Public Health England

Protecting and improving the nation's health

Tuberculosis in the North East

Annual review (2018 data)

Data from 2000 to 2018

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, research, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

Public Health England
Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8000
www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

Prepared by: Field Service (North East)
For queries relating to this document, please contact: Angela Cox

Published November 2019
PHE publications
Gateway number: GW-888

PHE supports the UN Sustainable Development Goals

Contents

The data presented in this report is correct as at April 2018.

Acknowledgements

We are grateful to all those who contribute information on people with tuberculosis in the North East, including nurses, physicians, microbiologists, scientists, outreach and social care and administrative staff. We also acknowledge colleagues at the PHE National Mycobacterium Reference Service for information on culture confirmation and drug susceptibility testing. Further thanks are due to the PHE National TB Unit for providing the cleaned matched dataset, the PHE North East Centre Health Protection Team and the North East Field Service team for their work supporting Enhanced Tuberculosis Surveillance.

Authors

This report was prepared by Angela Cox and Dr Petra Manley of the Field Service (North East), National Infection Service, Public Health England, and Dr Simon Howard of the PHE North East Health Protection Team.

Suggested citation

Public Health England. (November 2019) Tuberculosis in North East: Annual review (2018 data), 2019. Public Health England: (North East)

Foreword

Tuberculosis (TB) is perhaps one of the most misunderstood infectious threats to public health with many people thinking that it is a disease of the Victorian period with no relevance to today. However, this is not the case: it continues to be an important and significant threat to the health of our population, as well as a disease which carries a high morbidity burden for individuals. As a result, eradication of TB is one of the priorities for 2020-2025 identified in PHE's new Infectious Diseases Strategy.

TB is often characterised as a disease associated with migration to the UK. On a national level, this is accurate: 72% of cases were in people born outside the UK. Yet the picture in the North East is starkly different: almost half (45%) of our TB cases in 2018 were in people born in the UK. Given that almost a third of cases in the North East (27%) are symptomatic for more than 4 months before diagnosis, we will continue to work to make sure that front line clinicians consider a diagnosis of TB among UK-born patients with compatible symptoms. This will be a focus of World TB Day activity in the North East in March 2020.

The incidence of TB in the North East has not significantly changed in almost 2 decades This stands in stark contrast to the incidence in England which has almost halved in the last 7 years. The incidence of TB in Middlesbrough and Newcastle is no longer "around the national average": it is now considerably higher than the national average. The North East Health Protection Team is leading a national PHE project to gather and present evidence on successes in reducing the burden of TB in relatively low incidence areas, and the North East TB Network will consider how to implement best practice in our region.

TB is also a disease of deprivation. The incidence among the most deprived quintile of North East residents (8.1) is almost 4 times that among the least deprived quintile (2.3). The North East TB Network is considering what more can be done to ensure that we target hard-to-reach groups in a joined-up person-focused way, rather than multiple teams working on different disease areas targeting them separately. For example, in the North East we are currently working to trial latent TB testing in a drug and alcohol service.

The number of TB cases in the North East each year remains small, but there is still much work to be done to ensure that our region is not left behind as the incidence declines nationally.

Paul Davison, Deputy Director of Health Protection
PHE North East Centre

Executive summary

In 2018, 118 people were notified with TB in the North East, an increase of 7% on the previous year. The North East has lower notification rates of TB than England overall: 4.4 per 100,000 compared to 8.3 per 100,000 population [1]. In all but 2 local authorities (Middlesbrough and Newcastle upon Tyne), TB rates were below the national average.

The number of people with TB who were born outside the UK remained stable; however, there was a small increase in the number of people with TB born in the UK. TB rates in the UK born population remains very low at 2.2 per 100,000 while the rate in the people born outside the UK was 38.5 per 100,000. Most of the UK-born people were of white ethnicity.

In the highest incidence areas of Newcastle and Middlesbrough, more than 70% of people with TB were born outside the UK. India, Pakistan and Eritrea were the most common countries of birth among those born outside the UK. The most common ethnicity of people with TB born abroad was Black African, Indian and Mixed other.

More than half of people notified in 2018 had pulmonary disease. Pulmonary TB was more common among people born in the UK (77% vs 56% in those born abroad). In 2018, 75% of all cases were confirmed by culture, 78% among those with pulmonary TB, compared to 75% among those with pulmonary TB in England.

Information on key co-morbidities (diabetes, hepatitis B, hepatitis C, chronic renal disease, chronic liver disease and immunosuppression) has been collected as part of Enhanced TB surveillance since 2016. Almost a fifth of people had a key co-morbidity. The most common being diabetes.

Over a quarter of people with pulmonary TB continue to experience a delay of more than 4 months between symptom onset and the start of treatment. The delays were highest in males and those born in the UK and of a white ethnic group.

There was a small decrease in the proportion of people notified with drug sensitive TB (with an expected treatment duration of less than 12 months) who completed treatment by 12 months from 84% in 2016 to 75% in 2017. The proportion who died at the last recorded outcome was 4.7%, lower than in 2016 (6.7%)

In 2018, 17% of people notified with TB had a social risk factor, such as drug and alcohol misuse, homelessness or a history of imprisonment. This was the highest proportion since 2010 when data collection on risk factors began. People with risk factors mostly had pulmonary TB.

Information on HIV testing was available for 97% of people reported with TB (excluding cases that were diagnosed post mortem), of those 92% (excluding cases diagnosed post mortem and those where status was already known) were offered testing. The latest estimates suggested that 1.8% of people with TB were co-infected with HIV, the North East had the lowest proportion of people that were co-infected with HIV in England region and lower than the national proportion of 2.7%.

Resistance to one or more first line drugs remained the static among people with culture confirmed TB in the North East in 2018.

Recommendations

Recommendations for local NHS and PHE staff include:

i. ensuring that accurate and complete information is provided on the PHE enhanced TB surveillance system in a timely manner
ii. that best practice case management is followed for all patients, including universal HIV testing and obtaining sputum smear results.

The Yorkshire and Humber and the North East TB Control Board should continue to prioritise work with wider stakeholders to develop strategies to improve outcomes for under-served populations.

TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2018, 118 TB cases were reported among North East residents, a rate of 4.4 per 100,000 population. Following a continuous year on year decline since 2014, 2018 saw a slight increase of 7% in the number of cases in 2018 (Figure1). The rate of TB in the North East remained well below the England average of 8.3 per 100,000 population.

Within the North East, the highest rates of TB were seen in Newcastle upon Tyne (12 per 100,000 population) and Middlesbrough (9.2 per 100,000 population), and the lowest in Redcar and Cleveland and Northumberland (Figure 2).

TB Monitoring Indicator 1: Overall TB incidence per 100,000 population

Figure 1: TB case reports and rates, North East, 2000 to 2018

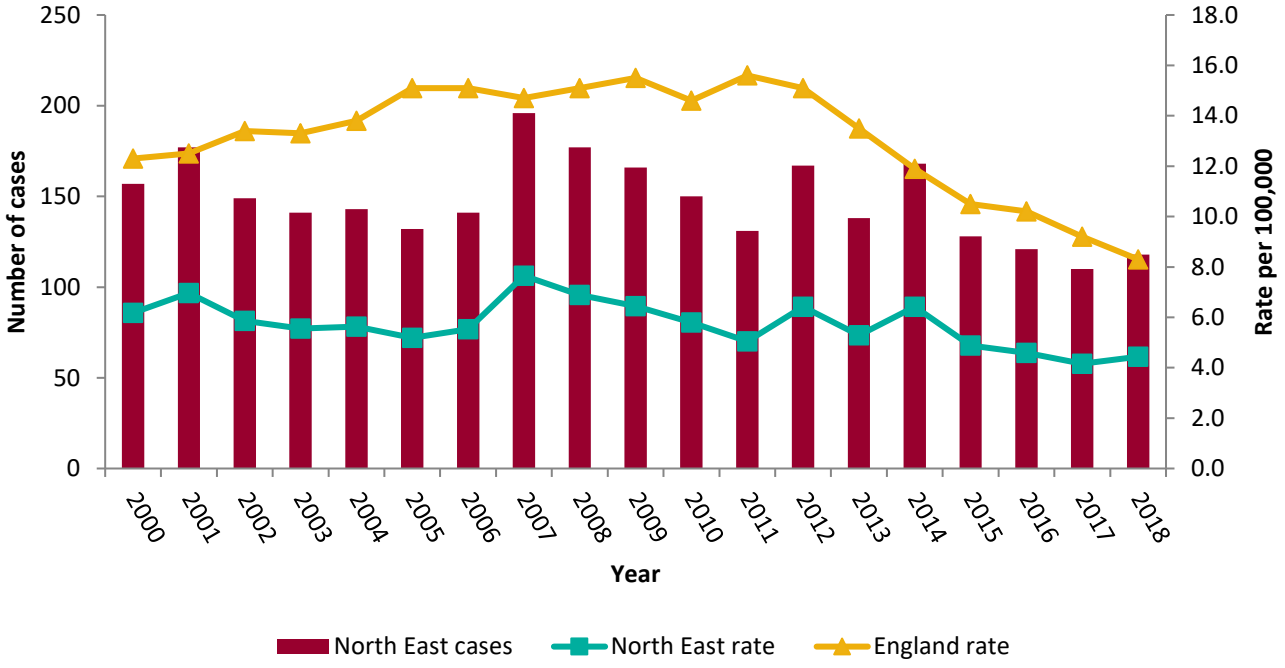


Figure 2: TB case rates, by North East local authority of residence, North East, 2000 to 2018

