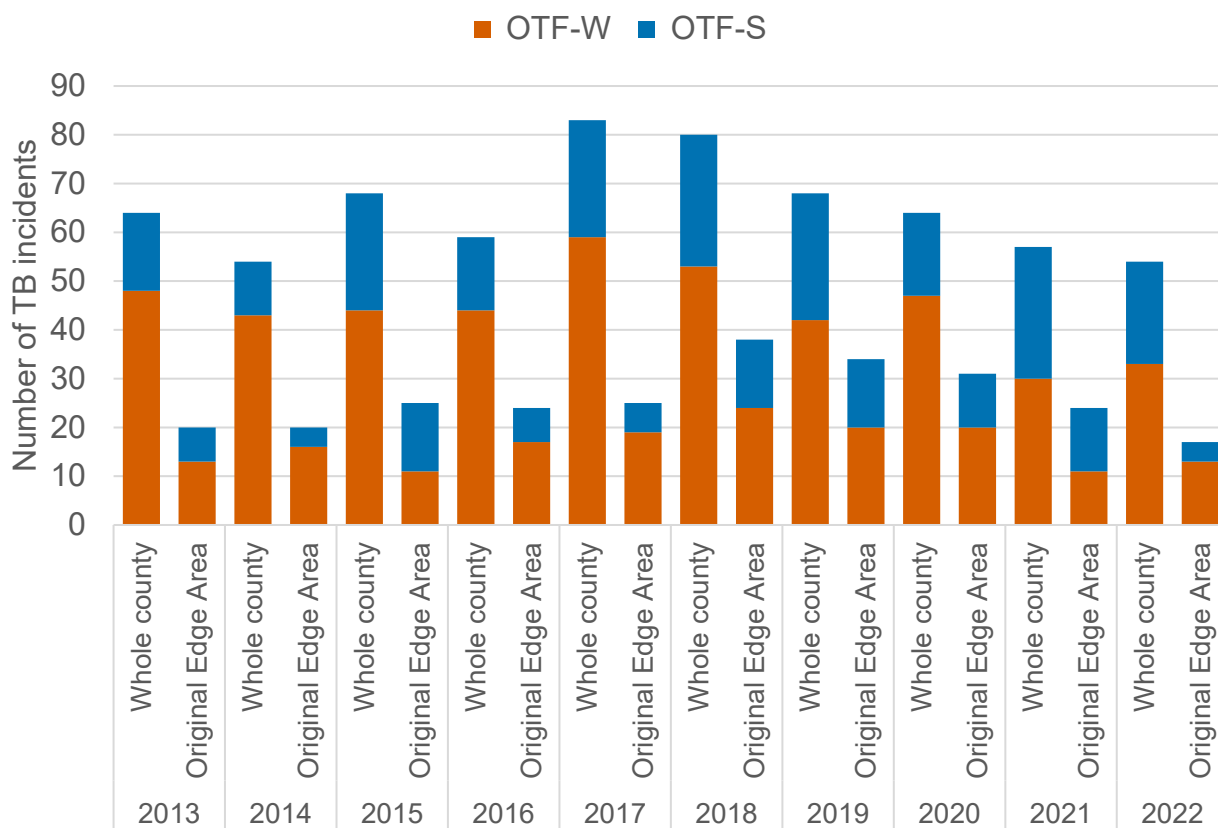


Figure 1: Annual number of new TB incidents in Warwickshire, from 2013 to 2022.

Disclosing test types

As in previous years, Whole Herd Tests the surveillance test type in 6 and 12-monthly routine surveillance, continued to detect the most incidents of TB in Warwickshire in 2022 (32). This was followed by 6 month post-incident surveillance tests (14) and slaughterhouse surveillance (7), as shown in Figure 2. These data show the continuing importance of 6 month tests and slaughterhouse surveillance to reduce disease spread.

