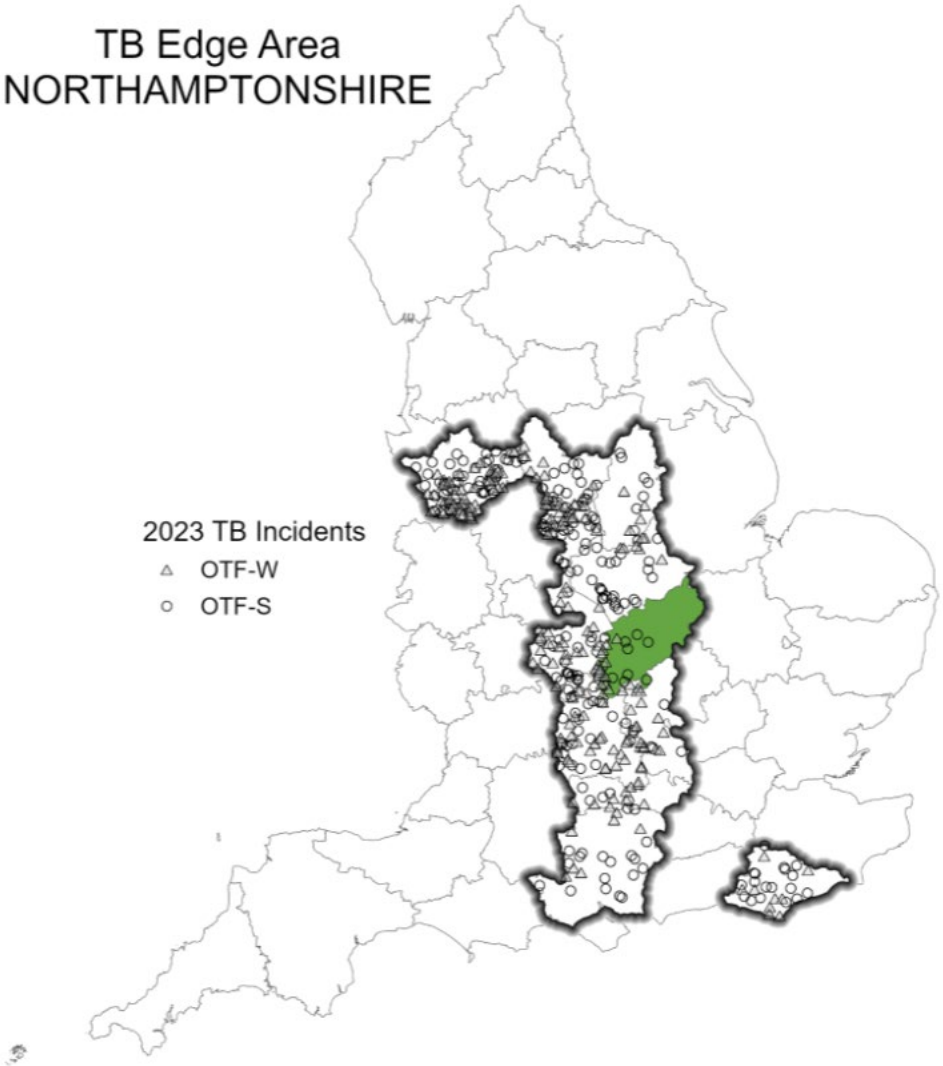
Animal &
Plant Health
Agency

Year End Descriptive Epidemiology Report: Bovine TB in the Edge Area of England 2023

County: Northamptonshire



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Introduction

The Edge Area was originally established in 2013, along with the Low Risk Area (LRA) and High Risk Area of England. In 2014, the 3 bovine tuberculosis (TB) risk areas were incorporated into the UK government's 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 adjust the approaches to TB surveillance and control in each risk area 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 Northamptonshire, an Edge Area county, in 2023. 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 those involved in the control of TB, both locally and nationally. This includes, but it is not limited to, cattle farmers, government and private 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 2023.

Types of TB incidents

Unless otherwise specified, this report includes all new TB incidents detected during the reporting period (1 January to 31 December 2023). This includes both 'Officially Tuberculosis-Free status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free status Suspended (OTF-S) incidents.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 (an animal positive to the Single Intradermal Comparative Cervical Tuberculin [SICCT] test), with either:

- typical lesions of TB identified at post-mortem (PM) meat inspection
- at least one animal with *M. bovis*-positive polymerase chain reaction (PCR) test (or bacteriological culture) results in tissue samples collected from carcasses during the PM inspection

OTF-S incidents are triggered by reactors to the skin test, but without subsequent detection of TB lesions or positive PCR test (or 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. This is due to differences in the information available at the time datasets are accessed.

Cattle industry

Northamptonshire has a low herd and cattle density, with most cattle situated in the western half of the county. As of 31 December 2023, the county had 446 cattle herds, a 2% reduction from 2022, when there were 454 cattle herds. The total number of cattle in Northamptonshire also decreased by 4%, from 47,835 in 2022 to 46,175 in 2023.

The average herd size in 2023 was 104 cattle, with small holdings (fewer than 50 cattle) accounting for 45% of the herds. Beef animals accounted for 87% of the total cattle population in the county, as shown in Appendix 1.

There is a single livestock auction market operating in Northamptonshire (Thrapston), but some cattle are brought into the county from Rugby and Thame markets in the adjoining Edge Area counties of Warwickshire and Oxfordshire, respectively. There were 11 registered AFUs in Northamptonshire in 2023, a decrease of one from 2022, as indicated in Appendix 2.

The number of cattle markets in operation in 2023 is captured and maintained centrally by the Animal and Plant Health Agency (APHA) TB Customer Service Centre. Where possible, this data is then subject to further validation by APHA veterinarians subject to their best knowledge of the local area. Some small discrepancies may therefore exist where changes to markets were not captured in time for this report.

All cattle herds in Northamptonshire (except AFUs) are subject to annual (12-monthly) routine surveillance testing for TB.

New TB incidents

The number of new TB incidents in Northamptonshire showed a steady increase from 11 new incidents in 2013 to a peak of 38 new incidents in 2020. However, the number of new TB incidents has been declining since 2021, with a sharp fall in 2022 (see Figure 1). The number of new TB incidents remained similar in 2023 compared to 2022, with 18 incidents recorded in 2023, compared to 19 in 2022 (Figure 1).

There were 8 OTF-W incidents, compared to 11 in 2022. The number of OTF-S incidents increased from 8 to 10 in 2023. Out of the 18 new incidents in 2023, 8 were in beef-suckler

herds (5 OTF-W and 3 OTF-S) and 8 were in beef-fattener herds (2 OTF-W and 6 OTF-S). Two of these incidents were in registered dairy herds (one OTF-W and one OTF-S).

