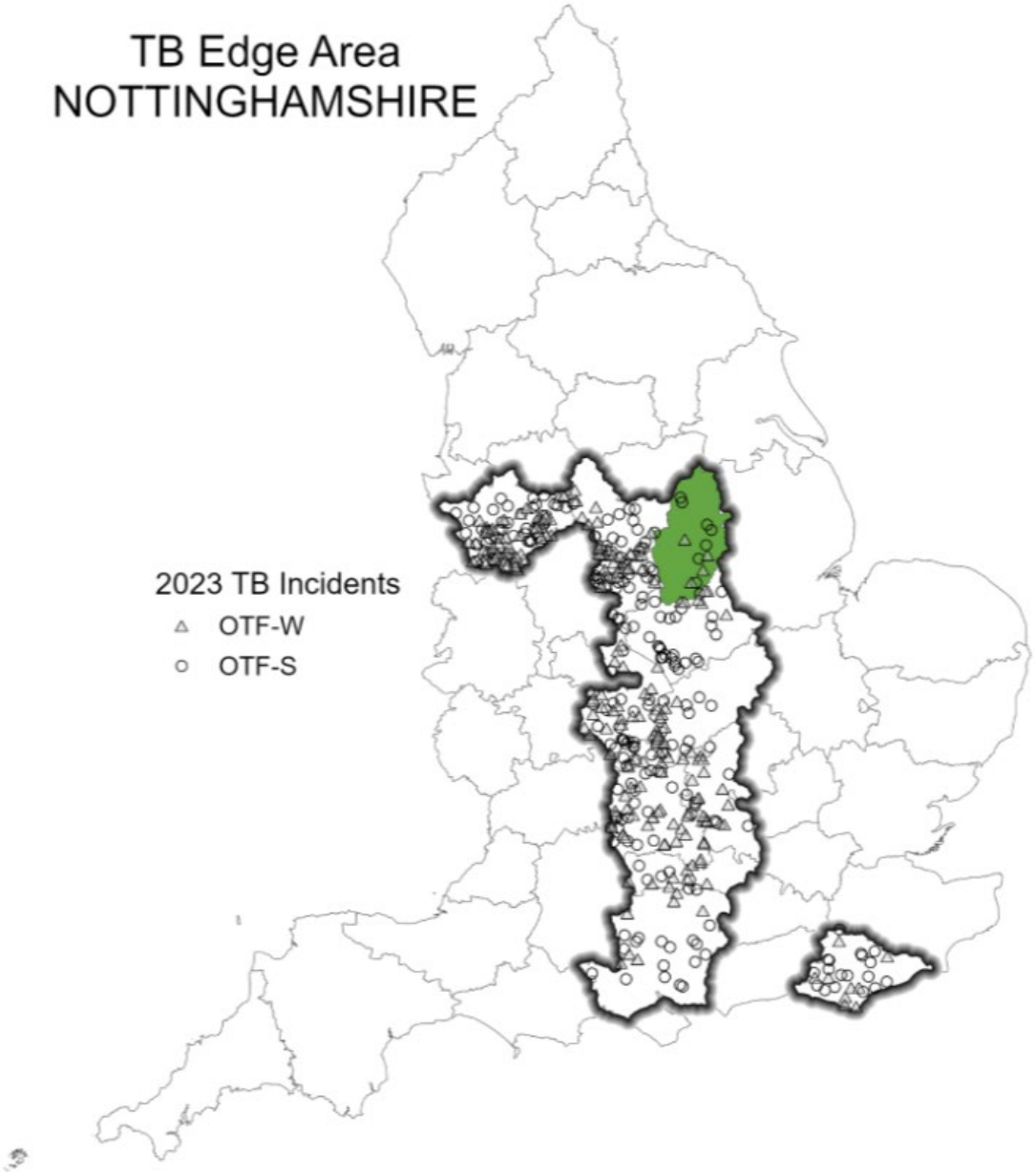
Animal &
Plant Health
Agency

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

County: Nottinghamshire



Contents

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 three 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 Nottinghamshire, 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 This includes both 'Officially Tuberculosis-Free Status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free Status Suspended' (OTF-S) incidents.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, due to differences in the information available at the time datasets are accessed.

Cattle industry

Beef herds continue to be predominant and accounted for 69% of the cattle industry in Nottinghamshire in 2023, as shown in Appendix 1. This is partly due to the arable industry providing high-energy by-products for the finishing of beef cattle.

The majority of herds, 54%, continue to be small with up to 50 cattle. Following the closure of Newark Livestock Market in 2019, there are no livestock markets in Nottinghamshire. The closest is Melton Market in Leicestershire. In 2023, there were 14 AFUs in Nottinghamshire at the start of 2023, however one had its status revoked in 2023 which is why there are 13 AFUs shown in Appendix 2 Table 3. There were 2 AFUs and one new Exempt Finishing Unit (EFU) approved in the year.

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.

Herds undergo routine annual (every 12 months) testing in Nottinghamshire.

New TB incidents

The number of new TB incidents decreased in 2023 compared to 2022, from 18 to 12, the lowest figure over the last 10 years (Figure 1). There was a reduction in OTF-W incidents from 6 to 4 and OTF-S incidents from 12 to 8. Of the 8 OTF-S incidents 5 were in dairy herds and of the 4 OTF-W incidents 2 were in beef fattening herds.

It was positive to see the number of incidents declining and following a downward trend to the pre-2021 numbers.