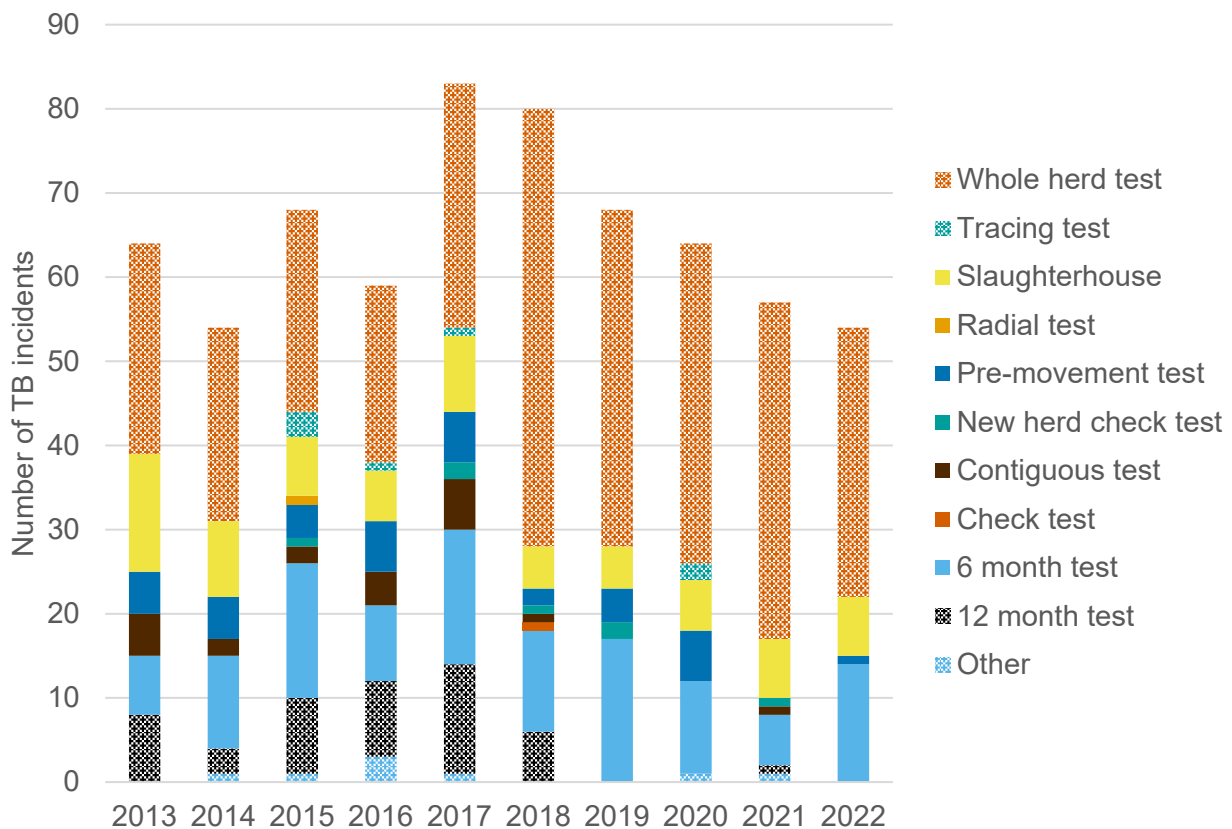


Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Warwickshire in 2022, according to the surveillance methods that detected them.

Duration of TB incidents

A total of 51 TB incidents were resolved in Warwickshire during 2022. Of these, 23 were new TB incidents that started in 2022, 25 started in 2021, 2 were from 2020 and one started in 2019.

The median duration of OTF-W incidents that ended in 2022 was 187 days (interquartile range (IQR) 159 to 350). One OTF-W incident took over 550 days (18 months) to resolve, but the majority (19 out of 29) did not last more than 240 days (around 8 months). The herd with the persistent TB incident (under movement restrictions for more than 550 days) was compliant with its TB testing regime, but reactors were disclosed at each test, increasing the duration of the incident.

Most OTF-S incidents that ended in 2022 (18 out of 22) were resolved within 240 days, median was 187.5 days (IQR 165 to 206). However, one lasted longer than 550 days.

One OTF-W TB incident, still open at the end of 2022, had been open for more than 550 days. The keeper was compliant with testing, yet each short-interval test disclosed more reactors leading to a longer than average testing period.

The median duration for all incidents that ended in 2022 was 187.5 days (IQR 161 to 254). This is shorter than the duration of incidents that ended in 2021 (204 days, IQR 167 to 277). 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

A dairy herd in the south of the county sustained an explosive TB incident in November 2022. This was disclosed at a 6M post-incident test, where 39% (342 of the 876 cattle tested) were reactors. Of these, 48% had visible lesions at post-mortem examination. Follow-up testing included interferon gamma (IFN- γ) blood testing, as well as supplementary IDEXX and Enferplex testing. Partial herd depopulation was completed following a veterinary risk assessment, leaving approximately 30% of the initial herd on the farm.

The most likely pathway of infection was considered to be residual infection in the herd from the last incident, which ended in July 2022. The local clade B6-62 of *M. bovis* was isolated.

TB in other species

There is no statutory routine TB surveillance of non-bovine species, apart from post-mortem examination 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 with an elevated risk of infection.

In 2022, there were 4 incidents of TB in non-bovine species. One incident was disclosed in alpacas. The most likely pathway of infection of this herd was movement of alpacas from a herd with a confirmed TB incident.

There was an incident of TB on one mixed livestock farm that kept 2 pigs, for personal consumption, in a 3-walled barn with open frontage. Both pigs were found to have lesions of TB at slaughter and *M. bovis* was cultured from those. The feed and water troughs were accessible to badgers and badgers were known to frequent the farm. The most likely pathway of infection was indirect interaction with wildlife.

One incident was disclosed by post-mortem meat inspection of sheep from a slaughter market in Warwickshire. Clade B3-11 of *M. bovis* was isolated and investigation continues into source and spread.

Incidence of TB

Warwickshire had the second highest TB incidence per 100 herd-years at risk in the 11 Edge Area counties. However, this parameter continued to decline for the third consecutive year, as shown in Figure 3.

Despite the decrease observed in 2022, Warwickshire's incidence rate (12.3 incidents per 100 herd-years at risk) remains above the overall incidence for the Edge Area (7.6)

Decreasing incidence may be potentially explained by factors such as:

- Reduced residual infection in cattle herds affected with TB incidents due to use of supplementary interferon gamma testing
- Reduced residual infection in wildlife populations due to the badger control measures
- Earlier detection of TB incidents due to the increased frequency of the default herd testing interval (6M testing in the whole county since 2018)