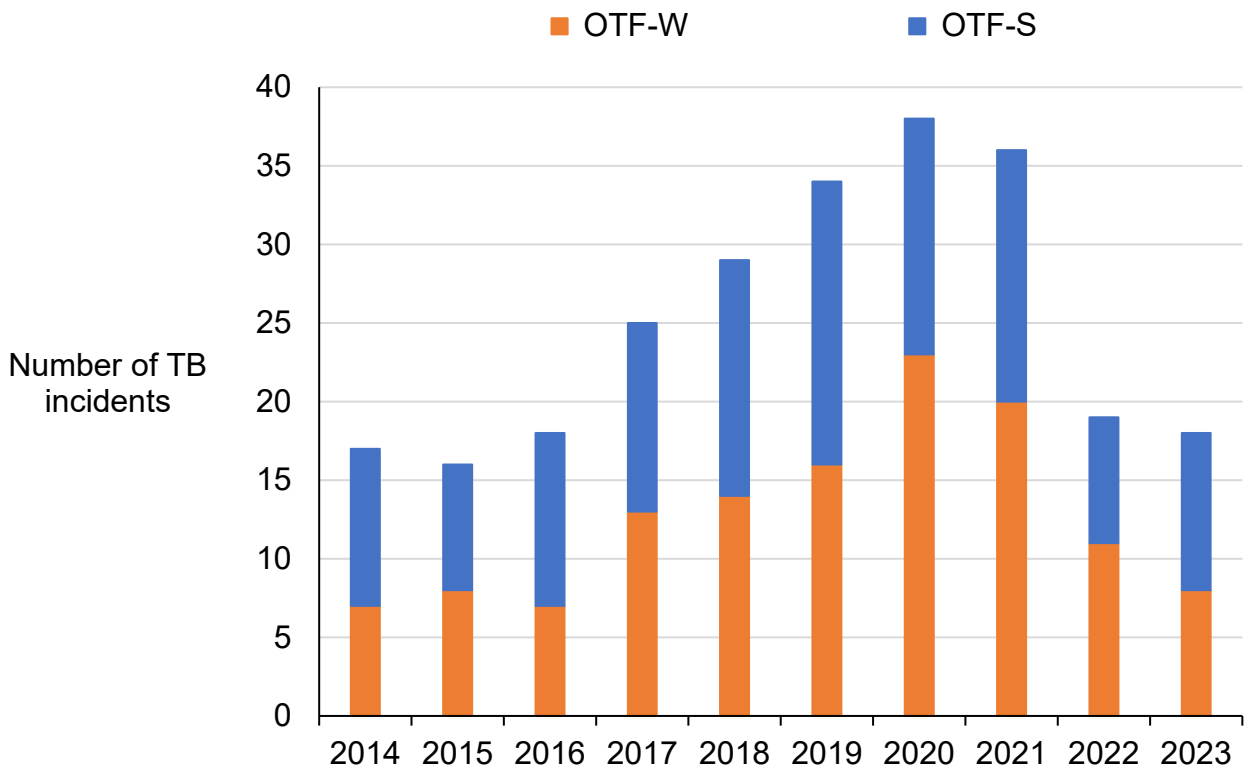

Figure 1: Annual number of new TB incidents in Northamptonshire, from 2014 to 2023.

Figure 1 description: Bar chart showing the number of confirmed TB incidents (OTF-W, in orange) and suspected (OTF-S, in blue) in Northamptonshire between 2014 and 2023. In 2023, there were 18 TB incidents in the whole county, 8 OTF-W and 10 OTF-S, the lowest number since 2016.

Disclosing test types

Cattle herds in Northamptonshire are subject to annual Whole Herd Testing. In 2023, whole herd testing (WHT) and radial (RAD) testing continued to detect the majority of new TB incidents. When compared to 2022, WHTs detected more new incidents in 2023 than RAD tests. In 2023, 3 of the new TB incidents in Northamptonshire were identified at a 6-month post-breakdown test, which is an increase of one compared to the previous 2 years (Figure 2).

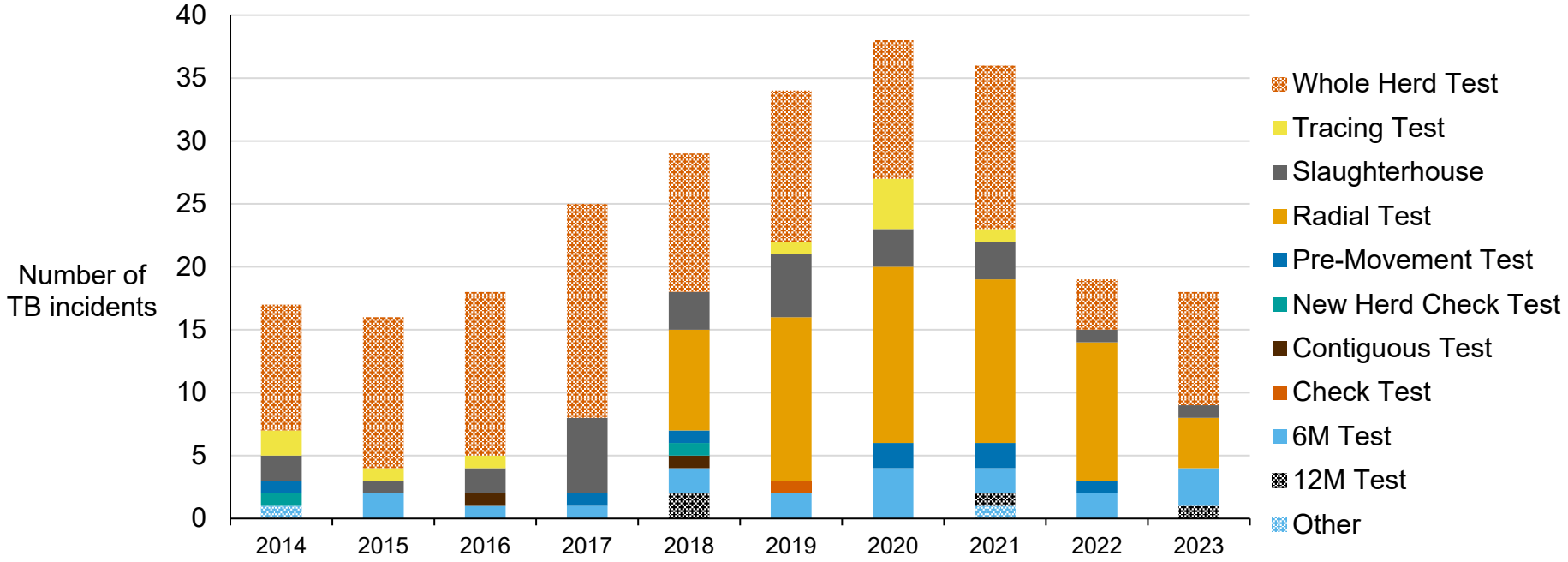

Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Northamptonshire in 2023, according to the surveillance methods that detected them.

Figure 2 description: A bar chart showing the number of new TB incidents disclosed by test type in Northamptonshire between 2014 and 2023. In 2023, most incidents were disclosed by whole herd tests (9), followed by a radial tests (4), 6-month post-incident tests (3 each), 12-month post-incident tests (1) and slaughterhouse testing (1).

Duration of TB incidents

A total of 20 TB incidents were resolved in Northamptonshire during 2023. Of these, 8 had started in 2023, and 12 had started in 2022.

The median duration for OTF-W incidents that ended in 2023 was 306 days, interquartile range (IQR) 251 to 339. Most OTF-W incidents were resolved in 241 to 550 days (6 out of 7) and the remaining OTF-W incident was resolved in 151 to 240 days.

Most OTF-S incidents that ended in 2023 (11 out of 13) were resolved within 240 days, although 2 were resolved quickly in under 150 days. The median duration was 185 days (IQR 166 to 209). Two incidents were resolved in 241 to 550 days.

The median duration for all incidents (both OTF-W and OTF-S) in Northamptonshire that ended in 2023 was 208 days (IQR 168.5 to 277). This was longer than the median duration of 179 days for incidents that ended in 2022 (IQR 166 to 315). It was also longer than the median duration for the whole Edge Area in 2023, which was 188 days (IQR 159 to 265).

There were 10 TB incidents still open at the end of the reporting year on the 31st of December 2023. This included 3 OTF-W incidents which were considered persistent (more than 550 days under restrictions).

Unusual TB incidents

In 2023, 2 separate holdings sustained explosive, recurrent OTF-W incidents, both of which were disclosed at 6-month post-breakdown testing.

One of these herds, an OTF-W incident in a beef fattening and suckler herd disclosed in October 2023, had experienced another OTF-W incident in 2022. A total of 36 reactors (out of 350 cattle tested) were found at the 6-month skin herd test. At post-mortem inspection 14 of those were found to have visible lesions (VL) of TB. An APHA veterinary investigation concluded that the most likely sources of infection for this explosive incident were residual infection in the herd and exposure to infected wildlife at grazing. As in the previous incident, Whole Genome Sequence (WGS) of the isolates from reactors identified clade B6-62 of *M. bovis* in this herd. The 2023 isolates were genetically identical to those from the 2022 incident, therefore supporting the likelihood of residual infection as the most likely source of infection for this explosive incident.

The other explosive recurring TB incident was in a medium sized suckler herd of 70 animals. 27 reactors were disclosed at the 6-month test in November 2023. This herd was OTF-S at the previous incident in 2022. However, following the detection of culture positive, visible lesions of TB in 17 of the 27 reactor animals in the new 2023 incident, the OTF status of the herd was withdrawn (OTF-W). Clade B6-62 of *M. bovis*, which is within

home range for Northamptonshire, was also isolated in this herd, therefore supporting the likely risk pathways of residual infection in the herd; exposure at grazing to infected badgers or other infected wildlife due to the high density of wild deer in the area.

TB in other species

There is no statutory routine TB surveillance of non-bovine species, apart from post-mortem examination (PME) of animals slaughtered for human consumption, or carcasses submitted to veterinary laboratories for diagnostic investigation. Targeted TB testing takes place in non-bovine herds under TB movement restrictions due to laboratory-confirmed incidents of *M. bovis* infection, and in specific herds of camelids, goats and captive deer at an elevated risk of infection. Although no active surveillance of wild deer is in place, reporting of suspected TB lesions in wild deer and wildlife carcasses is statutory and suspect carcasses are inspected and tested by APHA.