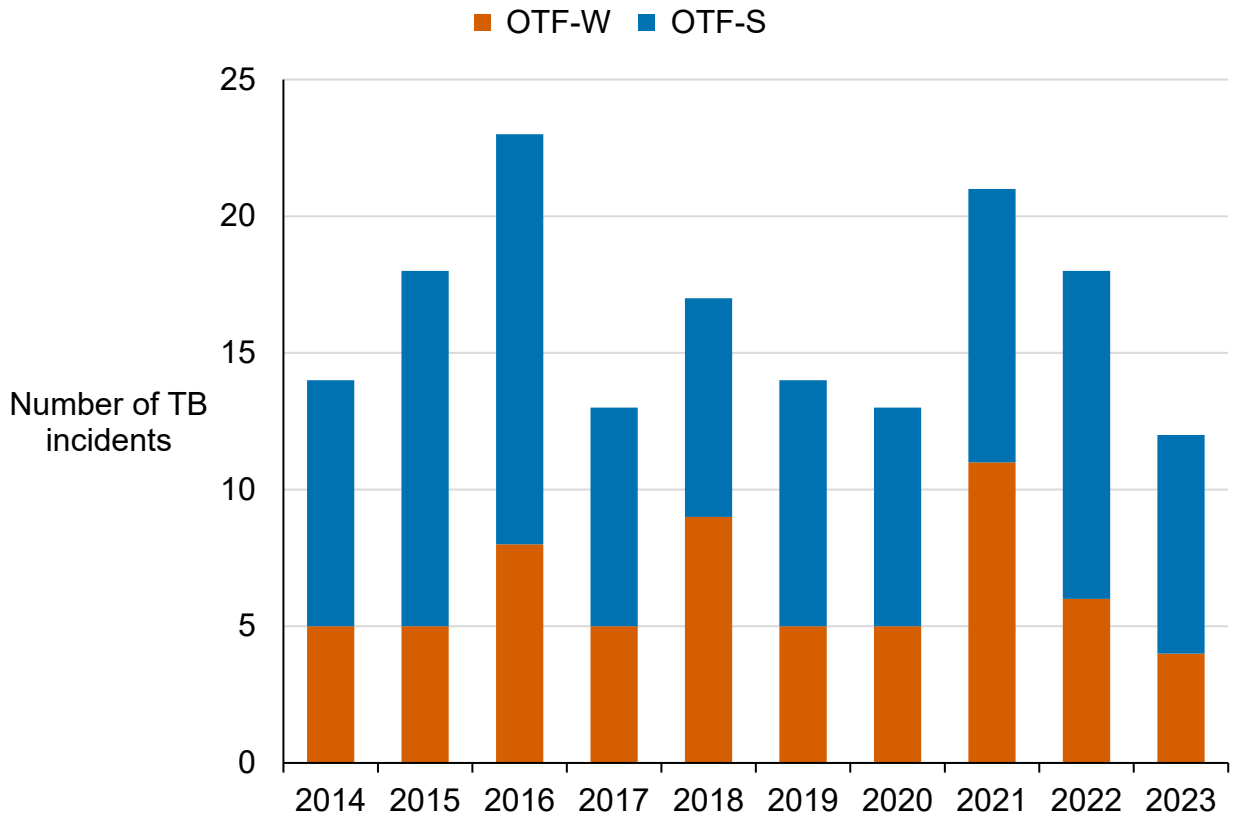


Figure 1: Annual number of new TB incidents in Nottinghamshire, from 2014 to 2023.

Figure 1 description: Bar chart showing the number of confirmed TB incidents (OTF-W, in orange) and suspected (OTF-S, in blue) in the whole of Nottinghamshire between 2014 and 2023. In 2023, there were 12 TB incidents in the whole county, 4 OTF-W and 8 OTF-S.

Disclosing test types

In Nottinghamshire, routine whole herd surveillance testing is carried out every 12 months. Whole Herd Tests (WHT), Pre-Movement tests and 6-month post-incident tests detected the most TB incidents in Nottinghamshire in 2023 (3 incidents for each test type) compared to previous years where WHT, radial tests and slaughterhouse cases were responsible for detecting the most incidents of TB.

In 2023, this was followed by 12-month tests, Check tests and Hotspot tests, each of which detected one TB incident, as shown in Figure 2. There were no TB incidents disclosed by Radial tests in 2023 compared to 5 TB incidents disclosed by this type of test in 2022. This is likely due to the decreased requirement for radial testing, in response to a lower number of new OTF-W incidents in 2023 compared to 2022 and 2021.

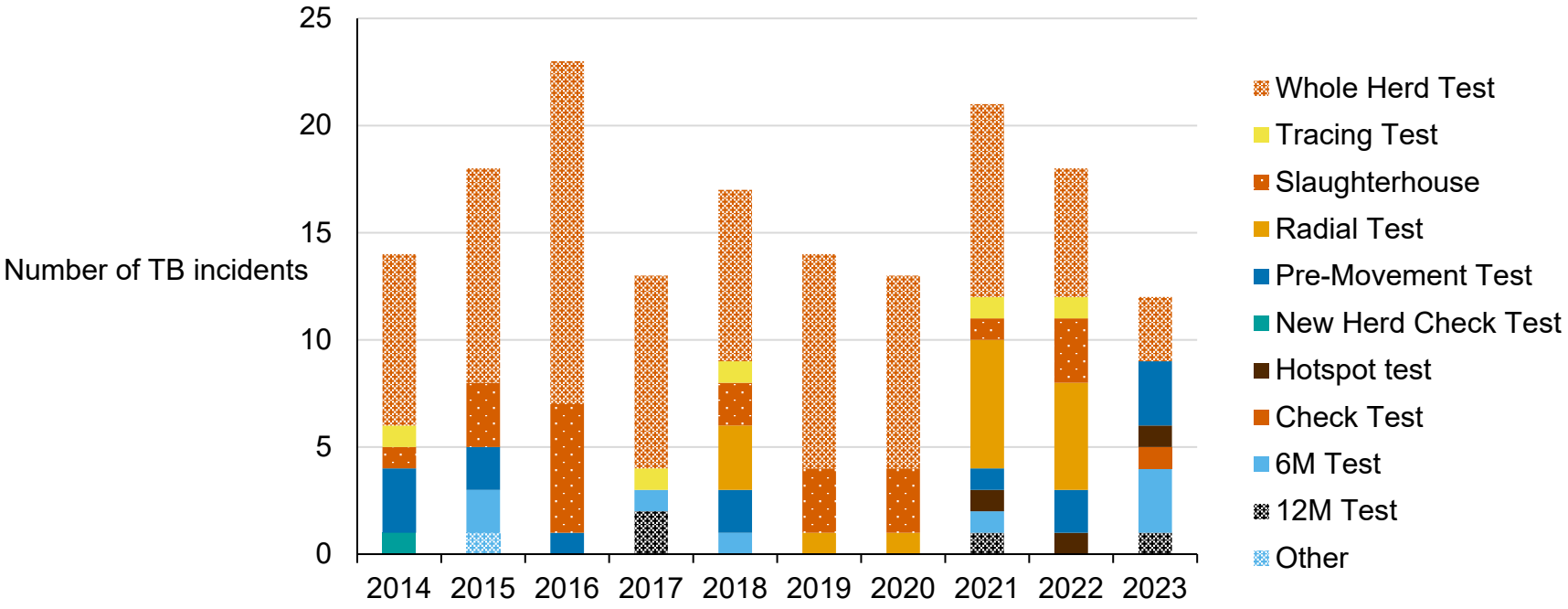


Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Nottinghamshire in 2023, according to the surveillance methods that detected them.

Figure 2 description: A bar chart showing the number of new TB incidents disclosed by test type in Nottinghamshire between 2014 and 2023. In 2023, most incidents were disclosed by whole herd tests (3), pre-movement tests (3) and 6-month post-incident tests (6M test, 3), followed by 12-month testing (12M, one), check tests (one), and hotspot tests (one).

Duration of TB incidents

A total of 15 TB incidents were resolved in Nottinghamshire during 2023. Of these, 4 were new TB incidents that started in 2023, 10 started in 2022 and one TB incident started in 2021.

The median duration for OTF-W incidents that ended in Nottinghamshire in 2023 was 265 days, interquartile range (IQR) 217 to 273 days.

Most OTF-S incidents that ended in 2023 (8 out of 10) were resolved within 240 days, and the median was 196 days (IQR 165 to 235).