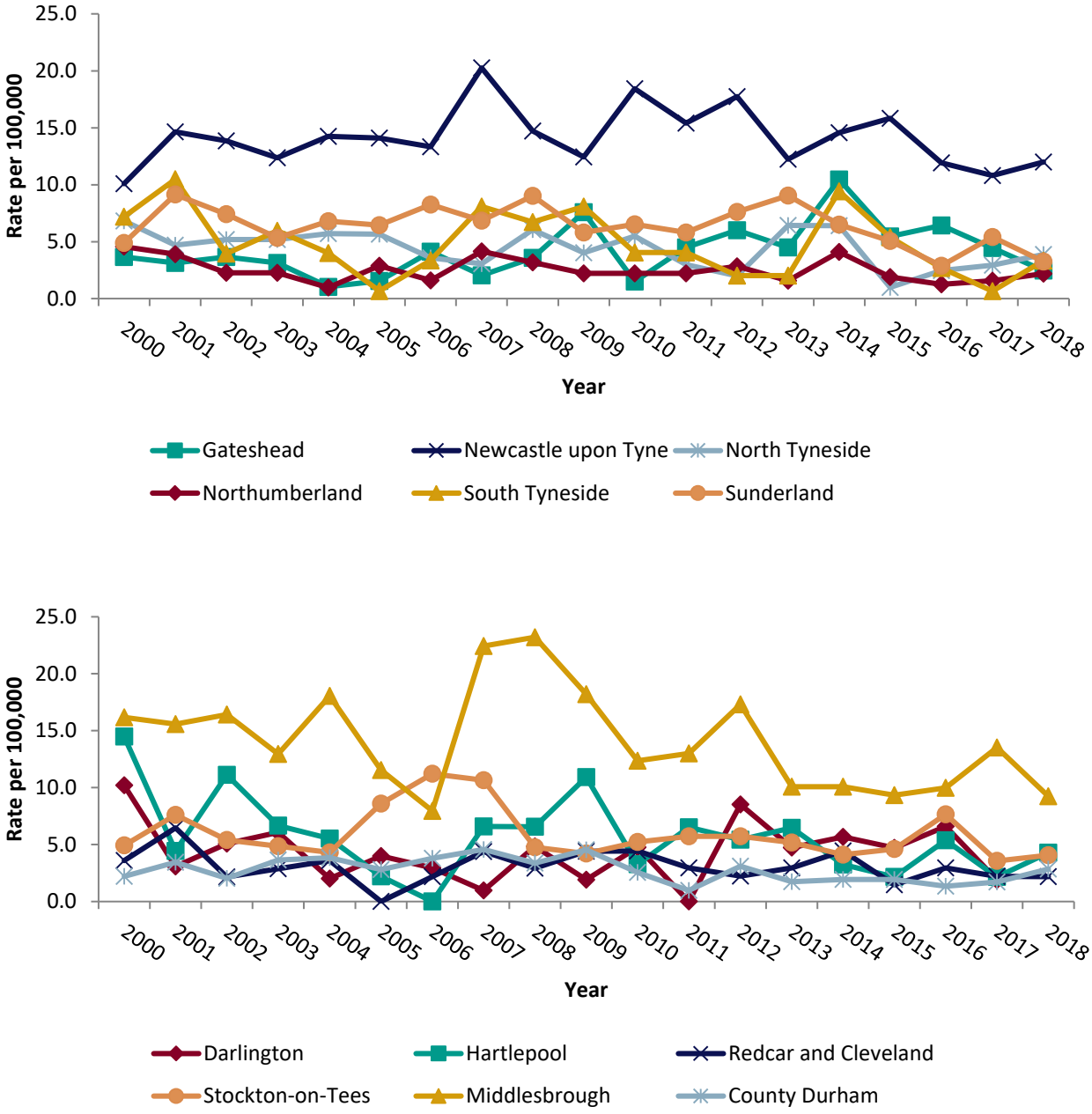
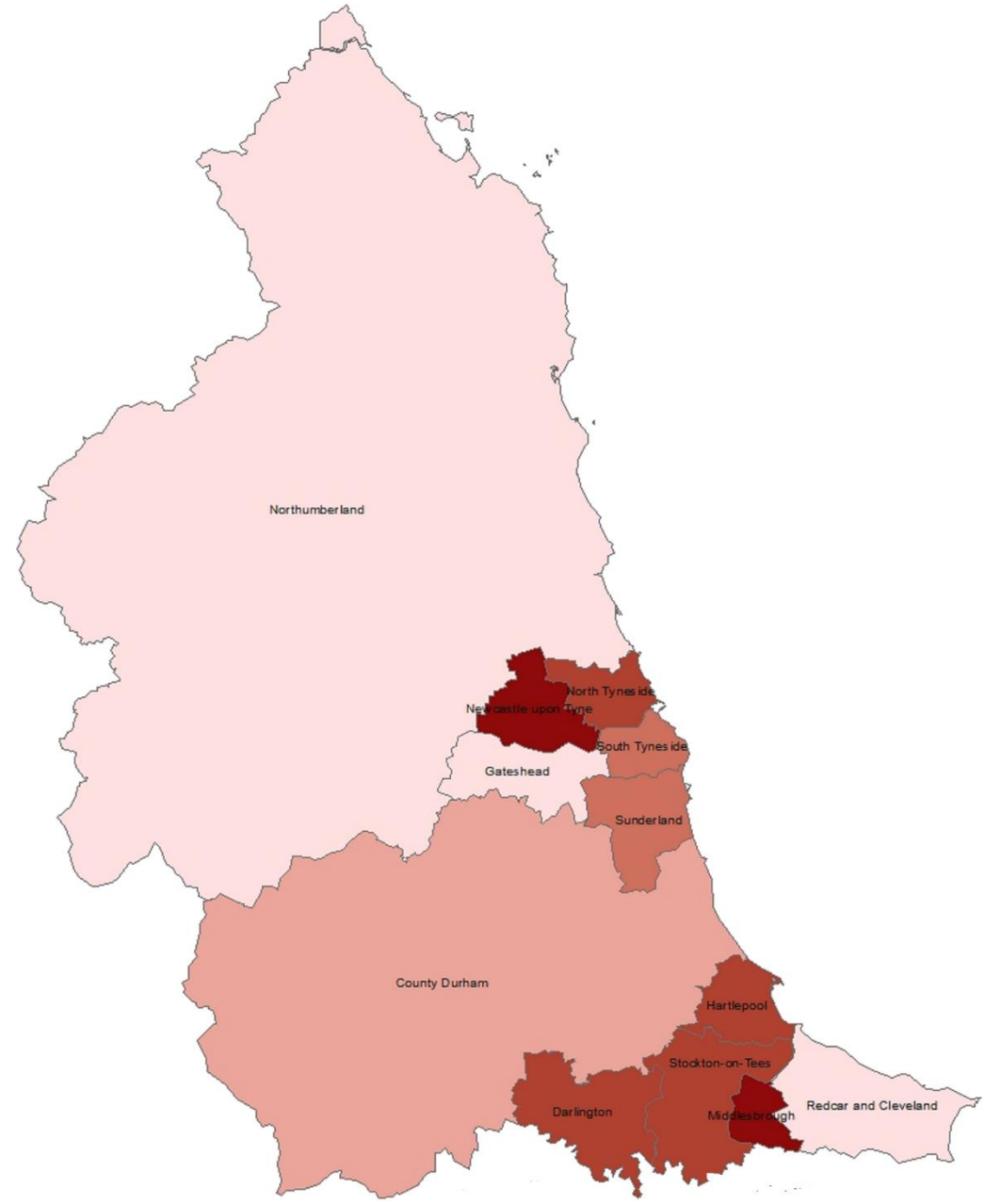


Figure 3: TB case rate by upper tier local authority of residence, North East, 2018



Demographic characteristics

Age and sex

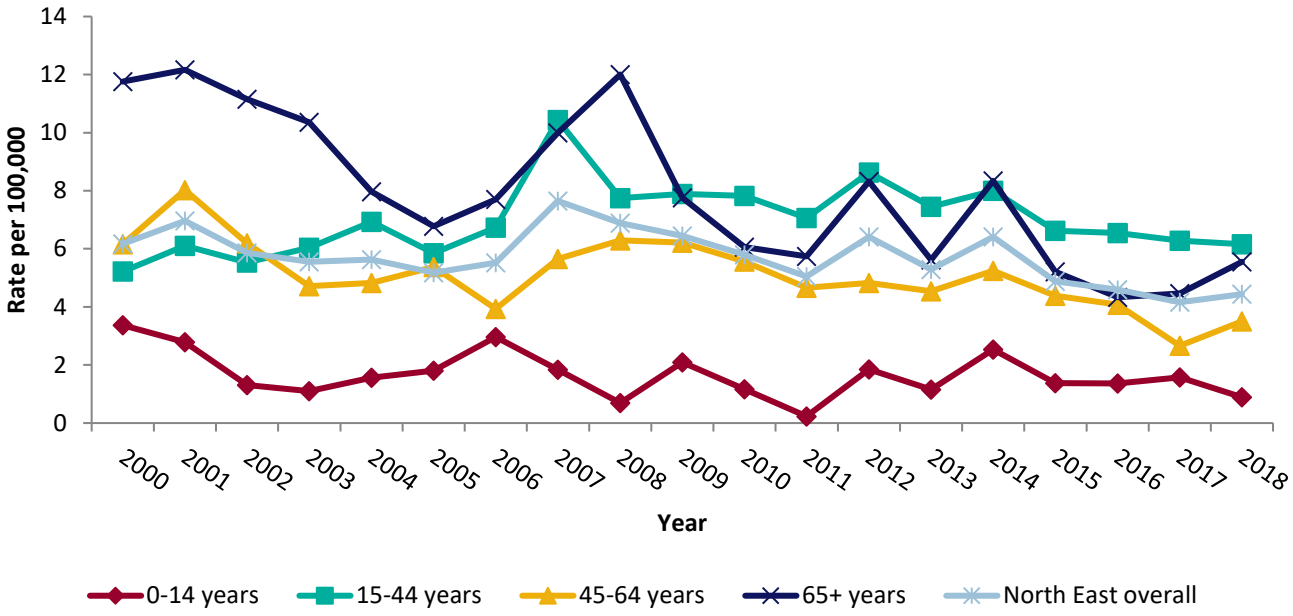
Data on age and sex were available on all cases of TB reported in the North East in 2018. In 2018, 64% (75/118) of people with TB were male and 36% female (43/118). Rates were higher among men than among women (5.7 per 100,000 population for males and 3.2 per 100,000 population for females).