There was one incident of TB in park red deer in the south of Northamptonshire in 2023. This herd of 325 red deer was back-traced following disclosure of TB test reactors in a herd of farmed deer in Devon in June 2022. The Devon holding had purchased 134 deer from the Northamptonshire herd in May 2022. One TB reactor in the Devon herd was found at post-mortem meat inspection to have a TB-like lesion in the respiratory tract, which yielded WGS clade B6-62 of *M. bovis* on culture. Devon is not within the home range of this clade. Therefore, the herd of origin of the deer in Northamptonshire was backtraced and placed under TB restrictions on receipt of these results. As skin testing was not possible for the herd of origin in Northamptonshire, a TB surveillance cull was organised. Approximately half of the herd was culled initially - 136 animals were subject to PME and had blood samples collected at culling. One deer was found to be IDEXX (antibody) blood positive but had no visible lesions of TB at PME. Another deer was found to be IDEXX positive and had PCR-positive visible lesions of TB in the respiratory tract and mesenteric lymph node at PME. Clade B6-62 was isolated from those lesions on bacteriological culture.

Further genomic analysis of these B6-62 isolates showed a close genetic relationship between the isolates from the animals moved to the farm in Devon and their deer herd of origin in Northamptonshire.

Incidence of TB

Incidence of TB in Northamptonshire in 2023 was 4.4 new TB incidents per 100 herd-years at risk (100 HYR), decreasing non-significantly from 4.5 in 2022 (Figure 3). Incidence fell in Northamptonshire between 2021 and 2022, and appears to have plateaued between 2022 and 2023, after a steady increase from 3.1 in 2015 to 8.8 in 2020. Further data in the coming years will be required to assess whether incidence is continuing to decline in this county.

In 2023, Northamptonshire had the third lowest incidence out of the 11 Edge Area counties, and lower than that of its neighbouring Edge Area counties (Leicestershire 5.0, Warwickshire 12.3, Oxfordshire 18.4, Buckinghamshire 5.9). This rate remained below the overall incidence rate for the Edge Area (7.2).

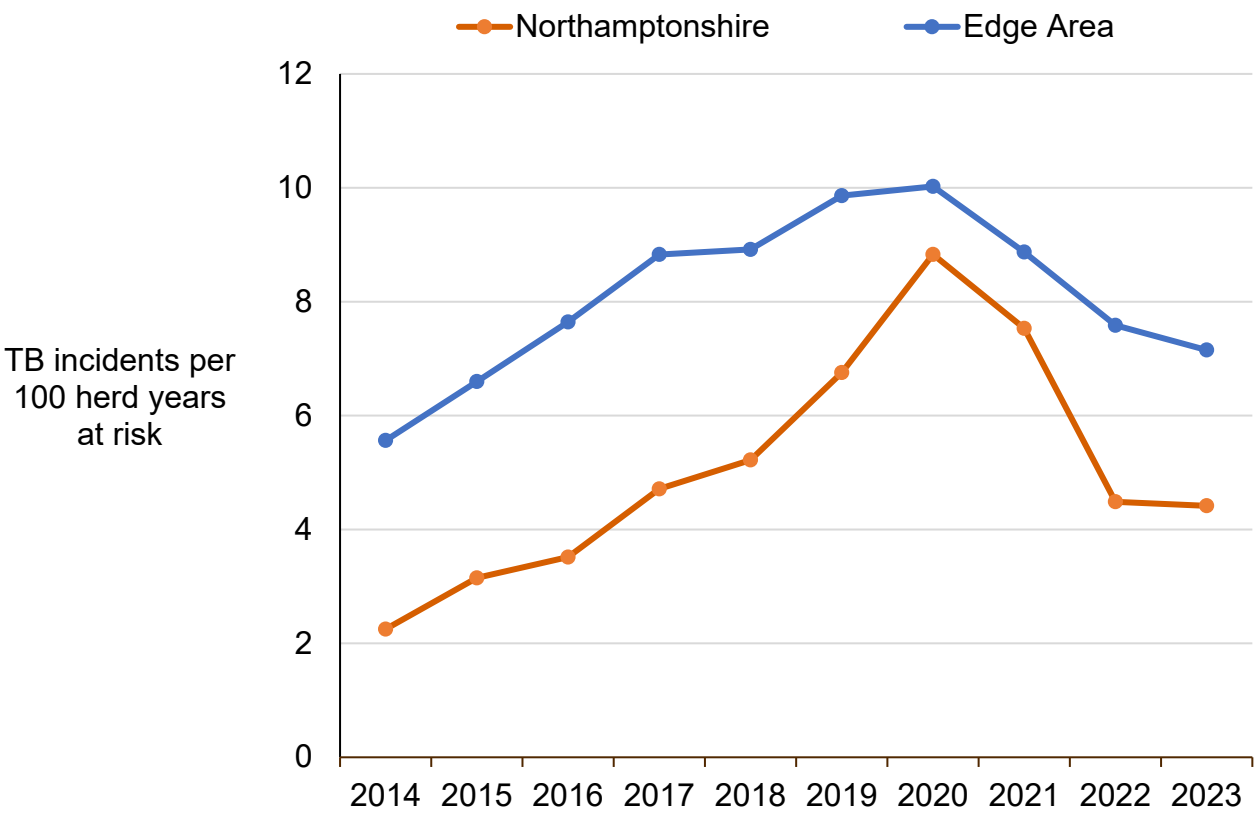

Figure 3: Annual incidence rate (per 100 HYR) for all new incidents (OTF-W and OTF-S) in Northamptonshire, from 2014 to 2023.

Figure 3 description: Line chart showing the incidence rate of new TB incidents per 100 herd years at risk (100 HYR) in Northamptonshire and the overall Edge area between 2014 and 2023. Incidence in Northamptonshire has been declining consistently since 2021 and appears to have plateaued in 2023 at 4.4 new TB incidents per 100 HYR.

Prevalence of TB

TB herd prevalence in Northamptonshire decreased slightly in 2023 (2.0%) from 2022 (2.2%), as shown in Figure 4. This was the third consecutive year that the end of year herd prevalence fell in Northamptonshire, after being at a higher level for the preceding 3 years (ranging from 3.4% to 4.1% between 2018 and 2020). Northamptonshire had the third lowest end of year prevalence out of the 11 counties in the Edge Area and was almost half the average value for the whole of the Edge Area in at the end of 2023 (3.7%).