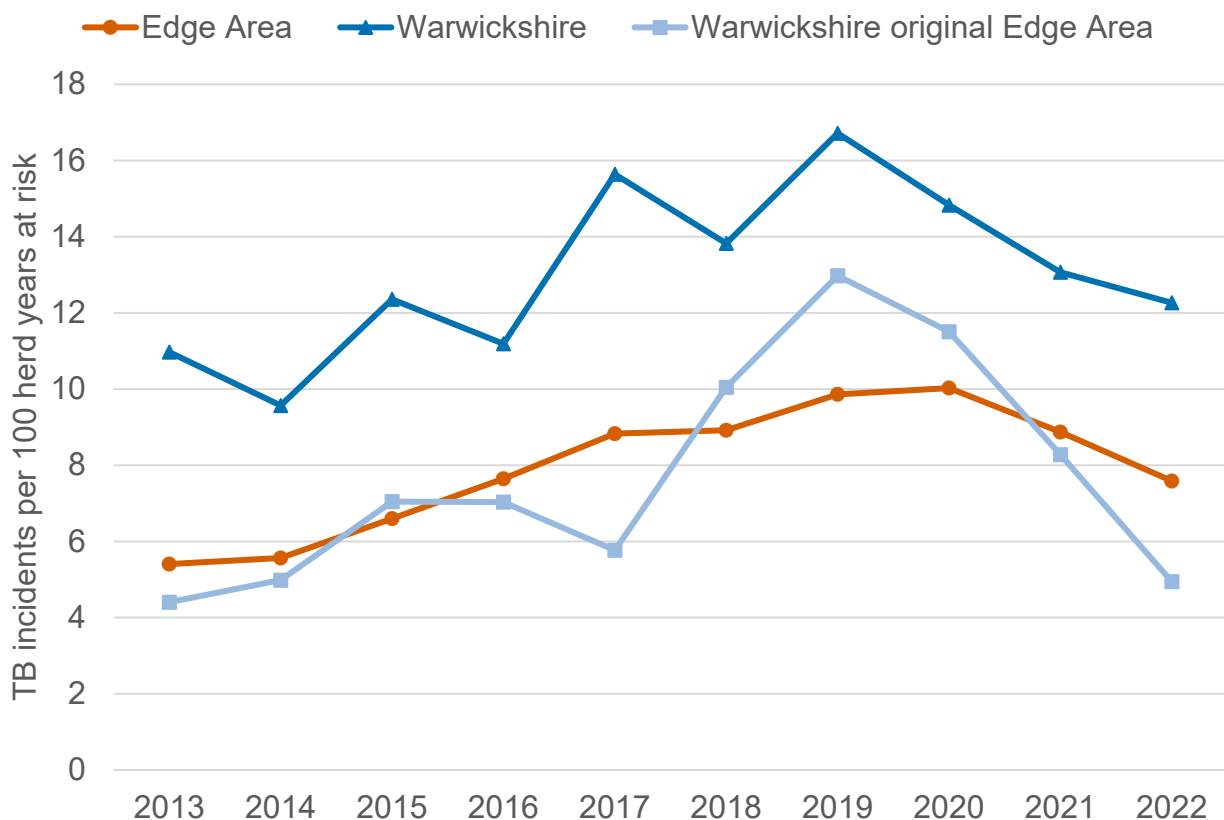


Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Warwickshire from 2013 to 2022.

Prevalence of TB

After 3 years of decreasing herd prevalence in the whole county, the prevalence increased slightly in Warwickshire in 2022 to 5.6% from 5.4% in 2021 (Figure 4). This may be due to a combination of factors, including an increase in OTF-W incidents, which usually have a longer duration.

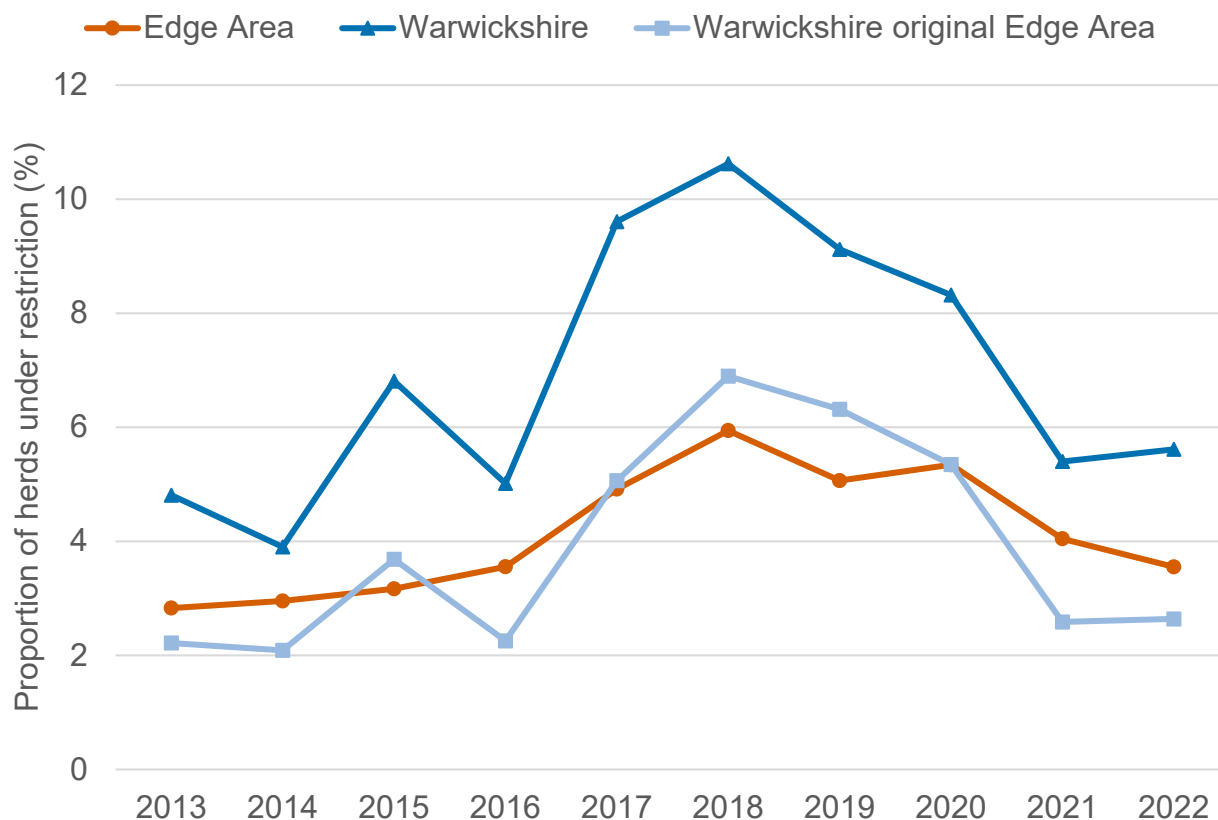


Figure 4: Annual end of year prevalence in Warwickshire, from 2013 to 2022.

Re-occurring TB incidents

In Warwickshire, there were a total of 20 herds with new TB incidents in 2022 that had not had another TB incident in the previous 3 years. Of these, 7 were OTF-S and 13 OTF-W, as shown in Figure 5. Incidents re-occurred in 62% of herds in 2022, with OTF-S incidents in 65% herds and OTF-W incidents in 59% herds. Re-occurrence in Warwickshire was slightly higher than in the Edge Area overall (50%) and was the third highest after East Sussex (71%) and Berkshire (67%).