Among both sexes the highest rates of TB were observed in those aged 30 to 39 years (8.9 per 100,000 population). When cases were stratified by age and sex, the highest rate was seen in males aged 30 to 39 (10.3 per 100,000 population). The highest rate for females was seen in those aged 20 to 29 (8.8 per 100,000 population) (Figure 4).

Figure 4: TB case reports and rate by age and sex, North East, 2018

Looking at the age distribution of cases using 4 broader age categories (<15s, 15 to 44, 45 to 64 and 65+), the rate in TB was highest among people aged 15 to 44 years. Compared to 2017 there was a 43.3% decrease in the rate among people aged 15 to 44 years, a 31.5% increase in the rate among people aged 45 to 64 and 24.3% increase in the rate among people aged 65+. The largest decrease in the rate was seen in among children aged <15 years where the rate has decreased from 1.6 in 2017 to 0.9 per 100,000 of child population in 2018. Of those children, the majority were UK born with a rate of 0.7 per 100,000 UK born children, a slight decrease on the previous year. (Figure 5)

Figure 5: TB case rates by age group, North East, 2000 to 2018



Place of birth and time since entry

The rates of TB in the non-UK born population should be interpreted in the context of changes to the pre-UK entry screening policies. In 2005, the UK piloted the pre-entry screening of long-term migrants to the UK for active pulmonary TB from 15 high TB incidence countries. In 2012, this pre-entry screening was extended to all countries with a high incidence of TB (i.e. >40 cases per 100,000 population). [2]

In 2018, place of birth was known for 99% (117/118) of people with TB in the North East. Of these cases, 64 (55%) were born outside of the UK, with a non-UK born TB rate of 38.5 per 100,000 population. The TB rate in non-UK born population remains very low at 2.2 per 100,000 population. Numbers of UK born cases increased slightly from 46 in 2017 to 53 in 2018. (Figure 6)

TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations

In 2018, information on time since entry to the UK and TB notification was available for 97% (62/64) of those born abroad. An increase was seen in those notified more than 11 years since entry to the UK, this group accounted for the greatest proportion of those born abroad (47%, 29/62). There was a continuation of the decrease among recent entrants to the UK (those diagnosed within 2 years after entry), 2 to 5 years and 6 to 10 years. (Figure 7)

Figure 6: TB case reports and rate by place of birth, North East, 2001 to 2018

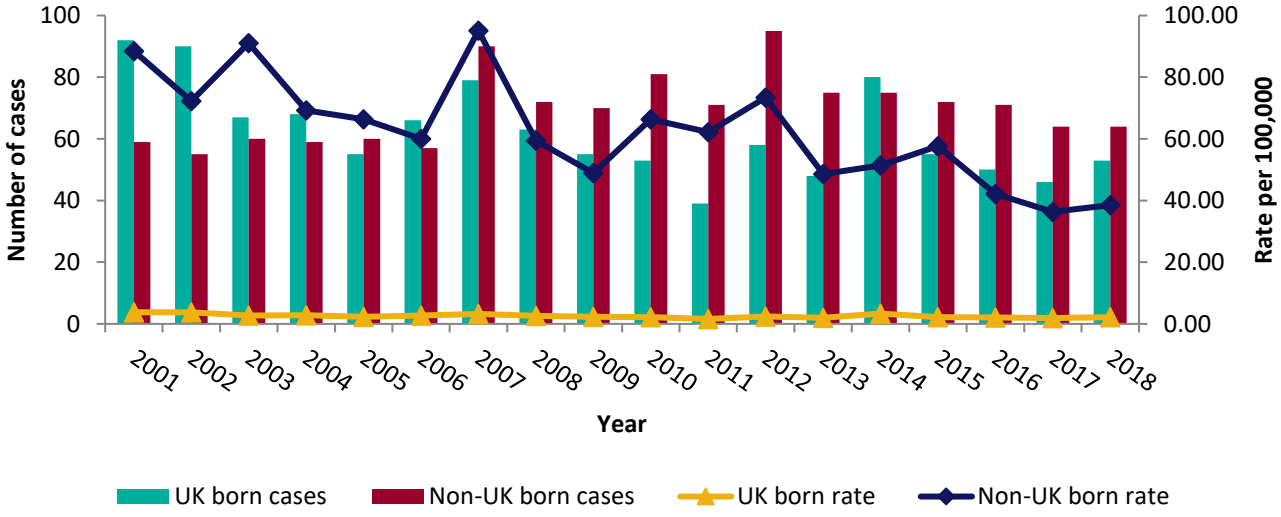
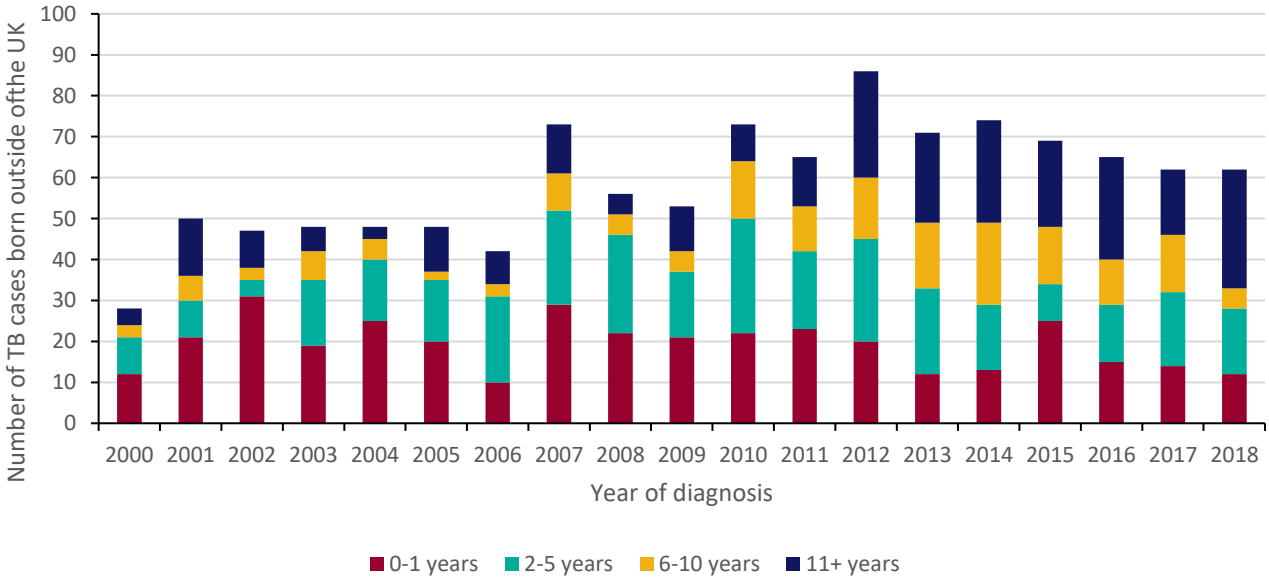


Figure 7: Time between entry to the UK and TB notification for people born outside the UK, North East, 2000 to 2018



For those born outside the UK, country of birth data was available for all the non-UK born cases. In 2018, the largest proportion of non-UK born TB patients were born in India (13, 20%) followed by Eritrea (7, 11%) and Pakistan (7, 11%). The average time between entry to the UK and TB diagnosis varied by country of birth.

Over the past few years, people born in India, Pakistan and Eritrea have made up the highest proportion of non-UK born population.