The median duration for all incidents that ended in Nottinghamshire in 2023 was 217 days (IQR 174 to 272). This is longer than the duration of incidents that ended in 2022: 194.5 days (IQR 160.5 to 239).

For the whole Edge Area, the median duration of all TB incidents that ended in 2023 was 188 days (IQR 159 to 265).

There were 8 incidents still open at the end of 2023, but none of these had been under movement restrictions for more than 550 days.

Unusual TB incidents

In 2023, 2 OTF-S incidents resulting in a high number of reactors were detected in dairy herds. One of them was still ongoing by the end of 2023 and had a total of 14 reactors removed during the disclosing WHT. The most likely source of infection for this herd was found to be local wildlife, with residual infection in the herd and contact with other cattle being also a possible source.

The other unusual OTF-S incident was resolved in 2023 and had a total of 13 reactors removed, with 7 of the reactors identified during the disclosing 6-month test and the other 6 reactors during the short interval tests. The most likely source of infection for this herd was found to be local wildlife.

As these are OTF-S incidents, the source of infection into these herds cannot be definitively concluded as no Whole Genome Sequence (WGS) data is available.

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 investigations. 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. There were no incidents of TB in other non-bovine species in Nottinghamshire in 2023.

Incidence of TB

Figure 3 provides the annual incidence rate in Nottinghamshire for all new TB incidents. The herd incidence rate in Nottinghamshire decreased from 4.8 in 2022 to 3.5 new TB incidents per 100 herd-years at risk in 2023. Of the 11 Edge Area counties, Nottinghamshire had the lowest incidence of TB in 2023. This was lower than the Edge Area overall (7.2).

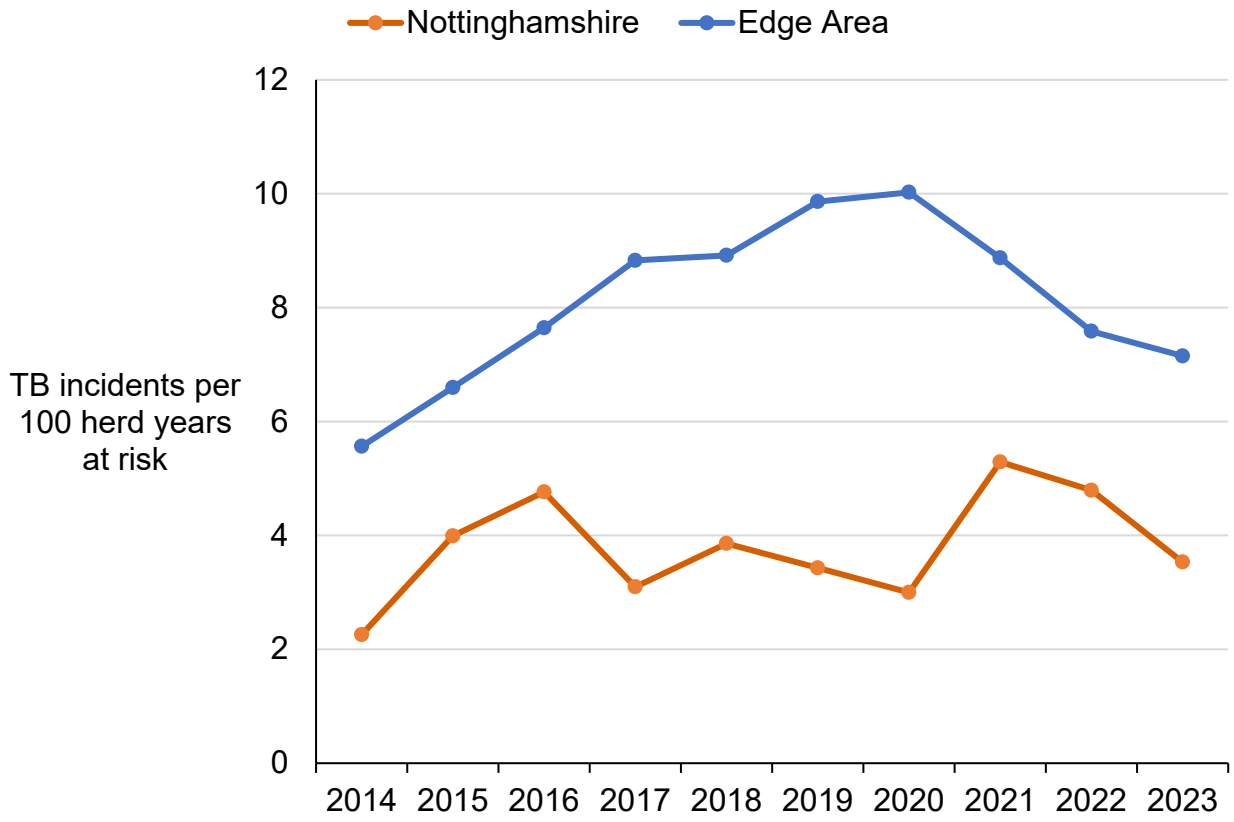


Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Nottinghamshire, from 2014 to 2023.

Figure 3 description: Line chart showing the incidence rate of new TB incidents per 100 herd-years at risk (100 HYR) in Nottinghamshire and the overall Edge Area between 2014 and 2023. Incidence in Nottinghamshire declined for the second consecutive year since 2021. In 2023, the incidence rate in Nottinghamshire was 3.5 new incidents per 100 HYR and in the Edge Area overall, incidence in 2023 was 7.2 new incidents per 100 HYR.

Prevalence of TB

Figure 4 shows herd prevalence decreased in Nottingham in 2023 compared to 2022, from 2.3% to 1.7%. This is consistent with the decrease of new TB incidents observed in 2023 and a decrease in OTF-W incidents, with a higher incident median duration than OTF-S incidents (see above).

Nottinghamshire had the lowest end of year prevalence out of the 11 counties in the Edge Area. This was lower than the overall rate for the whole of the Edge Area in 2023 (3.7%).