It is difficult to assess the pathways for these incidents as only 22% or 12 out of 54 new TB incidents received a preliminary or final APHA veterinary investigation to identify the source of infection due to the pressures of the highly pathogenic avian influenza (AI) outbreak work. They are likely to be driven by a combination of re-infection and residual infection.

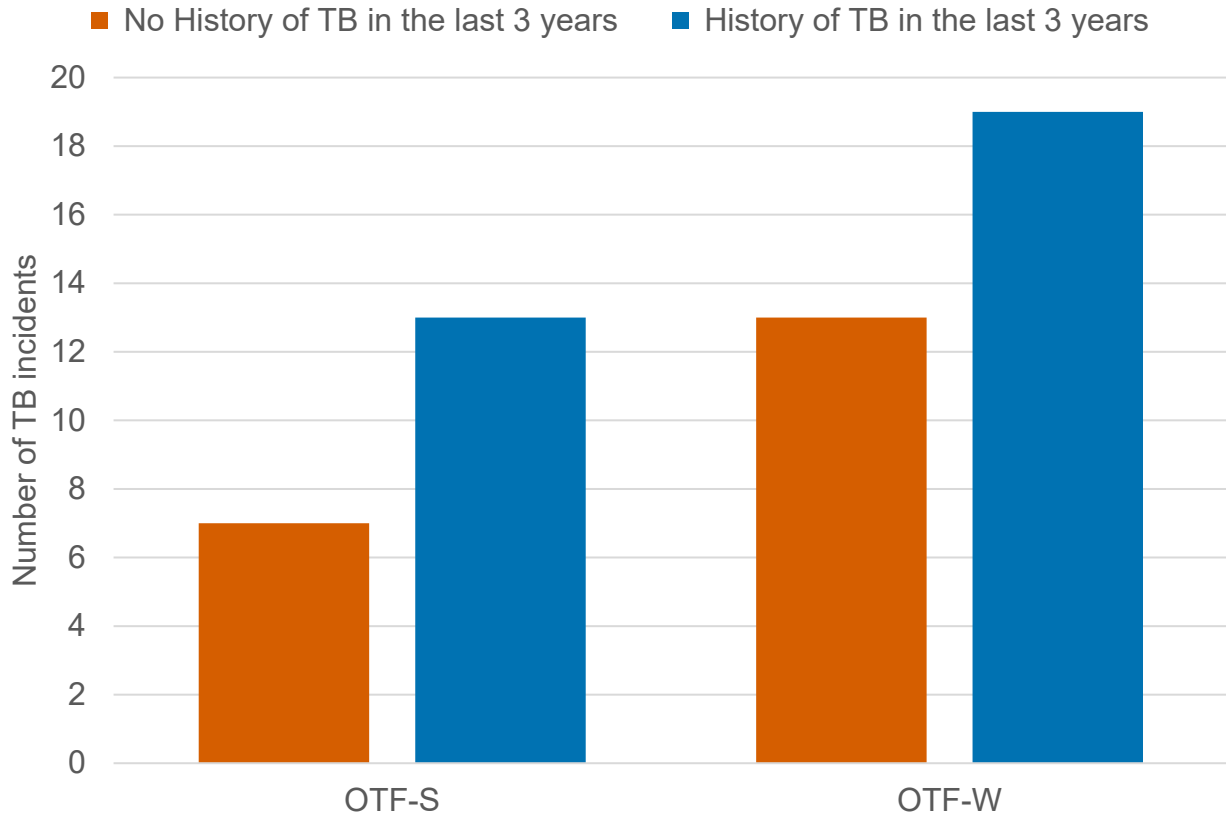


Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Warwickshire in 2022, with and without a history of any TB incident in the previous 3 years.

Geographical distribution of TB incidents

When including finishing units in the calculation of new incidents per 100 herd-years at risk, the bordering counties of Hereford & Worcester (16.3), Gloucestershire (15.6) and Oxfordshire (15.1) all had a higher incidence rate than Warwickshire in 2022 (12.7). As such, these neighbouring counties still represented a significant risk of TB infection pressure in 2022. Additionally, there was an increase in incidence in the High Risk Area as a whole (14.4).

High-density cattle population areas are generally associated with greater numbers of incidents, especially when combined with proximity to endemic areas; such as south Warwickshire. New TB incidents in 2022 were disclosed mainly in the south and south-west parts of the county, particularly on the borders with Oxfordshire, Gloucestershire, Worcestershire and Northamptonshire, as shown in Figure 6.