Table 1: Five most common countries of birth for people born outside the UK, North East, 2018

Country of origin	Number of cases	Proportion of non-UK born %
India	13	20
Eritrea	7	11
Pakistan	7	11
Philippines	5	8
Others<5	32	50
Total non-UK born	**64**	**100**

Ethnicity

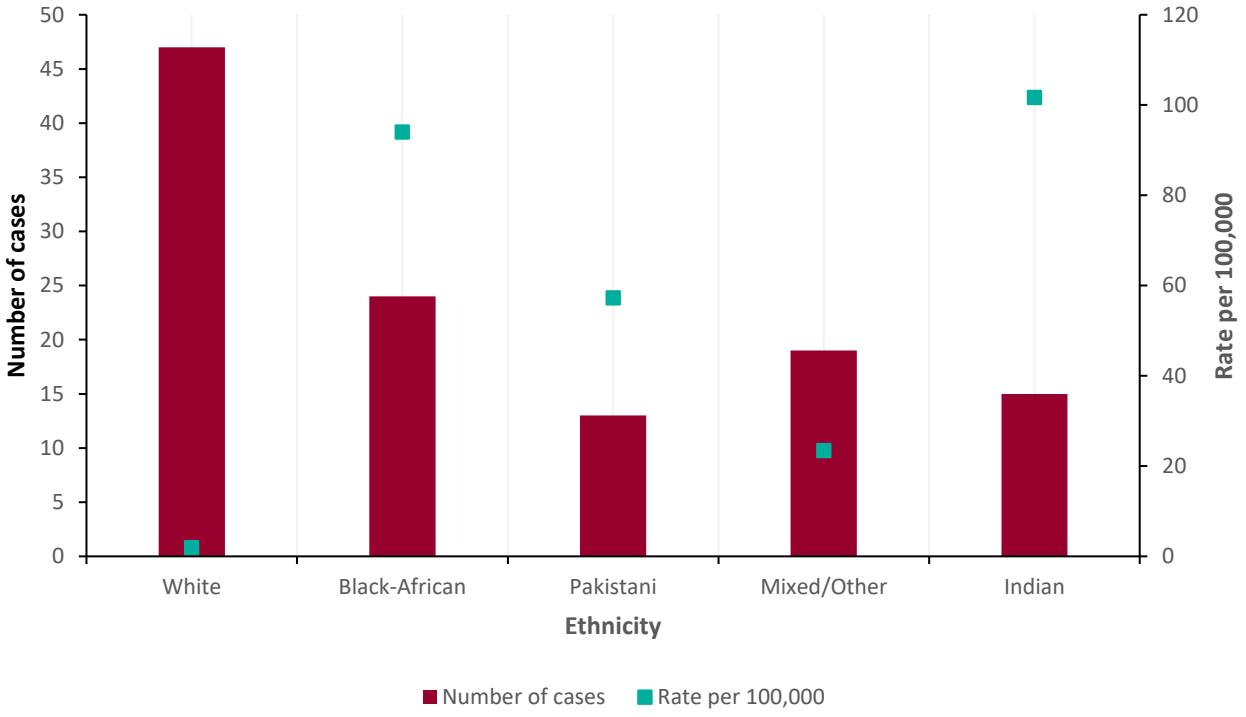
The rates in this section should be interpreted with caution, as population estimates, used as the denominators for the different ethnic groups were calculated using the Labour Force Survey, which is liable to sampling error for small population groups.[1]

As in previous years the most common ethnic group was White, accounting for 44% (47/118) of TB cases, followed by Black-African and Indian. Due to the predominantly White population of the North East this equates to a rate of 1.9 per 100,000 of the White population. The rates in the other groups were much higher.

Of the UK born TB cases reported in 2016 to 2018 ([a]3-year data due to small numbers), the majority (85%, 126/149) were in the White ethnic group. Among the non-UK born reported in 2016 to 2018, 36% (72/199) were in the Black African group; 14% (28/199) in the Mixed/Other group and 14% (32/199) were in the Indian group.

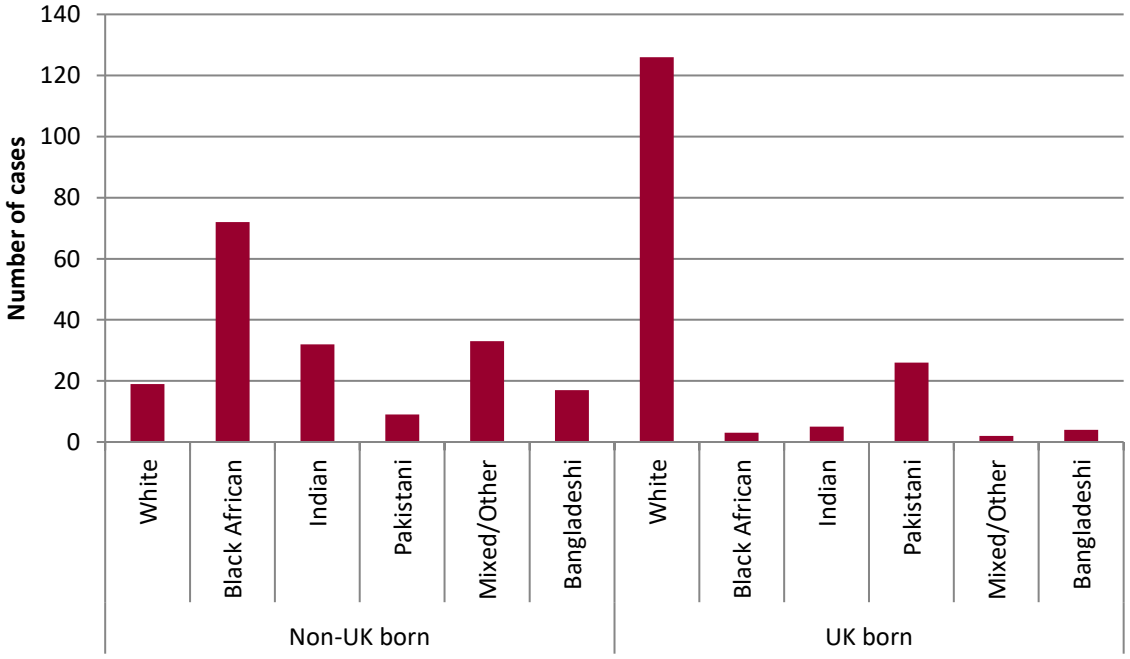
[1] The Labour Force Survey (LFS) was used to calculate population estimates based on a random sample of surveyed individuals, weighted to represent others in the region. Small populations are often underrepresented in the LFS sample, which may inflate TB rates for some ethnic groups

Figure 8: TB case numbers and rate by ethnic group, North East, 2018



*Cases with mixed/other, black Caribbean, black other, Chinese and Bangladeshi were grouped as 'Mixed/Other' due to low numbers

Figure 9: TB case number by ethnic group and place of birth, North East, 2016 to 2018[a]



Occupation

In 2018, occupation was known for 94% (80/85) of people with TB aged between 18 and 65. The most common occupational category was ‘Other’ (35, 44%), followed by ‘No occupation’ (29, 36%) and ‘Healthcare worker’ (9, 11%). In the ‘No occupation’ category, the most frequently reported status was ‘Unemployed’ (9/29, 31%).

Table 2: Occupational category of people with TB aged 18 to 65 years, North East, 2018

Occupation	Number of cases	%
Education	7	8.8
Health care worker	9	11.3
Other	35	43.8
No occupation	29	36.3
Total	**80**	

Clinical characteristics

Site of disease

In 2018, 65% of people notified with TB had pulmonary disease with or without extra pulmonary (+/- EP) sites (77, 65.3%). The most common extra pulmonary site was extra thoracic lymph nodes (22, 18.6%). Pulmonary TB was more common among those born in the UK than those born abroad (77%, 41/53 vs 56%, 36/64) and those with at least 1 social risk factor (88%, 15/17).

Table 3: Number of people with TB by site of disease, North East, 2018[b]

Site of disease	n	Proportion (%)
Pulmonary +/-EP sites	77	65.3
Pulmonary ONLY	54	45.8
EP Unknown	36	30.5
Pulmonary +EP sites	23	19.5
Lymph nodes (extra-thoracic)	22	18.6
Pleural	8	6.8
Other (extra-pulmonary)	6	5.1
Gastrointestinal	5	4.2
IT lymph nodes	4	3.4
Bone/joint (other)	4	3.4
CNS (other)	3	2.5
Genitourinary	2	1.7
Bone/joint (spine)	2	1.7
Miliary	1	0.8
Unknown	0	0.0
Laryngeal	0	0.0
Cryptic	0	0.0
CNS (meningitis)	0	0.0

[b] patients may have disease at more than 1 site, so the total % will not equal 100%

Previous history of tuberculosis

In 2018, data was available for 97% (114/118) of cases and of these 6% (7/114) of people with TB had a previous diagnosis more than 12 months before their current notification. Of these 4 cases were known to had previously been treated for TB, and one case received Direct Observed Therapy (DOT) during this time. Time since previous diagnosis was known for 6 cases, with a median time since diagnosis of 4 years (IQR 2-39).

Hospital inpatient and directly observed therapy

Data was available for 93% (110/118) of cases and of these 27.3% (30/110) of people diagnosed with TB were recorded as being an inpatient at time of diagnosis, this was more common among cases with at least 1 social risk factor (44%, 7/16).

Co-morbidities

Data on selected key co-morbidities, diabetes, hepatitis B and C, chronic liver disease, chronic renal disease, and immunosuppression has been routinely collected since 2015 and was available for 97% (114/118) of cases. In 2018, 17% (20/114) had at least 1 co-morbidity. The most common co-morbidity reported was diabetes, this was reported for 10% (11/112) of people with TB (Table 4). The prevalence of co-morbidities increased with age, with none reported for children under 15 years.

Table 4: Co-morbidities among people with TB, North East, 2018

Co-morbidity	n	%	Total*
Diabetes	11	9.82	112
Hepatitis B	1	0.90	111
Hepatitis C	2	1.87	107
Chronic liver disease	1	0.89	112
Chronic renal disease	3	2.65	113
Immunosuppression	5	4.39	114

*total number of cases where data on co-morbidities was recorded

Travel and visitor risk factors

Information on travel to a country outside the UK in the 2 years prior to diagnosis was known for 95% (112/118) of people notified in 2018. Of those, a quarter had travelled outside the UK. 44% (28/64) of people born outside the UK had travelled abroad. For people born outside the UK where the country of travel was known, 93% (25/27) had travelled to their own country of birth.

Information on visitors received from a country outside the UK, in the 2 years prior to diagnosis was available for 97% of people notified in 2018. 11% (13/114) of those had received a visitor from abroad. For people born outside the UK, where the origin of their visitor was known, 93% (11/12) had received a visitor from their own country of birth.