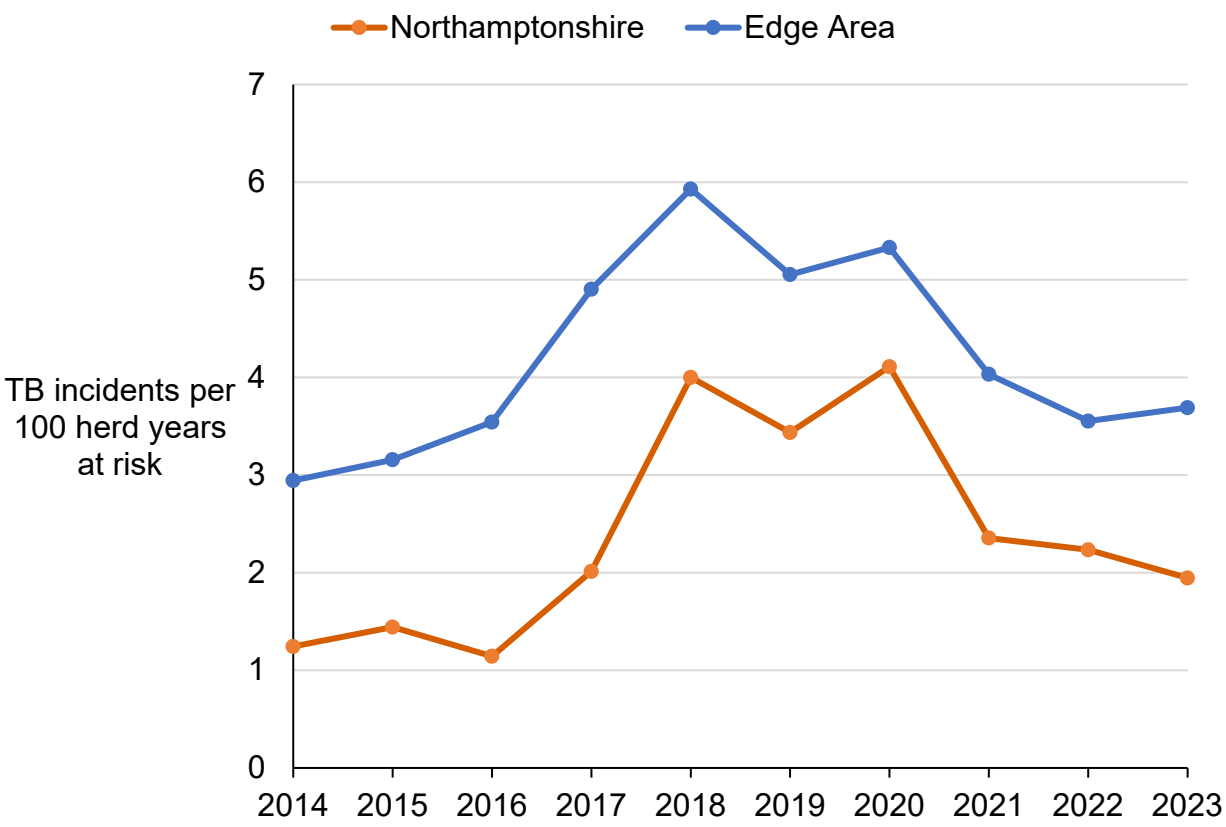

Figure 4: Annual end of year prevalence in Northamptonshire, from 2014 to 2023.

Figure 4 description: Line chart showing the annual end of year prevalence in Northamptonshire county overall and within the overall Edge Area, between 2014 and 2023. Prevalence in Northamptonshire and the Edge Area was increasing until 2018, however it has been broadly following an overall decreasing trend since. The prevalence of Northamptonshire remains below that of the Edge overall throughout the 10-year time period. Prevalence in Northamptonshire decreased in 2023 compared to 2022 – more detail is provided in the text.

Recurring TB incidents

Three-year recurrence

In Northamptonshire, 9 (50%) of the new TB incidents in 2023 occurred in herds that had had another TB incident in the previous 3 years, as shown in Figure 5. There was a higher percentage of OTF-W herds with a history of another TB incident in the previous 3 years (75%) than for OTF-S herds (30%) (6 out of 9 OTF-W incidents, compared to 3 out of 10 OTF-S incidents).

This is slightly lower than the percentage of recurrent TB incidents for the whole of the Edge Area (54%), with Northamptonshire ranking fifth lowest of the Edge Area counties.

APHA veterinary investigations established residual infection as a likely risk pathway for approximately half of the recurrent OTF-W incidents in this county. Due to a lack of WGS results for OTF-S incidents, it is more difficult to establish the likely source of infection in these herds. Movements of undetected infected cattle or local sources of infection were found to be likely risk pathways for the remaining recurrent incidents.

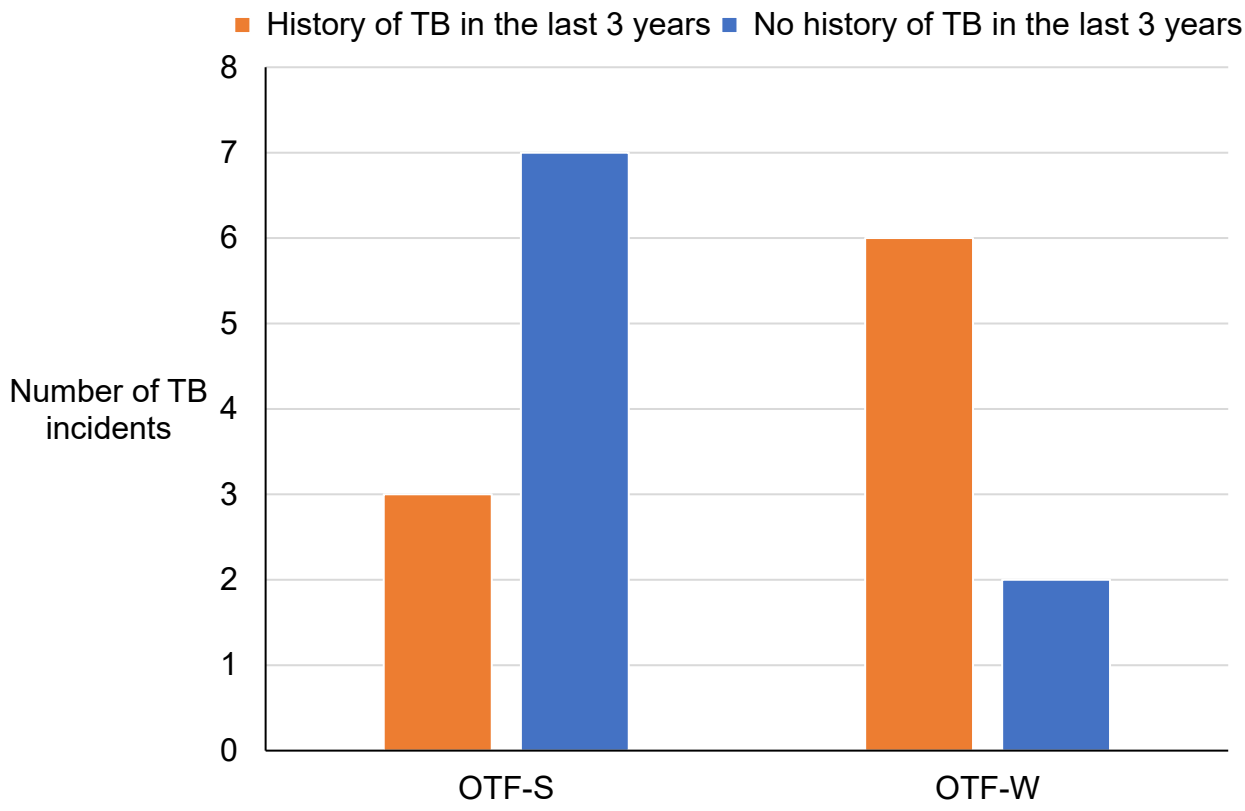

Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Northamptonshire in 2023, with and without a history of any TB incident in the previous three years.

Figure 5 description: Bar chart showing the number of herds with (in orange) and without (in blue) a history of a TB incident in the last 3 years in 2023, for OTF-S and OTF-W herds. A description of the data is provided in the text.

Overall recurrence

As shown in Figure 6, in 2023 67% of incidents reported in across the county occurred in herds with a history of TB during the herd's lifetime (5 out of 10 OTF-S and 7 out of 8 OTF-W).

This overall percentage of recurrent TB incidents in Northamptonshire was lower than in 2022 (83%, 7 out of 8 OTF-S and 8 out of 10 OTF-W).