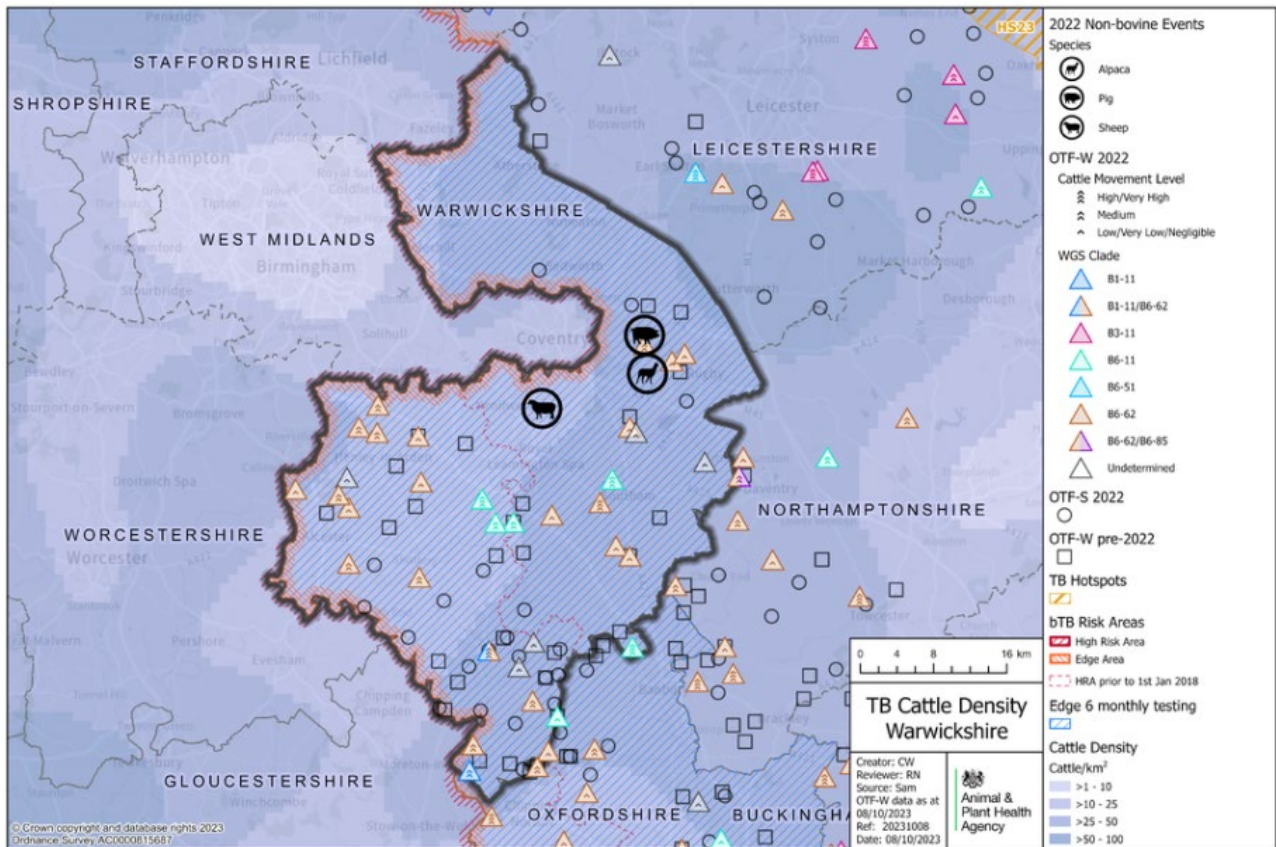


Figure 6: Location of cattle holdings in Warwickshire with new TB incidents (OTF-W and OTF-S) in 2022 and cattle holdings with pre-2022 OTF-W incidents still ongoing at the beginning of 2022, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle movements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

Appendix 2 provides a summary of headline cattle TB statistics in Warwickshire. In 2022, a total of 699 test positive animals were identified in Warwickshire, as shown in Figure 7. This is the highest total number of test positive animals removed from herds after a steady decline since a peak of 758 animals in 2018. The increase is in spite of fewer individual incidents and is most likely due to the number of reactors from the explosive incident already discussed.

Of the 699 test positive animals in 2022, 79% were skin test reactors, compared to 58% in 2021. The remaining animals removed in 2022, 21%, were IFN- γ test positive, compared to 42% in 2021. The decreased proportion of IFN- γ test positive animals may have been influenced by several factors. There was a change in IFN- γ testing policy introduced 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 were eligible for

sampling. Furthermore, the diversion of field resource to the large AI outbreaks which occurred in 2021 and 2022, together with the reduction in incidence are likely to have influenced the number of IFN- γ tests carried out in 2022 compared to 2021 and 2020.

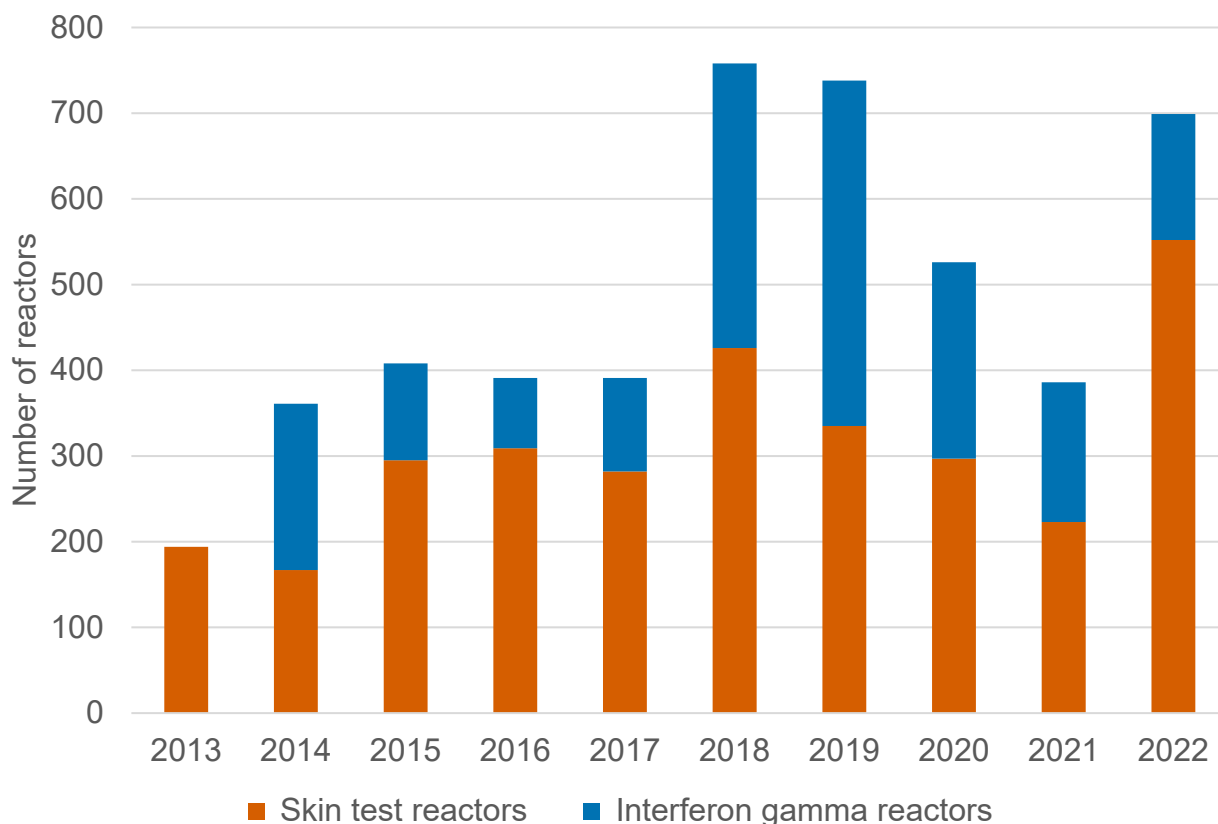


Figure 7: Number of skin test reactors (SICCT) and interferon gamma (IFN- γ) test positive cattle removed by APHA for TB control reasons in Warwickshire, from 2013 to 2022.