Laboratory confirmation of TB

Laboratory tests data collection

Laboratory data on culture confirmed TB isolates from the National Mycobacterium Reference Service (NMRS) were matched to TB case notifications, and the results were used to report culture confirmation. Results for microscopy, PCR and histology are also collected in ETS.

Culture confirmation and speciation

In 2018, 75% (89/118) of all TB cases reported in the North East were confirmed by culture, this is an increase from the previous year. The figure increased to 78% (60/77) among pulmonary cases and was lower (71%, 29/41) for cases with extra pulmonary disease.

Of the people with TB who had a positive culture diagnosis, 95.5 % were identified as *Mycobacterium tuberculosis (M.tuberculosis*) infection, 3.4% were identified as *M.africanum* and 1.4% were identified as *M.bovis*.

TB Monitoring Indicator 8: Proportion of pulmonary TB cases that were culture confirmed

Sputum smear

In 2018, sputum smear results were available for 44% (34/77) of people with pulmonary TB. Where known, 82% (28/34) of people were sputum smear positive.

TB transmission

Rate of TB in UK born children

TB in UK born children is used as an indirect indicator for recent TB transmission within the UK, since TB in children is likely to be caused by recent exposure (as opposed to reactivation of latent TB infection acquired some time previously).

In 2018 in the North East, the rate in UK born children was 0.7 per 100,000 population, this rate has decreased slightly from 2017. This North East rate was lower than the England rate of 1.2 per 100,000 for 2018.

TB Monitoring Indicator 5: Incidence of TB in UK born children aged less than 15 years

Strain typing and clustering

In December 2016, Whole Genome Sequencing (WGS) was rolled out by NMRS-North and Central, covering the Midlands and North of England, at which time MIRU-VNTR typing (the previous method of strain typing) was discontinued. By 2017 to 2018, the WGS typing for TB was extended to the whole of England and replaced any previous typing methods.

WGS of *Mycobacterium tuberculosis complex* isolates provides information on Single Nucleotide Polymorphism (SNP) differences between isolates and describes how isolates are related to each other. WGS provides good understanding of whether isolates are likely to be part of the same transmission chain and may also help determine the timing and direction of transmission. [3] [4] [5]

Epidemiologically linked patients involved in transmission are unlikely to be identified at SNP distances of more than 12 [6] therefore WGS clusters of TB are defined as patients with 1 or more “near neighbour” patients whose TB sequences differ by 12 SNPs or fewer. Additional epidemiological information is required to assess whether recent transmission may have occurred, and whether any additional public health action should be taken.

Proportion of people with TB in clusters and geographical distribution

In 2018, there were 89 culture confirmed cases in the North East of which 98% (87/89) had an isolate that had WGS performed. Of those sequenced cases, all cases had a

cluster result; of those 20% (17/87) clustered with at least one other 2017 to 2018 case in N&C England within 12 SNP.[2]

Cluster characteristics

35% of clusters comprised 2 cases, 53% of clusters comprised 3 to 4 cases and 12% comprised of 5 to 9 cases. Most clusters (65%,11/17) were of Euro-American lineages. Of the cases clustered within the North East, 76% (13/17) were pulmonary and mostly male.

[2] Clusters of TB are defined as patients with 1 or more ‘near neighbour’ patients whose whole genome sequences differ by 12 SNPs or fewer

Delay from onset of symptoms to start of treatment

Time from symptom onset to treatment start for patients with pulmonary TB

Overall delay includes time from symptom onset to the patient presenting to healthcare, and from the initial presentation to diagnosis and start of treatment. Information on delay was available for 91% (70/77) of all people with pulmonary TB. The remaining people were either asymptomatic at diagnosis, did not have a date of onset recorded or did not have a start of treatment recorded or were diagnosed post mortem.

In 2018, 40% (28/70) people with pulmonary disease started treatment within 2 months, and 33% (23/70) between 2 and 4 months from symptom onset. The remaining 27% (19/70) of pulmonary cases had a delay from symptom onset to treatment start of more than 4 months.

The median number of days between symptom onset and treatment start was 81 days.

Table 5: Time between symptom onset and treatment start[c], North East, 2018

	Pulmonary		Extra-pulmonary only		Overall	
Time delay	n	%	n	%	n	%
<2 months	28	40	12	30	40	36
2-4 months	23	33	12	30	35	32
Over 4 months	19	27	16	40	35	32
Total	**70**	**100**	**40**	**100.0**	**110**	**100**

[c] Excluding asymptomatic patients, and those with missing onset dates

TB Monitoring Indicator 6: Proportion of pulmonary TB patients starting treatment within 2 months of symptom onset

TB Monitoring Indicator 7: Proportion of pulmonary TB patients starting treatment within 4 months of symptom onset

Characteristics of pulmonary TB patients with a delay from onset of symptoms to treatment of more than 4 months

Of the 19/70 people with pulmonary TB with a delay from symptom onset to treatment start of more than 4 months; the majority were male (12/19), UK born (13/19) and aged 15 to 44 (8/19) and mainly White ethnicity (11/19).

TB outcomes in drug sensitive cohort

Drug sensitive cohort

For the purposes of TB outcome reporting, drug sensitive cases exclude all patients with rifampicin resistant TB (initial or amplified) including multidrug-resistant TB (MDR-TB, initial or amplified), and non-culture confirmed patients treated for MDR-TB [7]. Under this definition, cases with resistance to isoniazid, ethambutol and/or pyrazinamide but without resistance to rifampicin are included in the drug sensitive cohort. TB outcomes among patients with drug resistant disease are considered in the next chapter.

Treatment outcomes for the drug-sensitive cohort are reported separately for the following groups:

For patients with an expected duration of treatment less than 12 months, outcomes at 12 months are reported. This group excludes individuals with central nervous system (CNS) disease, who would be treated for 12 months. In addition, those with spinal, cryptic disseminated or miliary disease are excluded from this group, as CNS involvement cannot be reliably ruled out for the purposes of reporting.

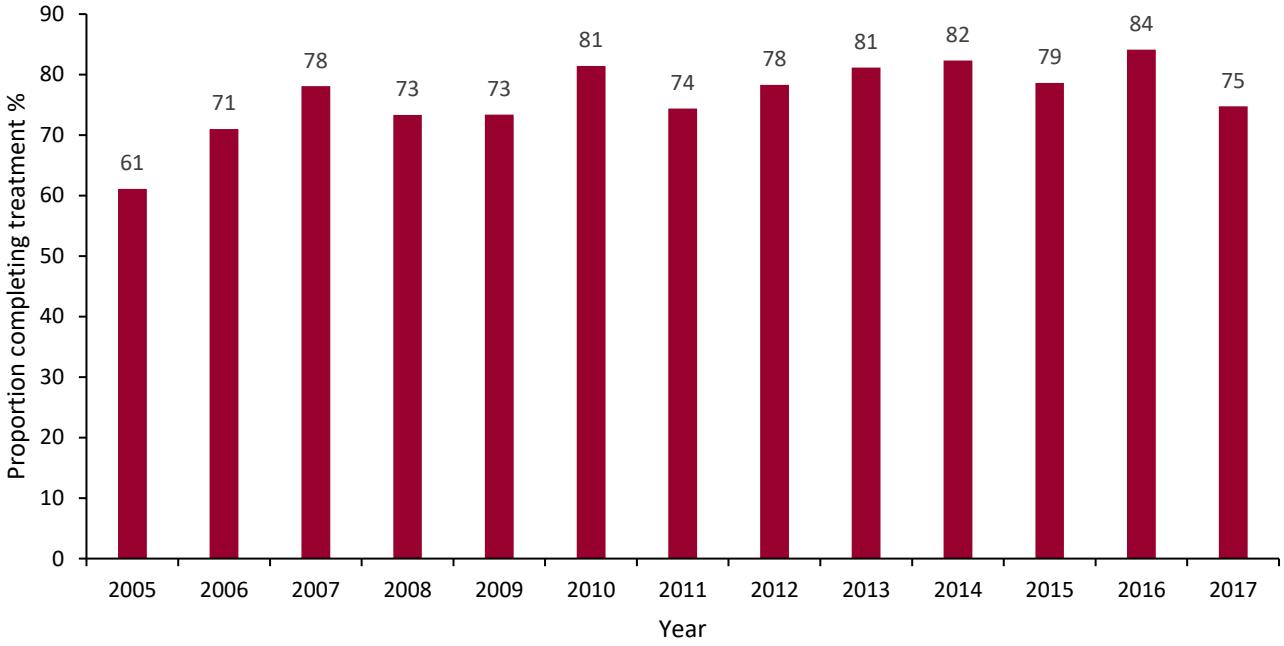
For patients with CNS, spinal, cryptic disseminated or miliary disease, the last recorded treatment outcome is reported.

Outcomes for TB patients with expected duration of treatment less than 12 months

In the North East, 75% (74/99) of people notified in 2017 (excluding CNS, spinal, military or cryptic disseminated TB) completed treatment within 12 months, this is a decrease on previous year. (Figure 11)

TB Monitoring Indicator 10: Proportion of drug sensitive TB patients who had completed a full course of treatment by 12 months

Figure 10: Proportion completing treatment at 12 months, North East, 2005 to 2017*



*Excludes rifampicin resistant TB, and patients with CNS, spinal, military or cryptic disseminated disease.

Table 6: TB outcome at 12 months, North East, patients diagnosed in 2017

Outcome	Number of cases	Proportion (%)
Completed	74	74.8
Died	5	5.1
Lost to follow up	7	7.1
Still on treatment	6	6.1
Treatment stopped	2	2.0
Not evaluated	5	5.1
Total	**99**	**100**

The most common reason for not completing treatment was lost to follow up (7%) and still being on treatment (6%).