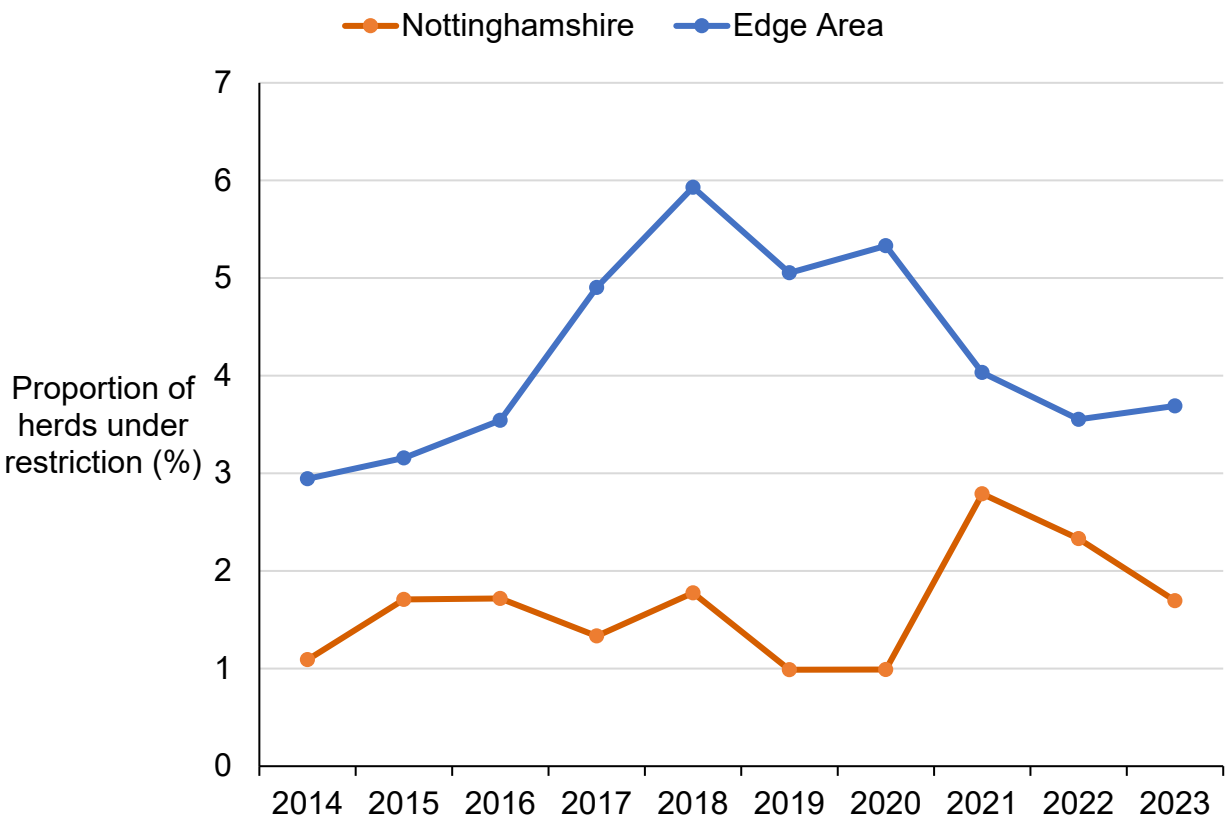


Figure 4: Annual end of year prevalence in Nottinghamshire, from 2014 to 2023.

Figure 4 description: Line chart showing the annual end of year prevalence in Nottinghamshire and within the overall Edge Area, between 2014 and 2023. The annual end of year prevalence in Nottinghamshire has decreased for the second consecutive year since 2021. In 2023, the end of year prevalence for Nottinghamshire was 1.7% of herds placed under TB restrictions in the county. Prevalence in the Edge Area overall in 2023 was 3.7% of herds.

Recurring TB incidents

Three-year recurrence

In Nottinghamshire, 7 (58%) of the 12 new TB incidents in 2023 were in herds which had experienced a TB incident in the previous 3 years (Figure 5). The proportion of OTF-S herds with a history of another TB incident in the prior 3 years was also higher than for OTF-W herds (62.5% compared to 50%).

Nottinghamshire had a recurrence rate slightly higher than the rate for the whole Edge Area (54% overall).

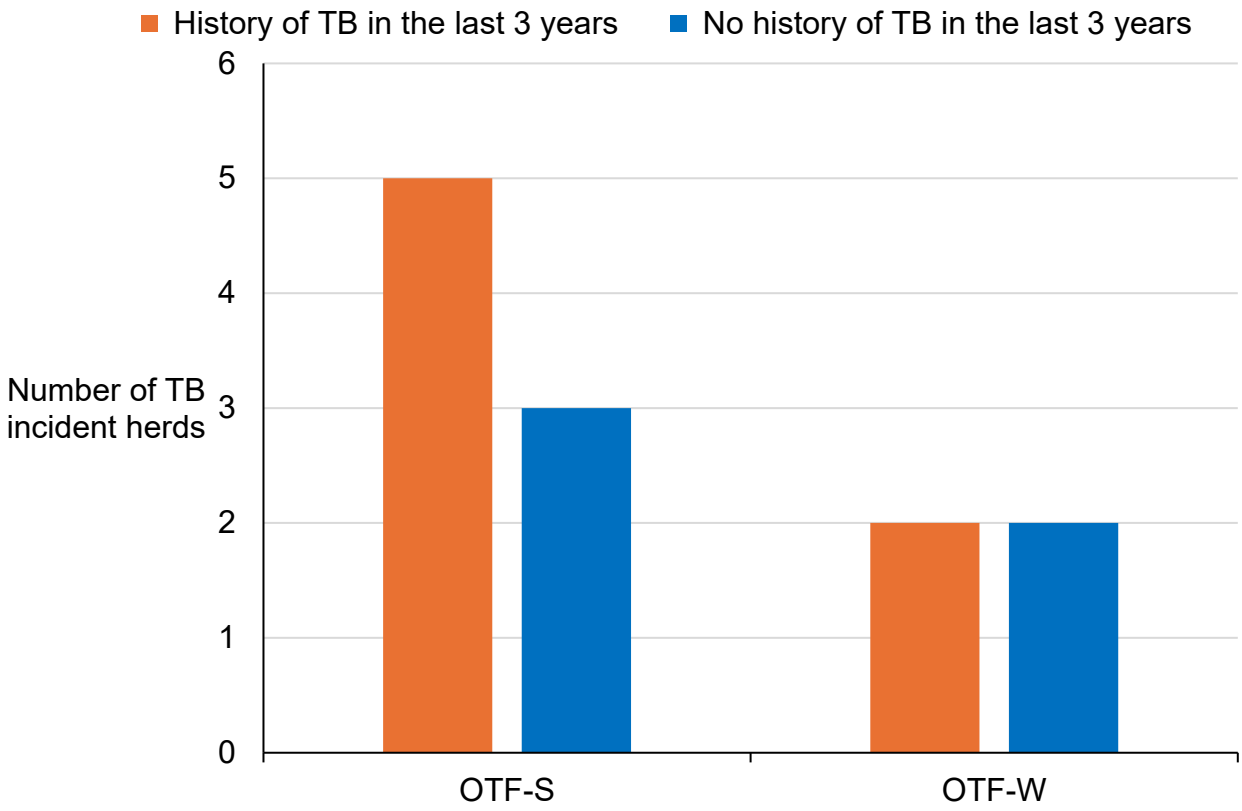


Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Nottinghamshire in 2023, with and without a history of any TB incident in the previous three years.

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

In 2023, 58% of incidents reported in the region were in herds with a history of TB in the herd's lifetime (5 out of 8 OTF-S and 2 out of 4 OTF-W), as shown in Figure 6. This includes looking back beyond the three-year period mentioned previously.

Overall recurrence of TB in Nottinghamshire in 2023 increased compared to 2022 (39%, 5 out of 12 OTF-S and 2 out of 6 OTF-W).