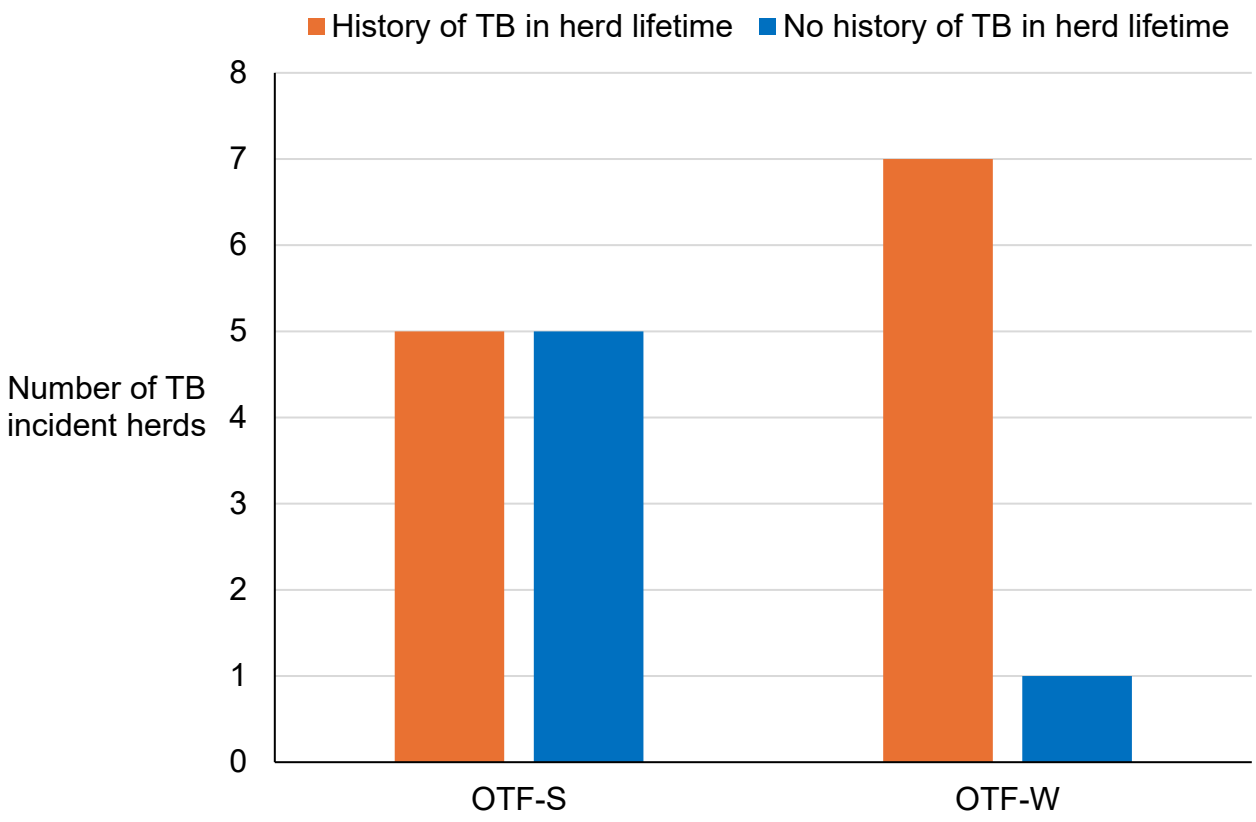

Figure 6: Number of herds with a TB incident (by OTF-W and OTF-S) in Northamptonshire in 2023, with and without a history of any TB incident at any point in the herd's lifetime.

Figure 6 description: Bar chart showing the number of herds with (in orange) and without (in blue) a history of a TB incident in the herd's lifetime in 2023, for OTF-S and OTF-W herds. A description of the data is provided in the text.

Geographical distribution of TB incidents

The distribution of cattle in Northamptonshire in 2023 was much the same as in previous years. As can be seen in Figure 7, most incidents continued to be detected in the southwest of the county along the borders with the other Edge Area counties of Warwickshire, Leicestershire, Oxfordshire and Buckinghamshire, where the cattle population is denser. All eight OTF-W incidents in Northamptonshire in 2023 were caused by WGS clade B6-62, with a homerange that encompasses Northamptonshire, so this is to be expected.

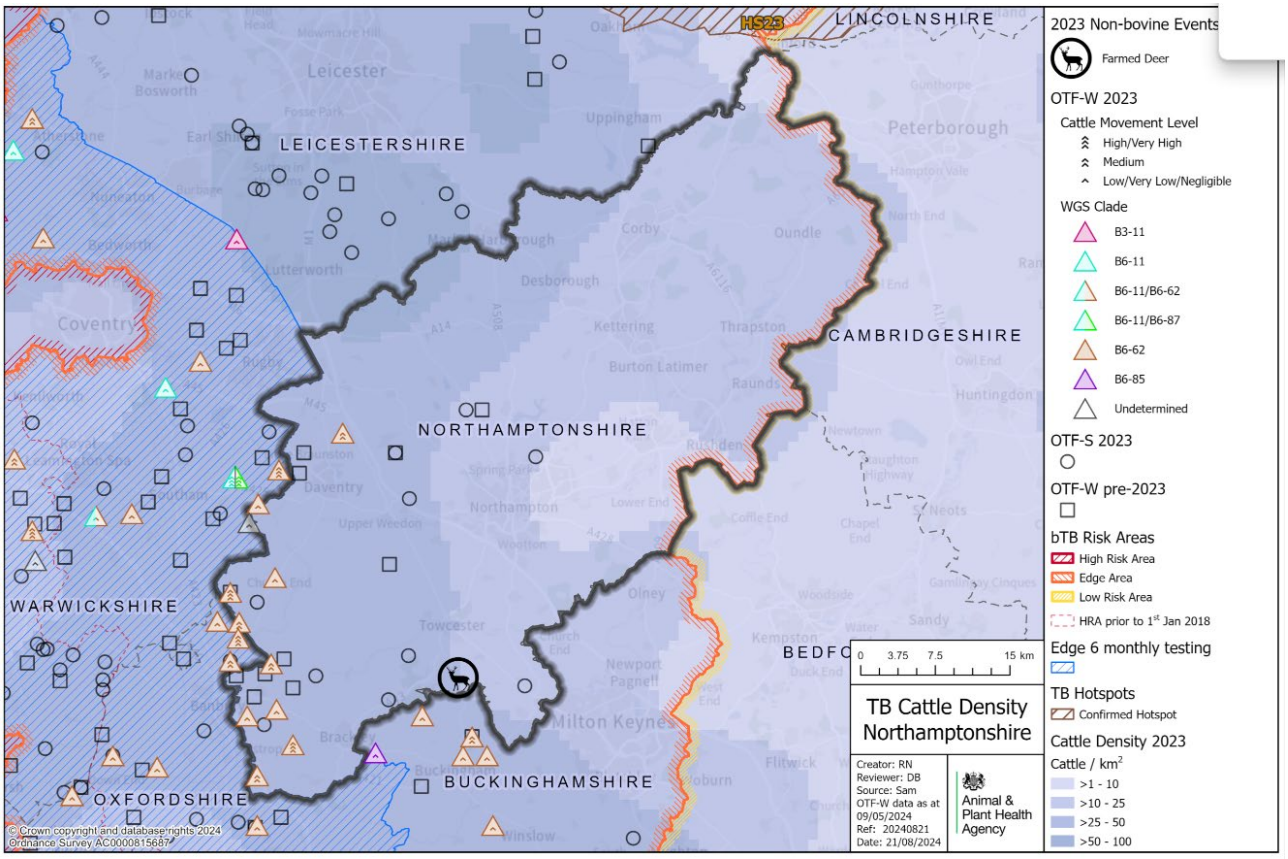

Figure 7: Location of cattle holdings in Northamptonshire with new TB incidents (OTF-W and OTF-S) in 2023 and cattle holdings with pre-2023 OTF-W incidents still ongoing at the beginning of 2023, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle movements associated with a high likelihood of infection, 2 chevrons for a medium likelihood and one chevron for a low likelihood.

Figure 7 description: Map of the Northamptonshire county showing the locations of cattle holdings in Northamptonshire with new TB incidents (OTF-S and OTF-W) in 2023 and pre-2023 OTF-W incidents on the map. The 2023 OTF-W incidents are shown as triangles, 2023 OTF-S as circles and pre-2023 OTF-W as squares. The 2023 OTF-W incidents are also coloured by WGS clade and contain chevrons to show the cattle movement algorithm score allocated to the incident (low/medium/high risk of cattle movements). Most incidents are located in the southwest of the county, and one red deer incident also occurred in Northamptonshire in the south of the county in 2023.

Skin test reactors and interferon gamma test positive animals removed

In 2023, there was a total of 151 TB test positive animals in Northamptonshire, as shown in Figure 8. This represented an increase of 66% in the number of test-positive animals removed from TB incident herds in 2022 (91).

Of the 151 test positive animals in 2023, 77% were skin test reactors and 23% were interferon gamma (IFN-γ) test positive. These proportions are relatively similar to that seen in 2022. The number of skin test reactors removed in 2023 was the highest number in the last decade. The number of reactors detected per incidents disclosed during the year (see Appendix 2, Table 4, row c) also showed an increase from 5.1 in 2022 to 8.4 in 2023. As herd incidence and prevalence has remained relatively similar to 2022, it is likely the increase in reactors seen in 2023 is due to detection of a greater number of positive animals within incident herds in comparison to previous years. It is difficult to establish the causes of the increase in number of reactors removed from incident herds, although it could be related to several recurrent TB incidents with high numbers of skin reactors.

Additionally, fewer animals were IFN-γ tested in 2022 (1,389) than in 2021 (2,935) and 2020 (2,404), which presumably accounted for the lower numbers of IFN-γ test-positive animals identified in 2022. The decrease in IFN-γ test positive animals in 2022 may have been influenced by several factors. Since 2017 all new OTF-W incidents in annual testing parts of Edge Area have been required to have at least one IFN-γ test. The number of reactors seen in 2023 were more in line with what was seen in previous years.