Of those still on treatment at 12 months information on why they were still on treatment was available for 67% (4/6). Out of these 2 were on a planned treatment regimen that exceeded 12 months. One case had their treatment changed due to intolerance/ side effects and a further case treatment was interrupted due to poor compliance.

Treatment completion was lower in males 73% (46/63) than females 78% (28/36). Treatment completion was also lower among the UK born that those born abroad (68% vs 79%). Those born abroad when compared to UK born were more often lost to follow up (9% vs 5%) and were less likely to die whilst on or before treatment (2% vs 7%)[3].

Outcomes for drug-sensitive cohort of patients with CNS, spinal, miliary or cryptic disseminated TB

In the North East, 88% (7/8) of the people notified in 2017 with rifampicin sensitive, CNS, spinal, miliary or cryptic disseminated disease, completed treatment within 12 months – the proportion increased to 100% by the last recorded outcome.

Deaths and 'lost to follow up' in the entire drug-sensitive cohort

Of the 107 cases notified in the entire drug-sensitive cohort, 5 cases (5%) had reported death as a reason for non-completion of treatment. Of these, the relationship between TB and death was unknown for 40% (2/5) of cases. TB caused, contributed to or was incidental to a total of 3 deaths.

The proportion of drug sensitive North East cases that were lost to follow up at the last recorded outcome has ranged from 1% to 9% overall since 2004. Of TB cases notified in 2017, 6% (7/107) were lost to follow up, 43% (3/7) of those had left the UK. The proportion was greater in males than females (86%, 6/7).

[3] Causes of death reported to ETS were not necessarily based on review of death certificates completed in routine death registration

Drug resistant TB (including outcomes in the drug resistant cohort)

Drug resistance

Anti-TB antibiotic drugs are a large family and resistance may occur to one or more of these antibiotics and may be in complex combinations. A distinction is made between first, second and third line TB antibiotic drugs depending upon their clinical effectiveness. First line drugs include isoniazid, rifampicin, pyrazinamide and ethambutol. Second line drugs are injectable agents (for example, amikacin, capreomycin, kanamycin), fluoroquinolones (for example, moxifloxacin, ofloxacin, ciprofloxacin) and other oral bacteriostatic agents. MDR-TB cases are initially resistant to at least isoniazid and rifampicin. Extensively drug resistant TB cases (XDR-TB) are initially MDR and resistant to at least 1 injectable agent and at least 1 fluoroquinolone [8].

Overall initial drug resistance and geographical distribution

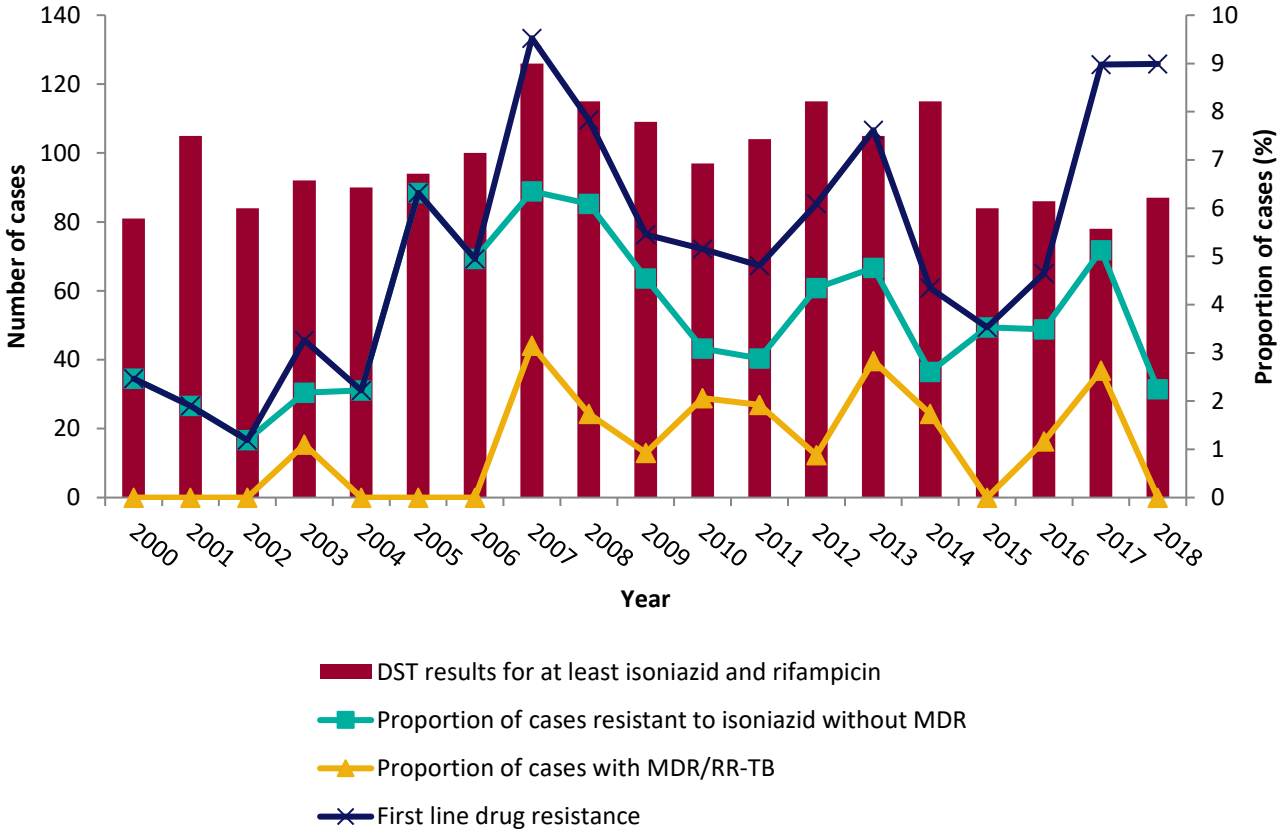
The number of cases in the denominator for this section is comprised of cases who had drug sensitivity testing for at least isoniazid and rifampicin (including both phenotypic testing and WGS prediction). Note: TB monitoring indicator 18 (first line drug resistance) excludes *M. bovis* cases with resistance to pyrazinamide.

In 2018, 9% (8/87) of the culture-confirmed TB cases in the North East were resistant to one or more first line drugs. This proportion of resistant isolates remained static from previous years. In 2018, 2 (2%) isolates had isoniazid resistance without MDR, there were no cases found to be multi-drug resistant (MDR). (Figure 13).

TB Monitoring Indicator 9: Proportion of culture confirmed TB cases with drug susceptibility testing reported for the 4 first line agents

TB Monitoring Indicator 18: Proportion of culture confirmed TB cases with any first line drug resistance

Figure 11: Proportion of TB cases with initial first line drug resistance, North East, 2000 to 2018



TB Monitoring Indicator 19: Proportion of culture confirmed TB cases with multi-drug resistant TB

A higher proportion of people born outside the UK had drug resistant disease (7/64, 11%). The highest proportion of resistant isolates were identified in cases of Indian origin (2, 25%) followed by Bangladeshi (1, 20%).

Drug resistance occurred at similar proportions for people with pulmonary TB and those with extra pulmonary TB.

TB outcome at 24 months for patients with rifampicin resistant disease

The case notified in 2016 with rifampicin resistant disease completed treatment at 24 months.

TB Monitoring Indicator 13: Proportion of drug resistant TB cases who had completed treatment at 24 months

TB in under-served populations

Social risk factors

Within the TB data collection system, data is collected on the presence or absence of 4 social risk factors (SRF) known to increase the risk of TB: current or history of homelessness, imprisonment, and drug misuse and current alcohol misuse. Data in this chapter, apart from area level deprivation, is presented for TB cases aged 15 and older.

In the North East in 2018, 17% (17/101) of TB cases aged 15 years and older had at least one SRF (Table 9), this was a slight increase from previous year. Of the cases in 2018 with at least 1 SRF, 35% (6/17) had 2 or more SRFs. During 2018 among people reporting social risk factors, the most prevalent risk factor was drug use followed by prison.

TB Monitoring Indicator 17: Proportion of patients with drug sensitive TB with at least 1 social risk factor who completed treatment within 12 months

Table 7: Social risk factors among TB patients, North East, 2009 to 2018

Year	Total	Number with all fields completed	Number with any risk factor	%
2009	157	98	14	14
2010	145	126	12	10
2011	130	112	15	13
2012	159	136	15	11
2013	133	119	12	10
2014	157	138	13	9
2015	122	108	14	13
2016	115	105	17	16
2017	103	97	16	16
2018	114	101	17	17

Table 8: Social risk factors among people with TB, North East, 2018

Risk factor	n	%	Total
Prison	6	5.8	104
Homelessness	3	2.9	104
Alcohol misuse	4	3.8	105
Drug use	11	10.3	107