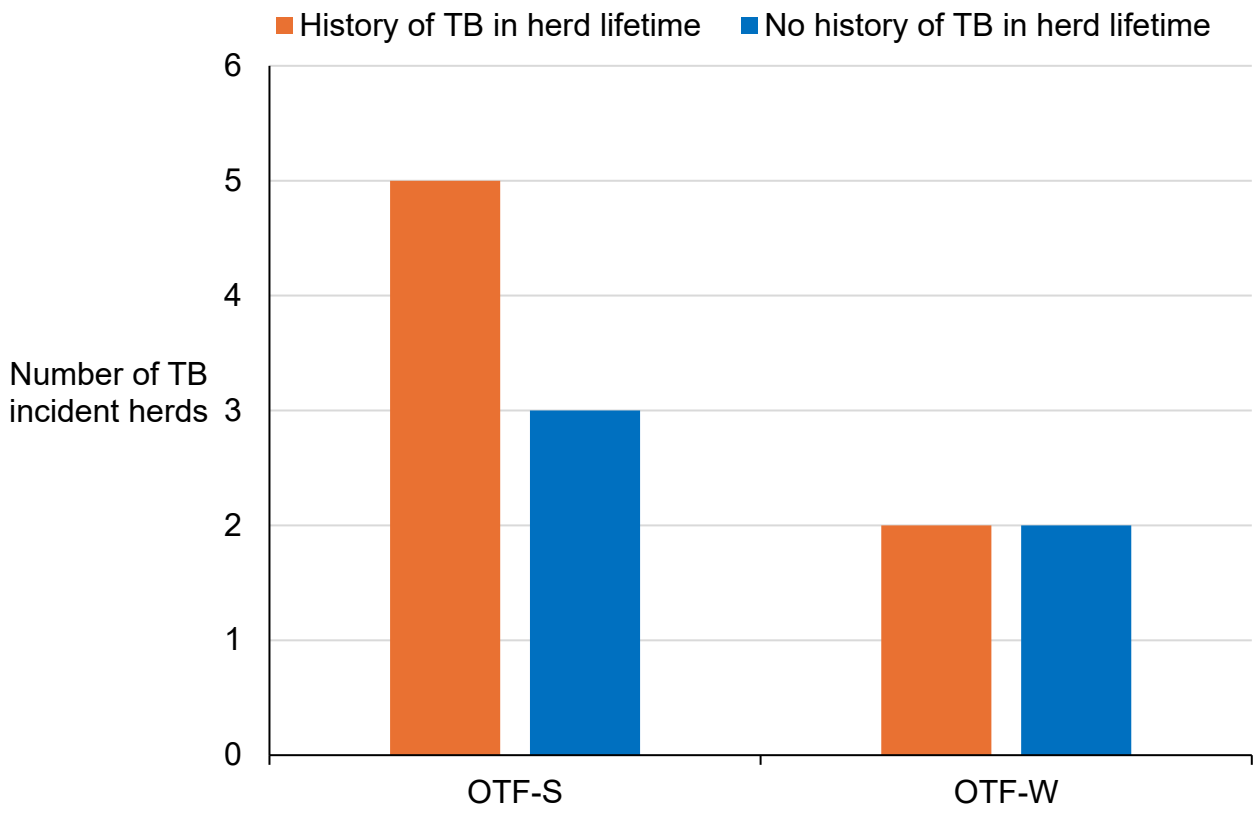


Figure 6: Number of herds with a TB incident (by OTF-W and OTF-S) in Nottinghamshire in 2023, with and without a history of any TB incident during the herd's lifetime.

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

Figure 7 shows TB incidents in 2023 were concentrated in the south and centre of the county, which mirrors the higher density of cattle holdings in these areas. This was similar to the distribution of incidents in 2021 and 2022.

Incidents in the south of the county were clustered within confirmed TB hotspot 23 (HS23), along the Leicestershire and Lincolnshire borders. HS23 is associated with WGS clade B3-11 of *M. bovis* (previously identified as genotype 25:a). HS23 was declared in a contiguous area of south-west Lincolnshire and north-east Leicestershire in 2018.

Compared to 2022, which saw an increase in the number of incidents in the west of the county bordering the six-monthly testing portion of Derbyshire, there were no incidents within this area in 2023.