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, 12 out of 54 (22%) new TB incidents in Warwickshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The results of these investigations are reported 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
- Whole genome sequencing (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 highest ranked movement into that herd. Herds are classified as having either:

- cattle movements associated with a 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 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.

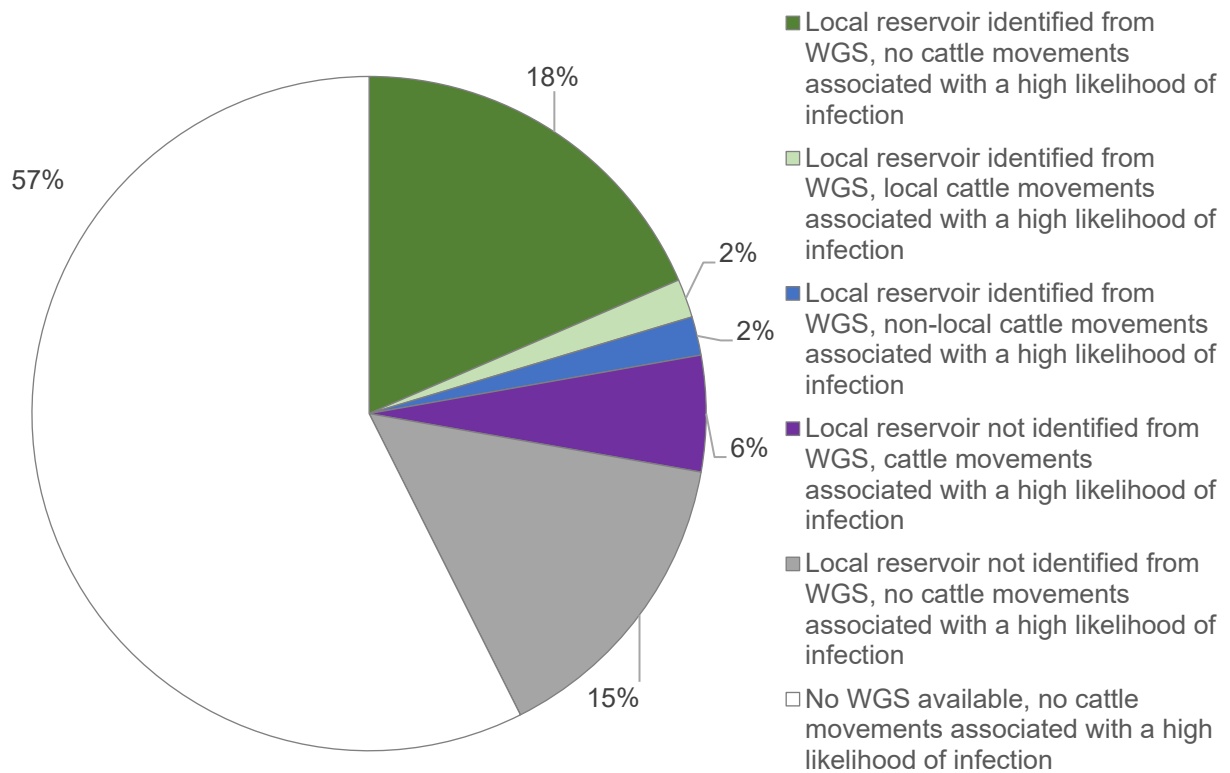


Figure 8: Risk pathway combinations identified by the WGS local reservoir indicator and cattle movement algorithm for all 54 new TB incidents in Warwickshire in 2022.

WGS data was available for 23 (43%) of all new TB incidents in Warwickshire. The WGS Local Reservoir Indicator identified a local reservoir of infection for 12 (20%) new TB incidents in 2022.

Of the TB incidents with WGS data available, 10 had a local reservoir identified without strong evidence of cattle movements (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.

One TB incident had evidence of both a local reservoir and cattle movements (within 25km) associated with a high likelihood of TB infection. For this incident, local cattle movements may have played a part in the spread of local infection, in addition to the previously listed local pathways. This incident is symbolised in light green.