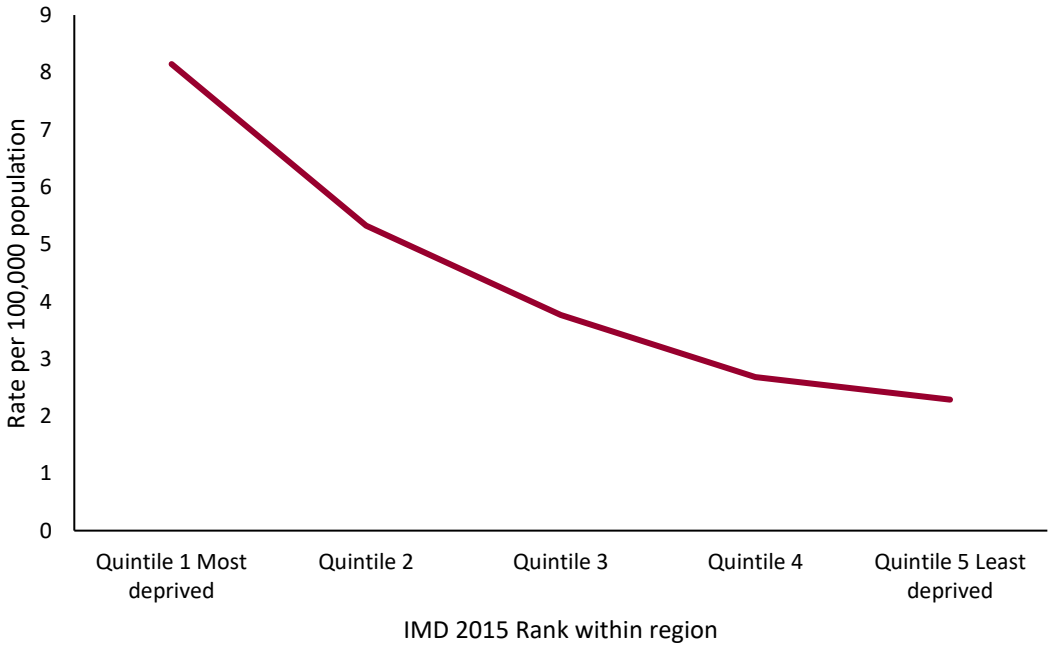
In the North East social risk factors were more common in people born in the UK, male and of white ethnicity. Of the people recorded with having a risk factor; among male the most frequent risk factor was imprisonment and among females the most frequent risk factor was drug use.

Of those with drug sensitive TB and at least one social risk factor, who were notified in 2017, just 60% completed within 12 months, although 20% were still on treatment, the remaining 20% were lost to follow up.

Deprivation

During 2018, the largest proportion of TB cases lived in areas from the most deprived quintile (44, 37%). The highest TB rates were also observed in the most deprived quintile, a rate of 8.1 per 100,000 in the most deprived quintile compared to a rate of 2.3 per 100,000 in the 20% of the population living in the least deprived areas.

Figure 12: TB case rate by deprivation, North East, 2018



TB-HIV co-infection and HIV testing of TB patients

HIV testing

TB complicating HIV infection is a well-recognised and particularly lethal clinical state but is successfully treated with a combination of highly active antiretroviral therapy (HAART) and appropriate TB antibiotic treatment [9].

For this reason, it is essential that all patients with TB should undergo HIV testing so that if they are diagnosed as having TB-HIV co-infection they can have the opportunity to start curative TB treatment and HAART as soon as possible, and in doing so preserve their life expectancy and reduce the risk of TB and HIV transmission to others.

In 2018, data on HIV testing was available for 97% of TB cases (106/115)[4]. Of those, 92% (94/102) were offered[5] an HIV test and 8% were not offered an HIV test. Among those offered testing, the uptake was high (98%, 92/94). All cases not offered an HIV test were UK born and the largest proportion were in the 65+ age category and predominantly male.

[4] Excludes cases identified at post mortem [5]excludes cases identified at post mortem and those where HIV status is already known

TB Monitoring Indicator 16: Proportion of TB patients offered an HIV test

TB-HIV co-infection rates

HIV status is not collected in ETS, but TB-HIV co-infection is estimated nationally by anonymously linking reports in ETS with the SOPHID and HANDD HIV datasets[6] for patients aged 15 years and older. [1] (Table 11)

The latest available information on TB-HIV co-infection for notified adults 15 years and over, estimated that 1.8% of people with TB in the North East were co-infected with TB. (see Tuberculosis in England: 2019 for methods. Tuberculosis in England: 2019 report presenting data to end of 2018[1]).

[6] SOPHID: Survey of Prevalent HIV Infections Diagnosed. HANDD: HIV and AIDS New Diagnoses Database

(Tuberculosis in England: 2019 (presenting data to end of 2018). This figure was similar to the proportion in the previous year.

The North East was the PHE centre with the lowest proportion of people with TB that were co-infected with HIV in 2018 in England. For England in 2018, 2.7% of people were co-infected with HIV, the lowest since 2003.

Table 9: Number and proportion* of TB cases with HIV co-infection, North East, 2001 to 2018

Year	n	%
2001	8	4.9
2002	9	6.3
2003	7	5.1
2004	8	5.8
2005	5	4
2006	8	6.3
2007	16	8.5
2008	6	3.4
2009	7	4.5
2010	5	3.4
2011	2	1.5
2012	1	0.6
2013	3	2.3
2014	6	3.8
2015	5	4.1
2016	4	3.5
2017	2	1.9
2018	2	1.8

* Proportion is calculated using the number of notified TB cases with HIV co-infection plus the number of un-notified TB isolates with HIV co-infection as the numerator, and the number of all notified TB cases (with or without HIV co-infection) plus the number of un-notified TB isolates with HIV co-infection as the denominator.

BCG vaccination

BCG vaccination status of TB patients

BCG vaccination status was available for 75% (88/118) of people notified in 2018. Where data was available, 60% (53/88) of cases had received the BCG vaccination.

The proportion receiving BCG vaccination was greater in those born abroad than those born in the UK (41/54, 76% vs 20/45, 44%).

Table 10: Number and proportion of TB patients with BCG vaccination, North East, 2018

	0 to 14 years		All ages	
	Number vaccinated	Proportion %	Number vaccinated	Proportion %
Non-UK born	1	100	37	74
UK born	2	100	15	41
All cases	**2**	**100**	**52**	**60**

*1 case missing country of birth

BCG vaccine coverage

BCG immunisation is recommended for people at higher risk exposure to TB, particularly to protect against serious forms of disease in infants. Information on neonatal BCG vaccine coverage at 12 months in English local authorities with TB incidence ≥40 per 100,000 and offering a universal programme is included as part of the Cover of Vaccination Evaluated Rapidly (COVER) programme.

Latent TB infection testing and treatment

This report, derived from the ETS surveillance system, which is a national case register and management system for cases of active TB, does not deal with the issue of latent TB infection (LTBI). A new development has been the establishment of a national programme for the screening and treatment of LTBI for new migrants introduced by the Department of Health and PHE which began in April 2015. Information for this programme is currently collected separately to the ETS. [10]

Individuals are eligible for the national LTBI testing programme if they are aged 16 to 35 years and entered the UK from a high incidence country (≥150 cases per 100,000 or sub-Saharan Africa) within the last 5 years and had been living in that high incidence country for 6 months or longer. Eligible individuals are primarily identified prospectively by GP practices during the new patient registration process, however some Clinical Commissioning Groups (CCGs) also search retrospectively through GP clinical systems or use community or secondary care services for identification.

Laboratory testing providers were selected for high TB incidence and burden CCGs[7] following a national NHS procurement process and establishing a laboratory provider framework. [11] As per national programme clinical guidelines, individuals who receive a positive diagnostic result (IGRA) are referred to secondary care to rule out active TB and initiate LTBI treatment. [12]

Currently no CCGs in the North East meet the threshold for screening.

[7] High incidence is here defined as >20.0 cases per 100,000; high burden is defined as ≥0.5% of the TB case burden in England

Discussion

In January 2015, PHE and NHS England published the Collaborative TB Strategy for England 2015 to 2020, which sets out the actions required to achieve a year on year reduction in TB incidence and a reduction in the health inequalities associated with the disease. This report of TB surveillance data for North East England up until the end of 2018 provides a comprehensive overview of the epidemiology of TB in the North East England following the implementation of the strategy.

Numbers and rates of TB in the North East remain low and below the national average. However, the rates and TB burden are higher in some areas and subgroups such as urban and deprived populations. In 2018, an increase was seen in people born in the UK than in previous years. A greater number of cases were born outside the UK than in the UK. Rates of TB in the UK born remain very low compared to the non-UK born population. The most common ethnic group of people with TB remains White, followed by Black African.

HIV testing was not offered, or not recorded as offered, to 8% of people with TB in 2018. UK guidelines recommend all TB patients should be offered a test, regardless of age or ethnicity or where they are resident [7]. Information on symptom onset was well completed and identified longer delays in extra pulmonary cases. Less than a half of pulmonary cases had a sputum smear result. This is an important indication of infectiousness and should be done on all patients where possible.

Treatment completion at 12 months among patients with rifampicin sensitive and non-CNS/spinal/miliary or cryptic disseminated disease in the North East in 2017 was below the national figure. The most commonly reported reason for not completing treatment was due to loss to follow up. The next most common reason was due to cases still being on treatment. First line drug resistance among people with TB in the North East remained static at 9%.

Conclusion and recommendations

This report updates the latest epidemiology of TB in the North East, describing those populations at increased risk of disease. This evidence can help services implement the basic elements of TB control, namely prompt identification of active cases of disease, supporting patients to successfully complete treatment, and preventing new cases of disease occurring, through effective case management and robust contact tracing. The information will also be useful to target resources effectively.