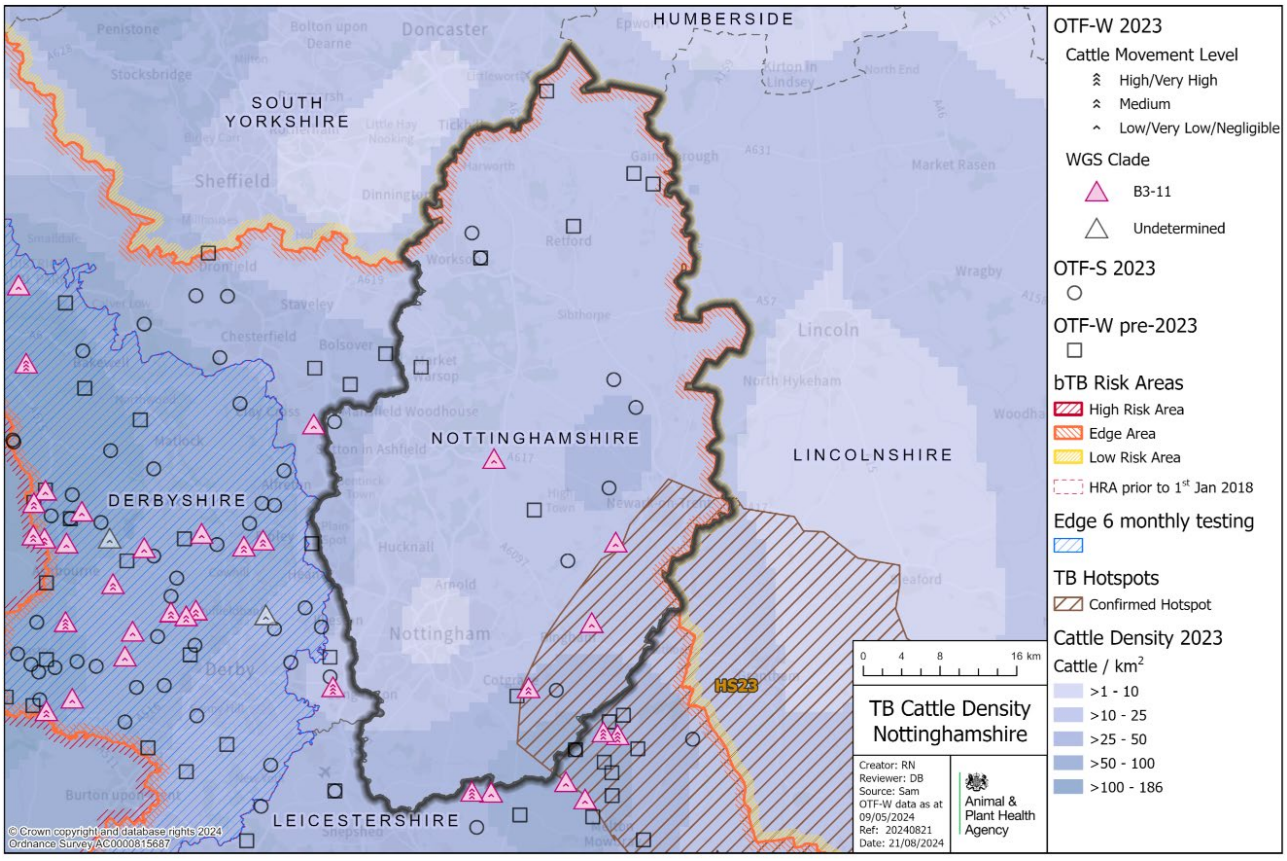


Figure 7: Location of cattle holdings in Nottinghamshire with new TB incidents (OTF-W and OTF-S) in 2023 and cattle holdings with pre-2023 OTF-W incidents still ongoing at the beginning of 2023, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle 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 Nottinghamshire showing the locations of cattle holdings in Nottinghamshire 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 or high-risk of cattle movements). Most incidents occurred in the south and east of the county – further detail provided in the text.

Skin test reactors and interferon gamma test positive animals removed

Appendix 2 provides a summary of headline cattle TB statistics in Nottinghamshire. In 2023, there was a total of 66 test positive animals in Nottinghamshire, as shown in Figure 8. This was less than the number of test-positive animals removed from herds in 2022 (79).

Of the 66 test positive animals in 2023, 80% were skin test reactors (57% in 2022) and 20% were interferon gamma (IFN-γ) test positive (43% in 2022). This highlights the ongoing importance of IFN-γ testing in OTF-W herds.

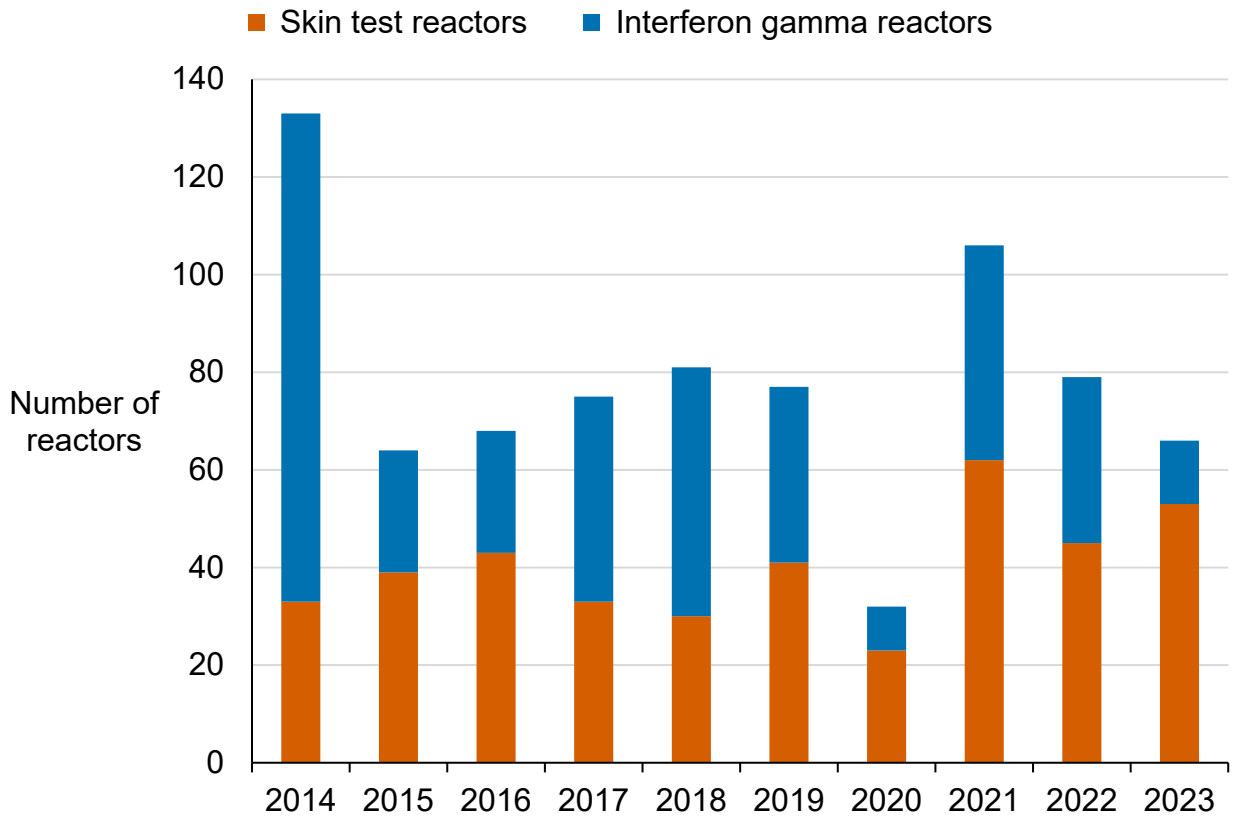


Figure 8: Number of skin test reactors (SICCT) and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Nottinghamshire, from 2014 to 2023.

Figure 8 description: Bar chart showing the number of skin test reactors and interferon gamma test reactors removed for TB control reasons in Nottinghamshire between 2014 and 2023. In 2023, 53 skin test reactor cattle and 13 interferon gamma reactors were removed in Nottinghamshire.

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.

Ian 2023, 9 out of 12 (75%) new TB incidents in Nottinghamshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The findings from this investigation are reported in Appendix 3.

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.