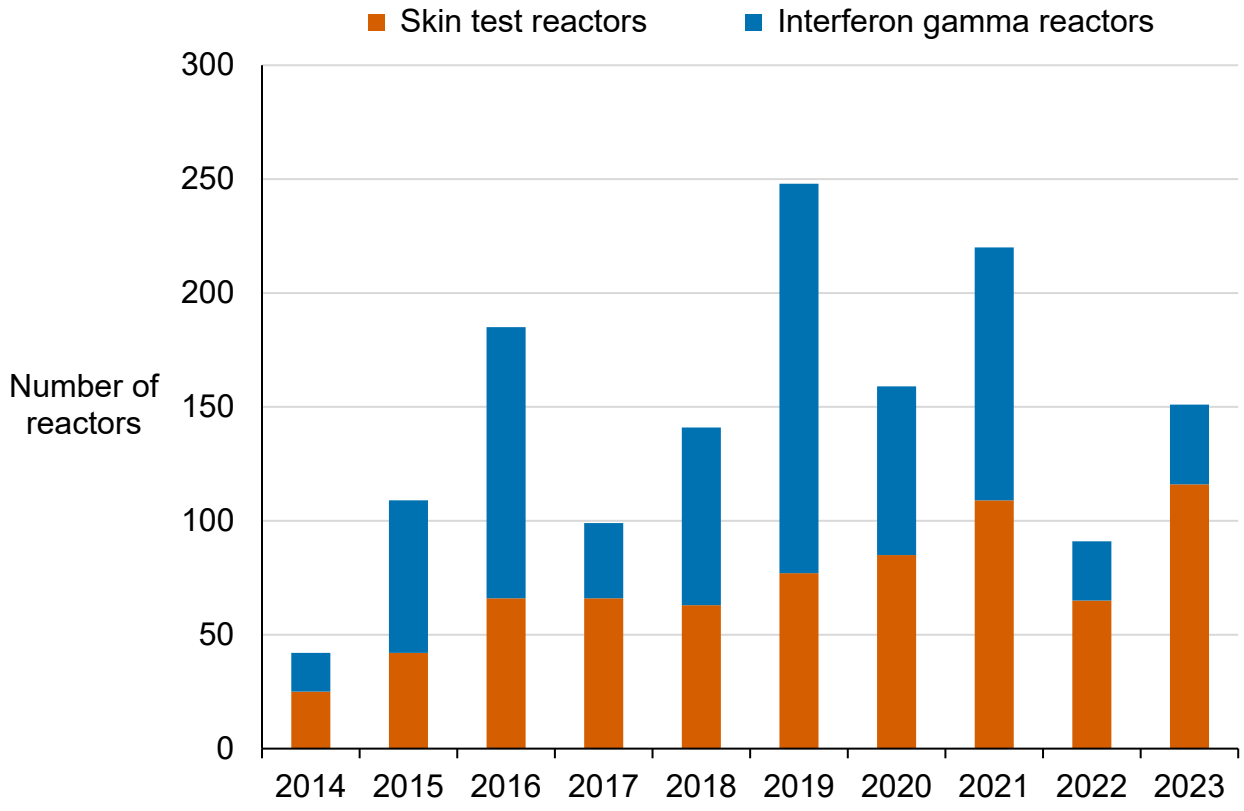

Figure 8: Number of skin test reactors (SICCT) and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Northamptonshire, from 2014 to 2023.

Figure 8 description: Bar chart showing the number of skin test reactors and interferon gamma test reactors removed for TB control reasons in Northamptonshire between 2014

and 2023. The number of reactors removed in Northamptonshire has been variable over the last 10 years. In 2023, 116 skin test reactor cattle and 35 interferon gamma reactors were removed in the county, compared to 65 skin and 26 gamma reactors in 2023.

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 biosecurity measures that may reduce the 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 mapping tool can be used to inform purchasing choices, reducing the risk of introducing undetected infection when moving cattle into a herd.

In 2023, 15 out of 18 (83%) new TB incidents in Northamptonshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The findings from this investigation are reported in Appendix 3. The number of investigations carried out in 2023 has notably increased compared to 2022, when only 3 out of 19 TB incidents received a veterinary investigation. However, not all investigations were able to be carried out in 2023. This was due to the continued impact and diversion of field resources as part of the 2022 to 2023 avian influenza outbreak which continued into spring 2023, in addition to the bluetongue virus outbreak from summer 2023 onwards.

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

- cattle movement algorithm
- WGS local transmission of infection indicator

The cattle movement algorithm uses cattle movement data to identify individual animals that were moved into a TB incident 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. 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 transmission of infection 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 transmission event:

- 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 2023.

There is always a degree of uncertainty about the estimated true routes of TB infection into a herd. The absence of a WGS indicator of local transmission, 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 9 provides the percentage of herds where each risk pathway combination was identified. The spatial distribution of these categories is presented in Figure 10. Each category is described in greater detail in the following text.

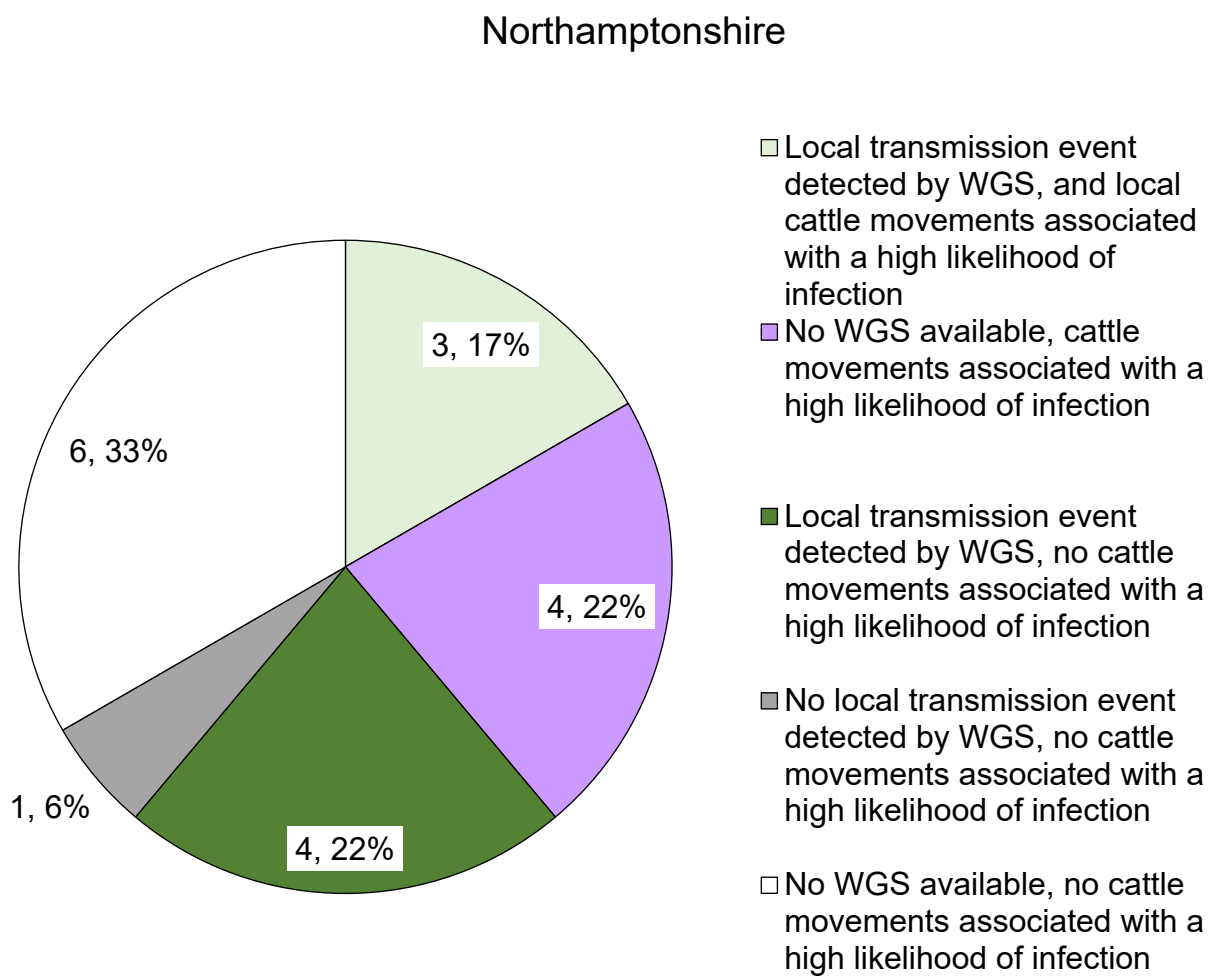

Figure 9: Risk pathway combinations identified by the WGS Local Transmission of Infection Indicator and cattle movement algorithm for 15 new TB incidents starting in Northamptonshire in 2023.