Key recommendations for the NHS and PHE derived from the data presented in this report include:

- ensuring that accurate and complete information is provided on the PHE Enhanced TB Surveillance system in a timely manner
- offering and encouraging HIV testing for all those diagnosed with TB and ensuring, where possible, that tests are done, in line with national guidance[7]
- increasing the proportion of pulmonary TB cases with a sputum smear result to better inform local infection control and prevention activity
- reporting treatment outcome for all patients, and reviewing reasons why completion is low in some areas

References

1. Tuberculosis in the England: 2019 Report (presenting data to end of 2018). Public Health England, August 2019 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/821334/Tuberculosis_in_England-annual_report_2019.pdf
2. Public Health England. UK pre-entry tuberculosis screening report 2015. 2016; Available from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/555150/UK_pre-entry_tuberculosis_screening_2015_GTW230916.pdf
3. Schurch, A.C., et al., High-resolution typing by integration of genome sequencing data in a large tuberculosis cluster. J Clin Microbiol, 2010. 48(9): p. 3403-6.
4. Gardy, J.L., et al., Whole-genome sequencing and social-network analysis of a tuberculosis outbreak. N Engl J Med, 2011. 364(8): p. 730-9.
5. Walker, T.M., et al., Whole-genome sequencing to delineate Mycobacterium tuberculosis outbreaks: a retrospective observational study. Lancet Infect Dis, 2013. 13(2): p. 137-46. 9.
6. Walker TM, Ip CL, Harrell RH, et al. Whole-genome sequencing to delineate Mycobacterium tuberculosis outbreaks: a retrospective observational study. The Lancet Infectious Diseases. 2013; 13(2):137-146
7. World Health Organisation. Definitions and reporting framework for tuberculosis - 2013 revision. 2013; Available from: http://apps.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf
8. World Health Organisation, Guidelines for treatment of tuberculosis. 2010.
9. Public Health England and NHS England. Collaborative tuberculosis strategy for England: 2015 to 2020. 2015; Available from: www.gov.uk/government/publications/collaborative-tuberculosis-strategy-for-england
10. NHS England. Latent TB Testing Laboratory Analysis Services: appointment of Providers to the National Framework. 2015; Available from: www.england.nhs.uk/resources/resources-for-ccgs/out-frwrk/dom-1/tbstrategy/providers/
11. Public Health England. Latent TB testing and treatment for migrants: a practical guide for commissioners and practitioners. 2015; Available from: www.gov.uk/government/publications/latent-tb-infection-ltbi-testing-and-treatment

Appendix A: Notes on the report

About the Field Service

The Field Service (FS) supports Public Health England (PHE) Centres and partner organisations through the application of epidemiological methods to inform public health action. It does this in 2 main ways, firstly by providing a flexible expert resource, available, as and when needed, to undertake epidemiological investigations for key health protection work and secondly through the expert analysis, interpretation and dissemination of surveillance information to PHE Centres, local health partners, service providers and commissioners of services. Within the FS network, excellence and innovation is encouraged, we foster academic collaborations and take active part and lead in research, development and training.

Intended audience

This report is for use by healthcare professionals who diagnose and/or care for people with tuberculosis (TB), commissioners involved in planning and financing TB services, public health professionals working to improve TB control and the health of at-risk populations, researchers with an interest in TB, and government and non-governmental organisations working in the field of TB. In particular, this report is for the use of the Yorkshire and Humber and the North East TB Control Board and North East TB Network.

Aim of report

This report describes the recent epidemiology of TB in North East region. It includes local trends, which areas and population groups have a high burden of disease, and detail on the care of patients.

Further TB information

The national report of TB in England is available at: www.gov.uk/government/publications/tuberculosis-in-england-annual-report. Additional data on TB notifications in the UK to the end of 2018, and breakdowns by country, can be found in the Official Statistic for TB, ‘Reports of cases of tuberculosis to enhanced tuberculosis surveillance systems: United Kingdom, 2000 to 2018. This is available at: www.gov.uk/government/collections/tuberculosis-and-other-mycobacterial-diseases-diagnosis-screening-management-and-data.

As part of the Collaborative TB Strategy for England 2015 to 2020, TB Strategy Monitoring Indicators are available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf). Where data for these indicators is presented in this report, the indicator name is shown.

A number of TB indicators at Upper Tier Local Authority and Clinical Commissioning Group level can be found at: http://fingertips.phe.org.uk/profile/tb-monitoring and were updated with data for 2018 in August 2018. [Note: data presented for TB monitoring indicators at regional level DOES NOT need to suppress small numbers due to the large size of the underlying population and the fact that these are not accompanied by any identifiable information].

Appendix B: Description of data sources and definitions

Data sources

This report is based on TB case notifications made to the PHE Enhanced Tuberculosis Surveillance system (ETS) in England to the end of 2018. This information is updated annually to take into account denotifications (where the patient was found not to have TB), late notifications and other updates. The data presented in this report supersedes data in previous reports.

Diagnostic laboratories serving acute hospitals are the first place in which TB infection-related samples are received and processed within the pathway of clinical diagnosis and management of suspected TB cases. Results for microscopy, polymerase chain reaction (PCR), histology and culture are collected in ETS. Appropriate referral of clinical specimens to the Mycobacterium Reference Laboratories is an important part of the routine work of the diagnostic laboratories in the investigation and management of TB cases.

The National Mycobacterium Reference Service (NMRS) receives these diagnostic materials and undertake characterisation using culture and molecular diagnostic methods to define species of *Mycobacterium*, TB antibiotic (drug) susceptibility and organism relatedness. Historically, organism relatedness has been determined by Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats (MIRU-VNTR) typing, however this has been superseded in recent years by Whole Genome Sequencing (WGS).

Definitions

BCG	Bacillus Calmette-Guérin vaccination
CI	Confidence interval
CCG	Clinical Commissioning Group
Cluster	Two or more patients notified within the time period of analysis with TB cause by strains with ≤12 SNP differences
CNS	Central nervous system
Cohort review	The systematic review of all TB patients notified by a TB service in a 3 to 4-month period, looking at standard outcomes in terms of patient care and number of contacts screened

Cryptic disseminated TB	Systemic illness without localising features
DOT	Directly observed treatment
Drug	In the context of TB control, a drug is an anti-TB antibiotic
Drug resistant cohort	The drug resistant cohort includes any patients with rifampicin resistant TB (initial or acquired), including MDR-TB (initial or acquired), as well as those without culture confirmation treated with an MDR-TB regimen
Drug sensitive cohort	The drug sensitive cohort excludes all TB patients with rifampicin resistant TB (initial or acquired) including MDR-TB (initial or acquired), and non-culture confirmed patients treated with an MDR-TB regimen
DST	Drug sensitivity testing, based on phenotypic analysis of cultured TB isolates
ETS	Enhanced TB surveillance system
First-line drug resistance	First-line anti-TB antibiotic drug resistance is defined as resistance to at least 1 of the first line antibiotics (isoniazid, rifampicin, ethambutol, pyrazinamide)
HAART	Highly active antiretroviral therapy
IGRA	Interferon-gamma release assay – blood test for TB infection which does not differentiate between active disease and LTBI
IMD 2015	The Index of Multiple Deprivation 2010 rank for each LSOA, based on deprivation score assigned, relative to other LSOAs in the PHE East of England area
IQR	Interquartile range
LSOA	Lower super output area (geographic definition)
LTBI	Latent TB infection
MDR	Multidrug resistance: cases initially resistant to at least isoniazid and rifampicin
Miliary TB	TB infection spread via the bloodstream to all parts of the body
MIRU-VNTR	Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats
PCR	Polymerase chain reaction
Post-mortem diagnosis	A patient diagnosed at post-mortem is defined as where TB was not suspected before death, but a TB diagnosis was made at post-mortem, with pathological and/or microbiological findings

	consistent with active TB that would have warranted anti-TB treatment if discovered before death
Pulmonary tuberculosis	A pulmonary case is defined as a patient with TB involving the lungs and/or tracheobronchial tree, with or without extra-pulmonary TB diagnosis. In this report, in line with the WHO's recommendation and international reporting definitions, miliary TB is classified as pulmonary TB due to the presence of lesions in the lungs
Second-line drugs	Second-line drugs include injectable agents (for example, amikacin, capreomycin, kanamycin), fluoroquinolones (for example, moxifloxacin, ofloxacin, ciprofloxacin) and other oral bacteriostatic agents.
SNP	Single nucleotide polymorphism – mutation of 1 base pair in the genome of an *M. tuberculosis complex* isolate
TB	Tuberculosis
UTLA	Upper tier local authority (geographic definition)
VOT	Video observed therapy
WGS	Whole genome sequencing
XDR	Extensive drug resistance: cases initially MDR and resistant to at least 1 injectable agent (amikacin, capreomycin or kanamycin) and at least 1 fluoroquinolone (moxifloxacin, ofloxacin or ciprofloxacin)

Treatment outcome

Information on outcomes were reported for all patients reported in the previous year, excluding those with known rifampicin resistant disease: outcomes for these were reported at 24 months. Definitions for outcome are based on World Health Organization (WHO) and European definitions but adapted to the UK context. In this report, all data was obtained from the ETS matched dataset provided in July 2018.

Proportions

All proportions in this report are calculated among patients with known information or a known result, except where otherwise stated.

Confidence intervals

A 95% confidence interval for incidence was obtained using the relevant procedure in Stata, assuming a Poisson distribution.

Population denominator

Tuberculosis rates by geographical area (Centre and local authority), age, sex and place of birth were calculated using ONS mid-year population estimates. Tuberculosis rates by ethnic group were calculated using population estimates from the Labour Force Survey (LFS) [www.esds.ac.uk/findingData/qlfs.asp]. The LFS is based on a population sample, so estimates are liable to sampling errors, particularly for small population subgroups, and should be interpreted with caution.

Cluster definitions

Strain typing was performed by the National Mycobacterial Reference Service using Whole Genome Sequencing. Analysis was undertaken on strain type clusters as defined above. Analysis of clustering in North East region was carried out on cases that clustered in the North East and notified between 2017 and 2018.