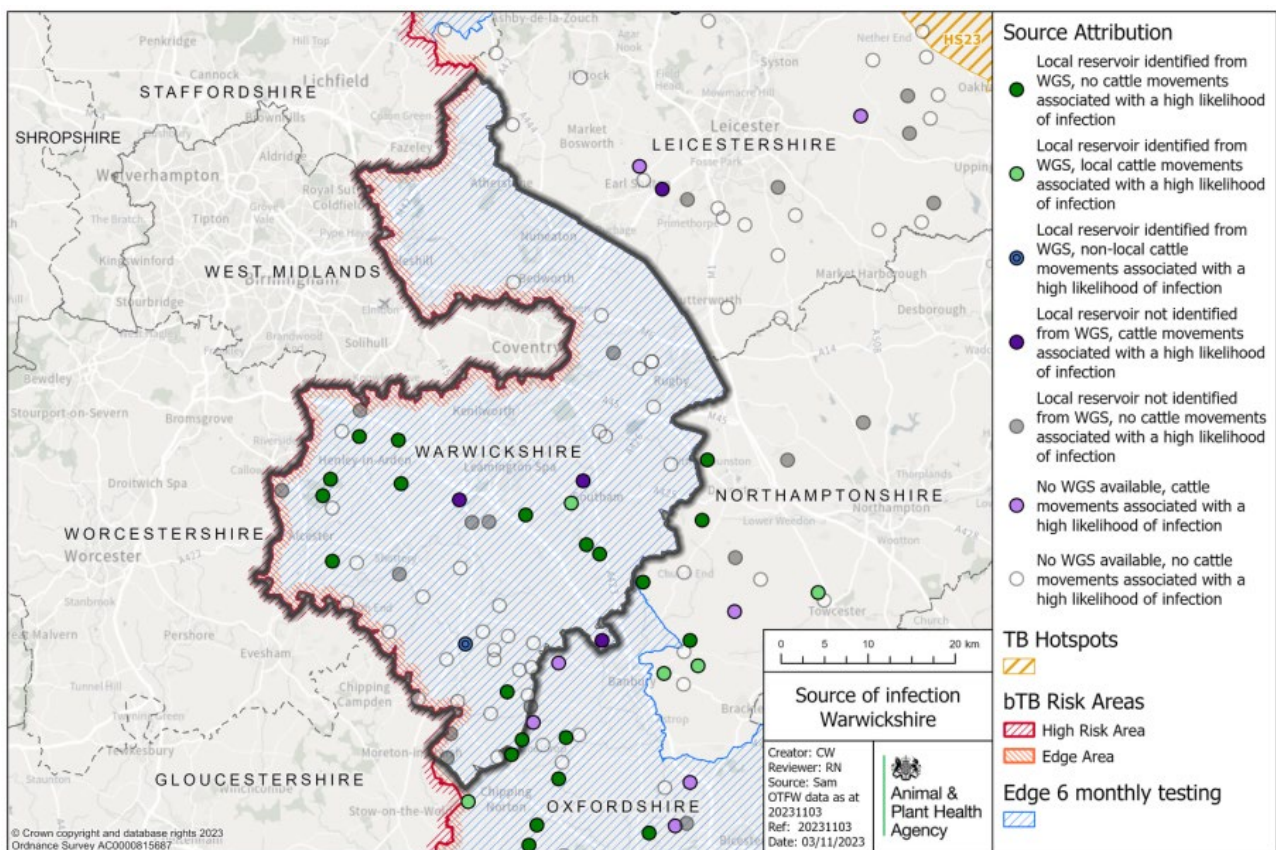


Figure 9: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Warwickshire that started in 2022.

For one other TB incident there was both evidence of a local reservoir and evidence of cattle movements, over a distance greater than 25km. With multiple likely risk pathways, it is possible there was more than one route of disease incursion into the herd. Both clades, B1-11 (homerange Shropshire) and B6-62 (within homerange) were identified during this incident, supporting this theory. This incident is shown with a blue symbol in Figure 9.

In Warwickshire, 3 TB incidents (6%) had evidence of cattle movements associated with a high or very high likelihood of TB infection, without evidence of a local reservoir. For those herds it was considered more likely than not that cattle movements played a part in the introduction of infection (purple symbols, Figure 9).

For 8 TB incidents (15%) 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 31 of the 54 (57%) TB incidents. These are shown as white dots in Figure 9, as there was insufficient evidence to determine a likely infection pathway.

New TB incidents in 2022 were disclosed mainly in the southern part of the county, particularly on the borders with Oxfordshire, Gloucestershire and Northamptonshire. There was also a cluster in the west of Warwickshire near the border with Worcestershire, as shown in Figure 10.

APHA moved to WGS of *M. bovis* isolates in 2021. Stable clusters of WGS clades tend to be found in areas where there is an established reservoir of infection. Previous annual reports refer to spoligotypes or genotypes. In this context there has been no change in the predominant strain of TB found in Warwickshire in recent years. Consistent with findings since 2019, and shown in Figure 10, the most commonly detected WGS clade of *M. bovis* was B6-62, associated with 76% of the OTF-W incidents (22 out of 29). Additional information provided by WGS of *M. bovis* isolates from OTF-W incident herds shows that disease has become established in the south of Warwickshire.