Figure 9 description: Pie chart showing the risk pathway combinations identified by the WGS local reservoir indicator and cattle movement algorithm for all 18 new TB incidents in Northamptonshire in 2023. Most (6, 33%) did not have any WGS and no cattle movements were identified with a high likelihood of infection. Further description provided in the text.

WGS data was available for 8 (44%) of all new TB incidents in Northamptonshire. The WGS local transmission of infection indicator identified a local transmission event for 7 (39%) new TB incidents in 2023.

A total of 4 TB incidents with WGS data available had a local transmission event identified without strong evidence of cattle movements (22%). These are dark green symbols in Figure 10.

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 3 new TB incidents (17%) had evidence of both a local transmission event and local cattle movements (within 25km) that were 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 10.

In Northamptonshire, 4 TB incidents (22%) had evidence of cattle movements associated with a high likelihood of TB infection, but WGS data was not available to assess any local transmission events. These are depicted in light purple in Figure 10.

For one new TB incident (6%), the WGS local transmission of infection indicator did not find evidence of local transmission of infection, and there was also no evidence of cattle movements associated with a high likelihood of TB infection. The source of infection is unclear for this incident (grey symbols).

For a further 6 new TB incidents in 2023 (33%), there was no evidence of cattle movements associated with a high likelihood of TB infection, and no WGS data available to explore local transmission events. These are shown as white dots in Figure 10, as there is insufficient evidence to determine a likely infection pathway.

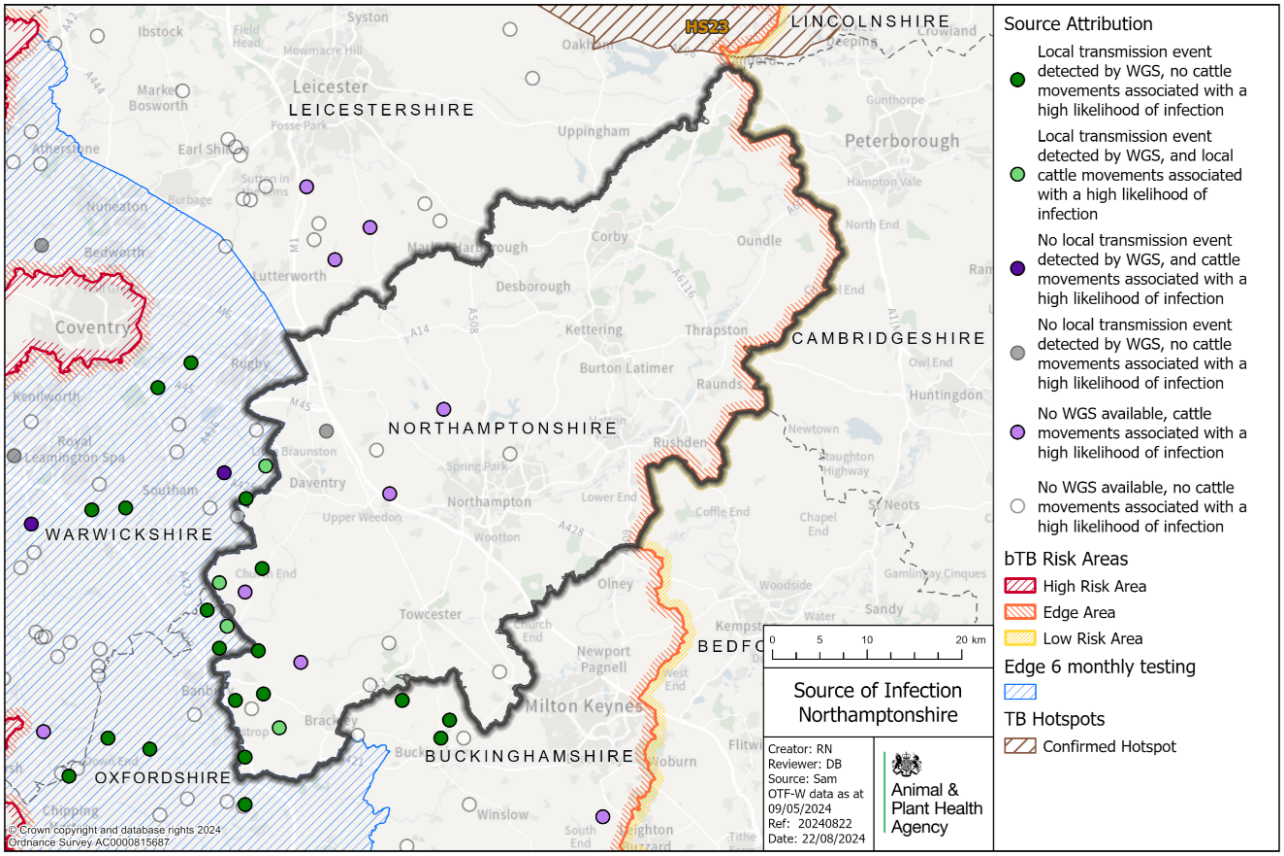

Figure 10: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Northamptonshire that started in 2023.
Note: Two dark green incidents placed on the border of the Northamptonshire county are actually located in the nearby counties of Warwickshire and Oxfordshire, however appear on the county border due to the scale of the map.

Figure 10 description: Map of the Northamptonshire county showing the locations of the 18 new TB incidents in Northamptonshire, coloured by the risk pathway identified for the incident. Dark green are herds with a local transmission event was identified from WGS and no cattle movements with a high likelihood of infection were identified in the herd. Light green represents incidents where local transmission event was identified from WGS and cattle movements with a high likelihood of infection were identified in the herd. Dark purple represents incidents where no local transmission event was identified from WGS and there were cattle movements identified with a high likelihood of infection in the herd. Light purple represents incidents with no WGS available and where there were cattle movements identified with a high likelihood of infection in the herd. Grey shows incidents where no local transmission event was identified from WGS and there were no cattle movements with a high likelihood of infection were identified in the herd either. White shows incidents with no WGS available and where there were no cattle movements with a

high likelihood of infection were identified in the herd either. A breakdown of the incidents by group is provided in the text.

Genotyping was replaced with WGS of *M. bovis* isolates at APHA in 2021.

Additional information is provided by WGS of *M. bovis* isolates from OTF-W herds. From this data, it is apparent that TB has become endemic in the west of the county. The presence of WGS clade B6-62 (which includes genotype 10:a, reported in previous years) is expanding across the Warwickshire and Oxfordshire borders into Northamptonshire, as shown in Figure 11.

In previous years, concern was raised about an increase in incidents along the route of high-speed rail (HS2) construction. Similar to 2022, the location of most new TB incidents in 2023 was in the south-west of the county, which is the area of HS2 construction. During on-farm investigations for incidents that started in 2023, disruption of badger setts caused by HS2 construction was identified as a possible factor influencing the spread of TB infection from wildlife. However, more evidence on the effect of HS2 construction on wildlife habitats and behaviour is required before further conclusions on a potential link can be drawn. There were no OTF-W incidents during 2023 in the Thrapston-Oundle corridor, that were of concern in 2019.