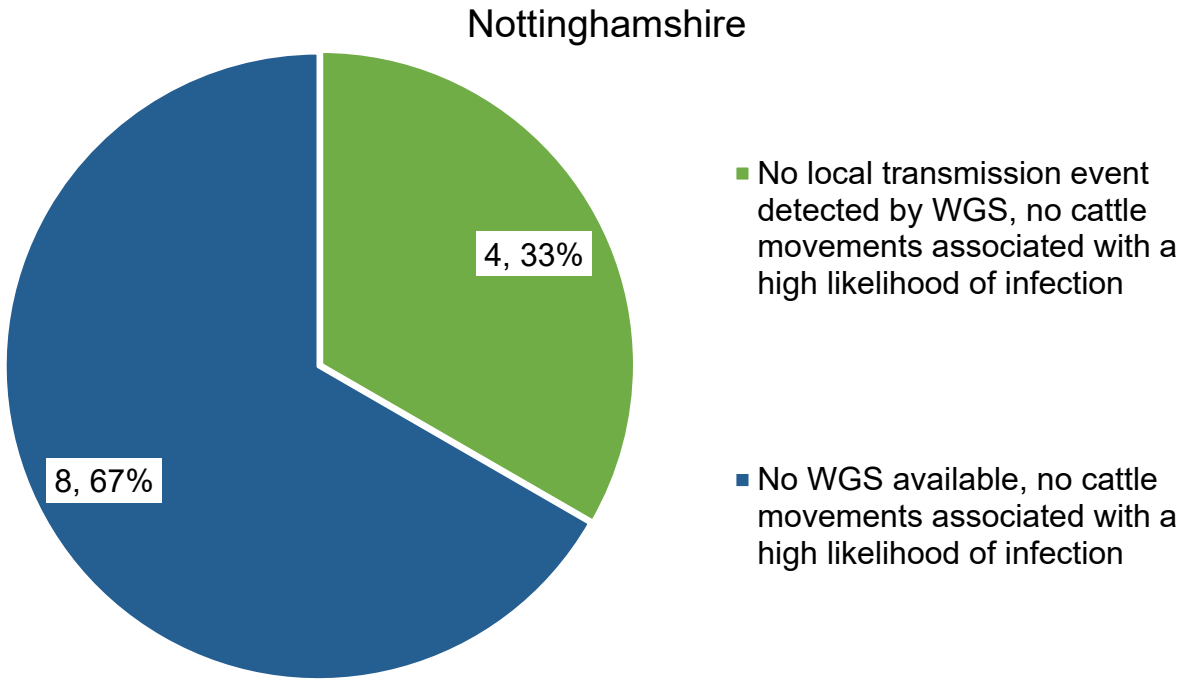


Figure 9: Risk pathway combinations identified by the WGS local transmission of infection indicator and cattle movement algorithm for all 12 new TB incidents starting in Nottinghamshire in 2023.

Figure 9 description: Pie chart showing the risk pathway combinations identified by the WGS local reservoir indicator and cattle movement algorithm for all 100 new TB incidents in Nottinghamshire in 2023. Most (8, 67%) 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 with a suitable quality to analyse for local transmission events were available for 4 (33%) of all new TB incidents in Nottinghamshire. The WGS local transmission of infection indicator did not identify a local transmission event for any of the incidents in Nottinghamshire.

For 4 TB incidents, the WGS local transmission of infection indicator did not find evidence of local transmission events, and there was no evidence of cattle movements associated

with a high likelihood of TB infection. The source of infection is unclear for these incidents (grey symbol).

There was no evidence of cattle movements associated with a high likelihood of TB infection and no WGS available to explore a local transmission event for 8 of the 12 (67%) TB incidents. These are shown as white dots in Figure 10, as there is insufficient evidence to determine a likely infection pathway.

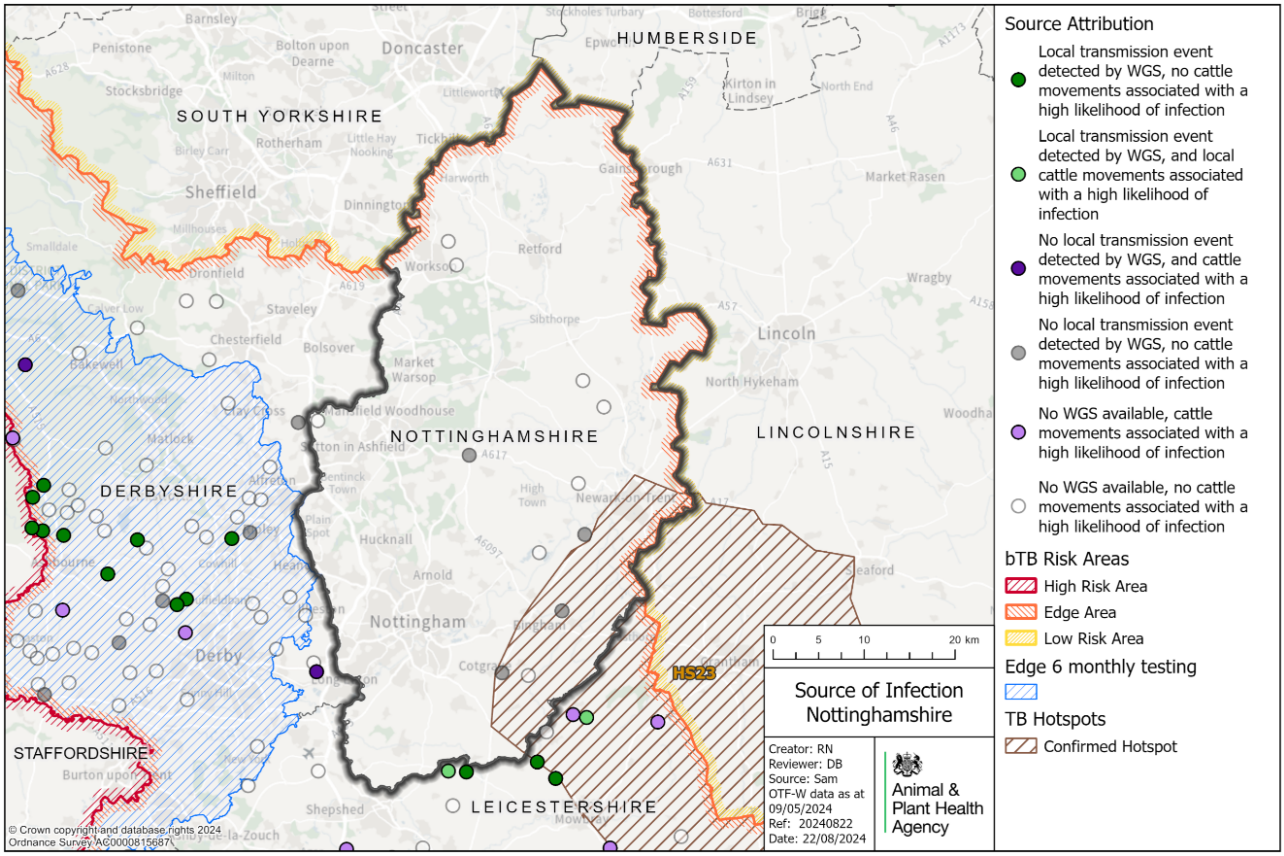


Figure 10: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Nottinghamshire that started in 2023.

Figure 10 description: Map of the Nottinghamshire county showing the locations of the 12 new TB incidents in Nottinghamshire, 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.

New TB incidents identified as having evidence of a local transmission event by the WGS Local Infection Indicator over the past 4 years are presented in Figure 11. There were no incidents of this kind in Nottinghamshire in 2023. However, a cluster of B3-11 in north Leicestershire, at Nottinghamshire's southern border, has been established over the last 5 years. This area belongs to the HS23 hotspot mentioned above, and more information can be found in the Leicestershire TB epidemiology report for 2023.