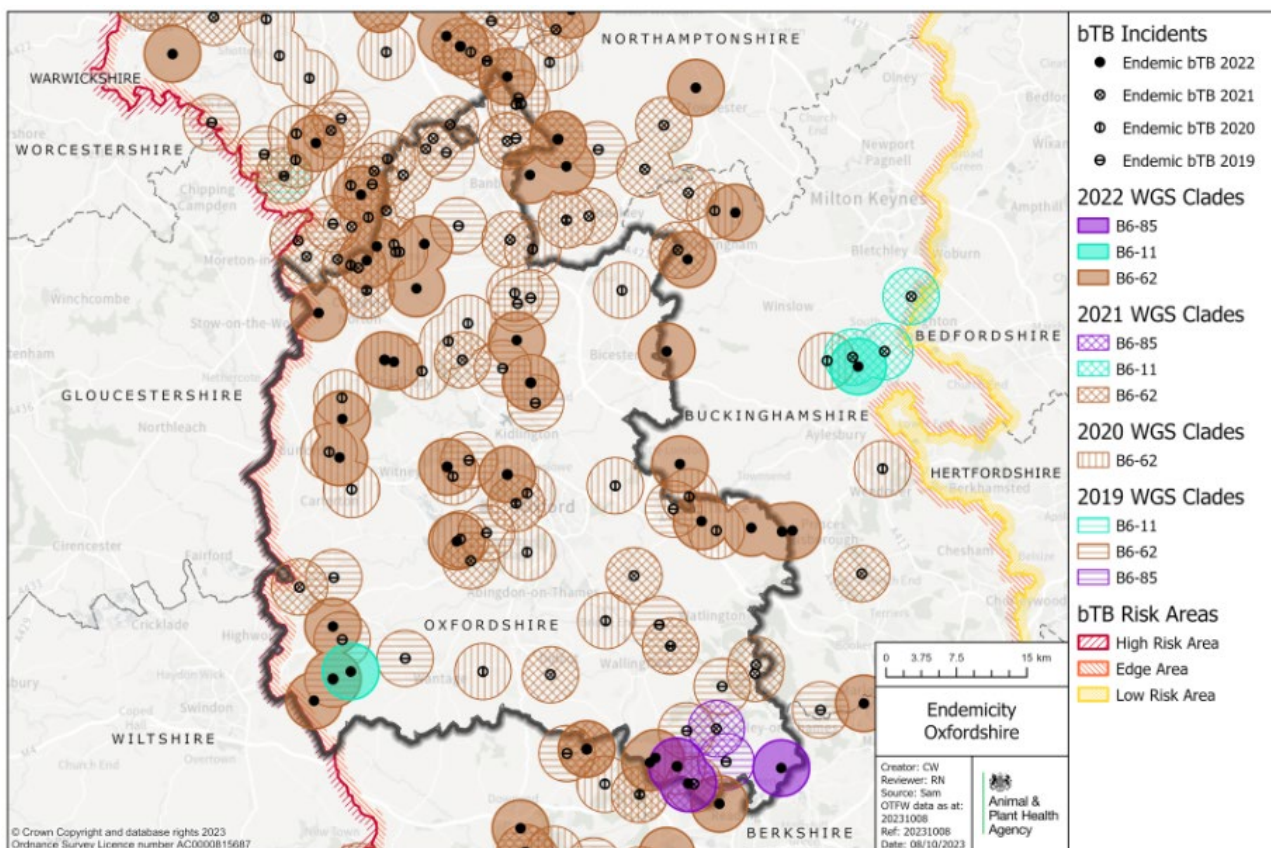


Figure 10: WGS clades of *M. bovis* detected in Warwickshire between 2019 and 2022, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and 9km (OTF-W incidents only).

Forward look

Despite a fifth consecutive annual decrease in the number of TB incidents, 2022 still saw a high number of incidents detected. The 6M routine surveillance testing of most cattle herds in Warwickshire supports the early detection of TB, reducing the potential for lateral spread

of infection. Official TB Free status (OTF) for Warwickshire will not be achieved by 2025, as set out in the Strategy for achieving OTF status for England, published in 2014. However, progress is being made and the outlook is positive.

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

- incentivising the uptake of effective biosecurity measures
- managing the TB risks posed by cattle movements to reduce the risk of spread of TB within and between farms
- continuation and further adoption of disease control measures to prevent the spread of TB between cattle and wildlife, including biosecurity, badger culling or vaccination, and local control of the wild deer population

Appendix 1: cattle industry demographics

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

Size of herds	Number of herds in Warwickshire
Undetermined	6
1 to 50	238
51 to 100	96
101 to 200	82
201 to 350	47
351 to 500	17
Greater than 500	14
Total number of herds	500
Mean herd size	107
Median herd size	54

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

Breed purpose	Number (and percentage of total) cattle in Warwickshire
Beef	39,192 (73%)
Dairy	12,056 (22%)
Dual purpose	2,210 (4%)
Unknown	0 (0%)
Total	53,458

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Warwickshire 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	626	587	584
(b) Total number of whole herd skin tests carried out at any time in the period	847	876	812
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	474	473	463
(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)	546	520	519
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	569	550	545
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period (including all Finishing Units)	17	27	21
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period (including all Finishing Units)	47	30	33
(g.1) Of the new OTF-W herd incidents, how many can be considered the result of movement or purchase with an existing incident based on current evidence?	10	6	N/A
(g.2) Of the new OTF-W herd incidents, how many were triggered by skin test reactors or 2x inconclusive reactors (2xIRs) at routine herd tests?	25	22	18

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 backward tracings, contiguous or check tests)?	14	7	8
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine slaughterhouse TB surveillance?	6	7	7
(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 TB incidents in non-grazing Approved Finishing Units)	38	20	22
(j) New confirmed (positive <i>M. bovis</i> culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	1	3 (1 alpaca, 2 pigs, 1 sheep)
(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	13	13	14
(k.3) Number of grazing exempt finishing units active at end of the period	0	0	0
(k.4) Number of non-grazing exempt finishing units active at end of the period	0	0	0

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

Animal-level statistics (cattle)	2020	2021	2022
(a) Total number of cattle tested in the period (animal tests)	105,931	101,974	97,113
(b.1) Reactors detected by tuberculin skin tests during the year	297	223	552
(b.2) Reactors detected by additional IFN- γ blood tests (skin-test negative or IR animals) during the year	229	163	147
(c) Reactors detected during year per incidents disclosed during year	8.2	6.8	12.9
(d) Reactors per 1,000 animal tests	5.0	3.8	7.2
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	4	9	2
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughter)	4	2	0
(f) Slaughterhouse (SLH) cases (suspect tuberculous carcasses) reported by Food Standards Agency (FSA) during routine meat inspection	13	12	13
(g) SLH cases confirmed by culture of <i>M. bovis</i>	11	9	12

Note (c) Reactors detected during year per incidents disclosed during year. Reactors may be from incidents disclosed in previous 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, 12 out of 54 (22%) new TB incidents in Warwickshire 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 degree of certainty ascribed. Any combination of definite, most likely, likely, or possible contribute to 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 its certainty. 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 available for OTF-S herds and are limited by the number of positive culture results as well as policy considerations (usually only one per incident). 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 12 incidents with a preliminary or a final veterinary assessment in Warwickshire in 2022.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	2	1	9	0	50.9%

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Cattle movements	1	0	0	0	1.4%
Contiguous	0	0	0	0	0.0%
Residual cattle infection	2	3	1	0	14.0%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	0	0	0	0	0.0%
Fomites	0	0	0	0	0.0%
Other wildlife	2	4	1	0	19.2%
Other or unknown source	0	1	1	0	14.5%

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.



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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](#).

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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.