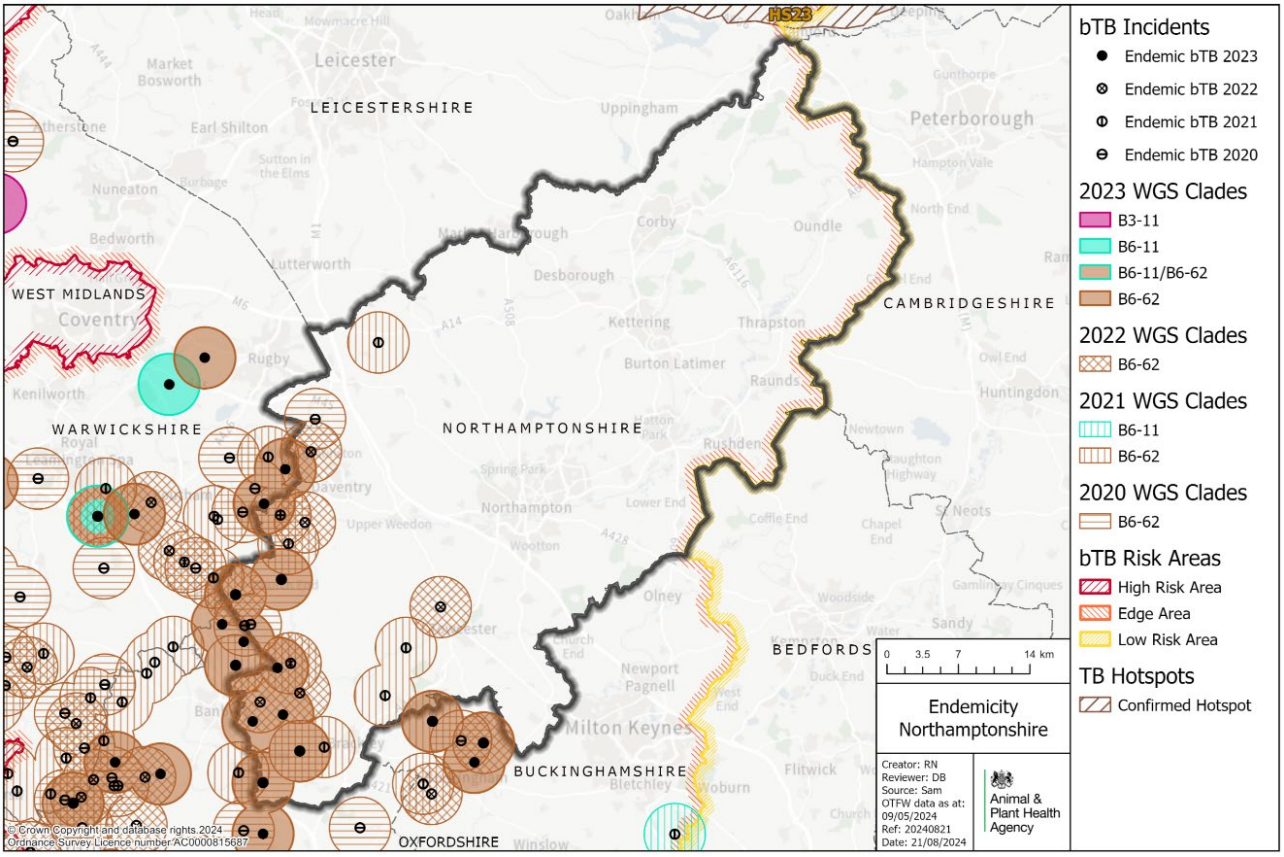

Figure 11: WGS clades of *M. bovis* detected in Northamptonshire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and 9km (OTF-W incidents only).

Figure 11 description: Map of Northamptonshire showing the WGS clades of *M. bovis* detected in Northamptonshire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another OTF-W incident in the past 4 years and within 9km of it. Clades are shown as circles on the map with each clade represented by a different colour. The year from which the clade was identified is shown by either having the colour be solid (2023) or different types of hash (2022 to 2020). All incidents show in the southern and eastern parts of Northamptonshire. Further detail is provided in the text.

Forward look

It is difficult to predict the course of the TB epidemic in Northamptonshire over the next 2 years due to the factors contributing to the spread of disease. While it has been positive to see a continued reduction in TB incidents since 2020, there is evidence that TB has become endemic in the west end of the county. It is concerning that established wildlife reservoirs are suspected in the west of Northamptonshire. A total of 828 badgers were removed in this county as part of licensed badger culling operations in 2023, with no badger vaccination undertaken. See Summary of 2023 badger control operations.

Data from 2023 indicates that new TB incidents have been caused by residual infection, resulting in recurrent incidents as well as spread from both local reservoir of infection and local cattle movements (within 25 km). This reflects the complex epidemiology of this disease. Disease still appears to be spreading from the neighbouring Warwickshire and Oxfordshire counties. Therefore, a cross-county strategy continues to be necessary to tackle TB effectively.

TB eradication policy will need to continue to be holistic and adapting to the epidemiology of the disease in this county.

Despite the declining herd incidence and prevalence trends over the last 3 years in Northamptonshire, it seems unlikely that the county will be eligible for OTF status by 2038.

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

- incentivising the uptake of effective farm biosecurity measures
- managing the TB risks posed by cattle movements to farms

In addition, continuation and further adoption of disease control measures is needed to prevent the spread of TB between cattle and wildlife, including biosecurity, badger culling or vaccination, and local control of the wild deer population, where appropriate. This includes:

- encouraging the uptake of effective biosecurity measures, including the uptake of TB Advisory Service visits

- explaining the risk of TB spread posed by cattle movements to keepers 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
- consideration of the use of further cattle measures to reduce the recurrence rate/ the likelihood of residual infection remaining in herds (increased sensitivity of testing)

Appendix 1: cattle industry demographics

Table 1: Number of cattle herds by size category in Northamptonshire as of 31 December 2023 (RADAR data on number of holdings in the report year)

Size of herds	Number of herds in Northamptonshire
Undetermined	7
1 to 50	199
51 to 100	97
101 to 200	79
201 to 350	36
351 to 500	17
Greater than 500	11
Total number of herds	446
Mean herd size	104
Median herd size	58

Table 2: Number (and percentage of total) of animals by breed purpose in Northamptonshire as of 31 December 2023

Breed purpose	Number (and percentage of total) cattle in Northamptonshire
Beef	40,540 (87%)
Dairy	4,636 (10%)
Dual purpose	978 (2%)
Unknown	21 (0.045%)
Total	46,175

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Northamptonshire between 2021 and 2023 (Sam data showing the number of herds flagged as active at the end of the report year).

Herd-level statistics	2021	2022	2023
(a) Total number of cattle herds live on Sam at the end of the reporting period	566	551	525
(b) Total number of whole herd skin tests carried out at any time in the period	676	543	489
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	458	443	433
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of TB movement restrictions)	532	513	499
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	548	535	512
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period	16	8	10
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period	20	10	8
(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?	2	0	1
(g.2) Of the new OTF-W herd incidents, how many were triggered by skin test Reactors or twice-inconclusive reactors (2xIRs) at routine herd tests?	6	2	5

Herd-level statistics	2021	2022	2023
(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)?	14	8	3
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine slaughterhouse TB surveillance?	3	0	1
(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)	8	7	8
(j) New confirmed (*M. bovis* PCR- or culture-positive) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	1 wild red deer (farmed)
(k.1) Number of approved finishing units with grazing that were active at end of the period	0	0	0
(k.2) Number of approved finishing units without grazing that were active at end of the period	14	14	11
(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 Northamptonshire between 2021 and 2023

Animal-level statistics (cattle)	**2021**	**2022**	**2023**
(a) Total number of cattle tested with tuberculin skin tests or additional IFN-γ blood tests in the period (animal tests)	78,449	62,352	56,350
(b.1) Reactors detected by tuberculin skin tests during the year	109	65	116
(b.2) Reactors detected by additional IFN-γ blood tests (skin-test negative or IR animals) during the year	111	26	35
(c) Reactors detected during year per incidents disclosed during year	6.1	5.1	8.4
(d) Reactors per 1,000 animal tests	2.8	1.5	2.7
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	3	0	2
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughters)	7	1	1
(f) Slaughterhouse (SLH) cases (suspect tuberculous carcasses) reported by Food Standards Agency (FSA) during routine meat inspection	13	8	5
(g) SLH cases confirmed by *M. bovis* PCR testing or bacteriological culture	6	6	3

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 in the table above.

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

In 2023, 15 out of 18 (83%) new TB incidents in Northamptonshire received a preliminary or final APHA veterinary investigation to identify the source of infection. Not all Disease Report Form (DRF) investigations were carried out in 2023. This was due to the continued impact and diversion of field resource as part of the 2022 to 2023 avian influenza outbreak which continued into spring 2023, in addition to the bluetongue virus outbreak from summer 2023 onwards.

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 2023.

Table 5: Suspected sources of *M. bovis* infection for the 15 incidents with a preliminary or a final veterinary assessment in Northamptonshire, in 2023

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	14	3	7	0	59.0%
Cattle movements	2	0	0	0	2.2%
Contiguous	0	0	0	0	0.0%
Residual cattle infection	3	1	0	0	4.7%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	0	0	0	0	0.0%
Fomites	1	1	0	0	5.6%
Other wildlife	1	1	0	0	2.7%
Other or unknown source	0	1	0	0	25.8%

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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