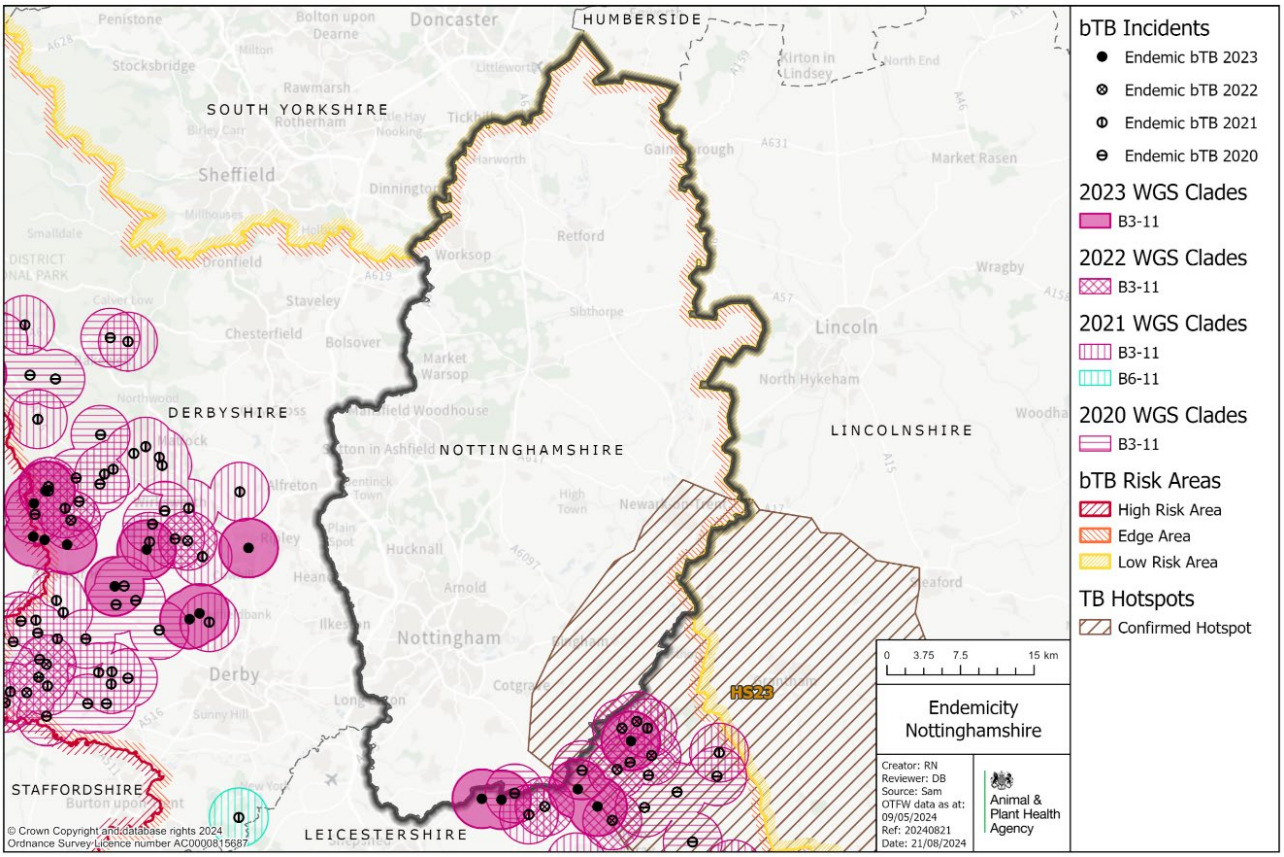


Figure 11: WGS clades of *M. bovis* detected in Nottinghamshire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and 9km (OTF-W incidents only).

Figure 11 description: Map of Nottinghamshire showing the WGS clades of *M. bovis* detected in Nottinghamshire 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 northeastern parts of Nottinghamshire. Further detail is provided in the text.

Forward look

The number of new incidents in 2023 has continued to decline following a peak in 2021. It is at the lowest level since 2014. However, the geographical distribution of new incidents within the county remains relatively similar to that seen in previous years. They are located mainly in the south of the county in and around HS23, as well as the north and centre.

This may be a cyclical event, like has been seen previously in the county, but it may also deteriorate with the possibility of infection becoming established in the south, Centre and north of the county.

Additionally, prevalence in Nottinghamshire at the end of the reporting year was 1.7%. It seems unlikely for Nottinghamshire to become eligible for OTF status by 2025, as set out in the strategy for achieving OTF status for England, published in 2014. However, if the disease trend continues to decline as a result of effective disease control measures it is possible Nottinghamshire will achieve OTF status by 2038.

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

- further work by APHA and stakeholders to determine the most likely risk pathways for incidents with an uncertain pathway at present. This may include looking further at local wildlife sources and encouraging farmers in the HS23 area to engage in the specific control measures established as part of this hotspot, such as continuing to report badger and wild deer carcasses
- managing the TB risks posed by cattle movements to reduce the risk of spread of TB within and between farms. This is particularly relevant in the centre and north of the county, which have seen incidents of imported infection in previous years
- 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)
- continuation and further adoption of measures to prevent the spread of TB between cattle and wildlife, including biosecurity, disease control measures in badgers, and local control of the wild deer population, where appropriate
- managing the TB risks posed by residual infection in herds to reduce the risk of recurrent incidents and spread of disease between cattle and from cattle to environment and wildlife

Appendix 1: cattle industry demographics

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

Size of herds	Number of herds in Nottinghamshire
Undetermined	4
1 to 50	218
51 to 100	62
101 to 200	57
201 to 350	33
351 to 500	11
Greater than 500	16
Total number of herds	401
Mean herd size	103
Median herd size	41

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

Breed purpose	Number (and percentage of total) cattle in Nottinghamshire
Beef	28,718 (69%)
Dairy	11,332 (27%)
Dual purpose	1,226 (2%)
Unknown	3 (0.007%)
Total	41,279

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Nottinghamshire 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	476	483	485
(b) Total number of whole herd skin tests carried out at any time in the period	463	491	399
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	396	372	360
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of TB movement restrictions)	436	439	442
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	459	469	474
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period	10	12	8
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period	11	6	4
(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	3	0
(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?	4	0	0

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)?	7	6	4
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine slaughterhouse TB surveillance?	1	3	0
(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	5	4
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	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	10	11	13
(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 Nottinghamshire 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)	58,457	62,630	47,324
(b.1) Reactors detected by tuberculin skin tests during the year	62	45	53
(b.2) Reactors detected by additional IFN-γ blood tests (skin-test negative or IR animals) during the year	44	34	13
(c) Reactors detected during year per incidents disclosed during year	5.0	4.4	5.5
(d) Reactors per 1,000 animal tests	1.8	1.3	1.4
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	1	3	0
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughters)	5	1	10
(f) Slaughterhouse (SLH) cases (suspect tuberculous carcasses) reported by Food Standards Agency (FSA) during routine meat inspection	3	4	4
(g) SLH cases confirmed by *M. bovis* PCR testing or bacteriological culture	1	3	0

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, 9 out of 12 (75%) new TB incidents in Nottinghamshire 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 is 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 9 incidents with a preliminary or a final veterinary assessment in Nottinghamshire, in 2023

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	4	1	6	0	54.1%
Cattle movements	3	0	1	0	12.1%
Contiguous	1	0	0	0	1.9%
Residual cattle infection	2	2	0	0	14.2%
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	1	0	0	6.6%
Other or unknown source	1	0	0	0	11.1%

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.