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Tuberculosis in North West England
Annual review (2017 data)

Data from 2000 to 2017

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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: PHE Field Service North West.
For queries relating to this document, please contact: FES.NorthWest@phe.gov.uk.

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Contents

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Authors

This report was prepared by Stefanie Davies and Dr Daniel Todkill of Field Service North West, National Infection Service, Public Health England.

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Executive summary

National

A total of 5,102 cases of tuberculosis (TB) were reported in England in 2017 [1]. This corresponds to an incidence rate of 9.2 per 100,000 population, less than the previous year (10.2 per 100,000 in 2016).

Regional

A total of 532 new cases of TB were reported to the enhanced surveillance scheme in North West England in 2017. This corresponds to a regional incidence of 7.3 per 100,000 population, a decrease from the previous year (8.2 per 100,000 in 2016; 589 cases).

Local

The North West local authorities with the highest incidence in 2017 were Manchester (22.4 per 100,000 population) and Blackburn with Darwen (22.2 per 100,000 population).

Age groups

In 2017, age-specific incidence was highest in the 15-44 years age group at 10.1 per 100,000 population. The rate in the 0-14 age group was 2.3 per 100,000 in 2017, lower than the previous year (2.8 per 100,000 in 2016).

Ethnic groups and origin

The greatest proportion of new TB cases in 2017 occurred in the Pakistani ethnic group (28.8%), followed by the White ethnic group (26.9%). TB in the White ethnic group decreased by 20.1% (from 179 cases in 2016 to 143 cases in 2017); cases in the Pakistani ethnic group decreased by 8.4% (from 167 cases in 2016 to 153 cases in 2017).

In 2017, 65.5% of TB cases reported in the North West were born outside the UK. Of cases born outside the UK, 34.7% were in the Pakistani ethnic group; 19.2% were diagnosed within one year of entry; and 44.4% were diagnosed 11 or more years after entry (a proportion that has increased over previous years).

Under-served populations

Those in under-served populations (which include migrants, refugees, asylum seekers and those with social risk factors) have a higher risk of acquiring TB. TB control in this group of individuals has become a priority area across England. In the North West, 10.7% of cases in 2017 had at least one social risk factor (SRF); a slight decrease from the previous year (12.1% in 2016). The majority of cases with at least one SRF were male (79.5%) and aged between 15 and 44 years (56.4%).

62.2% of cases with at least one SRF were UK born, and in this population most cases were White (95.7%). In 2017, 23.1% of cases with SRFs had more than one risk factor, a decrease from 35.3% in 2016.

In 2017, 42.3% of TB cases were resident in areas considered to be the most socio-economically deprived in the North West compared to 6.0% who were resident in the least deprived areas. TB rates were highest among the most socio-economically deprived areas of the North West (9.7 and 11.5 per 100,000 population in the 2 most deprived quintiles) compared with the least socio-economically deprived areas (2.9 per 100,000 population).

Clinical characteristics

Less than half of the TB cases reported in the North West in 2017 had pulmonary disease (45.4%), a smaller proportion than in previous years (57.2% in 2016; 53.3% in 2015). Of those cases with pulmonary disease, 75.0% were confirmed by culture, a similar proportion to previous years (73.3% in 2016; 78.5% in 2015).

Treatment outcome

Among drug sensitive TB cases notified in 2016, 85.0% of those with an expected treatment duration of less than 12 months completed treatment within 12 months (compared with 83.8% of cases reported in 2015). The most common reasons for non-completion of treatment were death (6.4%) and being lost to follow up (4.7%). Of those that were lost to follow up, almost a third had left the UK (32.0%).

Among drug sensitive TB cases with central nervous system (CNS), spinal, miliary or cryptic disseminated disease, 68.0% of those reported in 2016 had completed treatment within 12 months; 14.0% required continued treatment. A total of 80.0% had completed treatment at the last recorded outcome.

Four rifampicin-resistant TB cases were reported in 2015 (compared with 6 cases in 2014); 3 of these had multi-drug resistant TB (MDR-TB). All 4 cases were still on

treatment at 12 months; 3 cases went on to complete at 24 months, while one remained on treatment.

Drug resistance

The proportion of culture positive cases with resistance to at least one first-line drug was 9.1% in 2017; slightly higher than in previous years (6.1% in 2016, 4.8% in 2015) and similar to national levels (8.5% in 2017) [1]. A total of 6.5% (21/324) had isoniazid resistance, 0.3% (1/324) were resistant to rifampicin, and 0.3% (1/324) had MDR-TB, resistant to isoniazid and rifampicin. There was one recorded case of extensively drug resistant (XDR) TB in the North West in 2017.

Key recommendations for the NHS and Public Health England

TB rates were highest among the most socio-economically deprived areas of the North West (9.7 and 11.5 per 100,000 population in the 2 most deprived quintiles), compared with the least socio-economically deprived areas (2.9 per 100,000 population). Additionally, a high proportion of cases (43.3%) were not in education or employment. Commissioners and partners should work to ensure that efforts are focused on these disadvantaged populations to address inequalities in health.

Overall, the proportion of cases with social risk factors has remained fairly consistent since 2019, highlighting that underserved populations must remain a priority for intervention. Strategy and interventions should continue to focus on reducing TB rates in these groups and reducing health and social inequalities.

Of cases born abroad who were notified in 2017, the greatest proportion had been resident in the UK for at least 11 years. This highlights the continued need for the identification and treatment of migrants with latent TB infection to prevent the future development of active disease. Work should continue to raise awareness about TB in migrant communities and their healthcare providers.

Almost two thirds of pulmonary cases in the North West started TB treatment within 4 months of symptom onset; however, this means that almost a third of cases started treatment more than 4 months after symptom onset, which may have increased the opportunity for TB transmission. Consider local work to identify groups at increased risk of delayed diagnosis and engage with workforce linked to these groups. The NHS should make every effort to increase the proportion of sputum smear results among pulmonary cases to enable better TB control.

PHE and partner organisations should continue to ensure cohort review is used as an opportunity to review local incidents (such as TB deaths) to promote learning and sharing of ideas for case management.

The Collaborative Tuberculosis Strategy for England 2015 to 2020 [2] sets out the improvements that need to be achieved to bring about a sustained decline in TB in England and the mechanism by which these improvements should be achieved. The North West TB Control Board (which covers Greater Manchester, Cumbria and Lancashire and Cheshire and Merseyside) oversees improvements in TB control, especially among the most vulnerable groups, in addition to the provision of strong and effective public health and clinical services. TB service providers should utilise the PHE

TB Strategy Monitoring Indicators Tool [3] to track their performance and to support development of local TB action plans.

The NHS should offer HIV testing for all those diagnosed with tuberculosis and ensure that tests are done in line with national guidance [4].

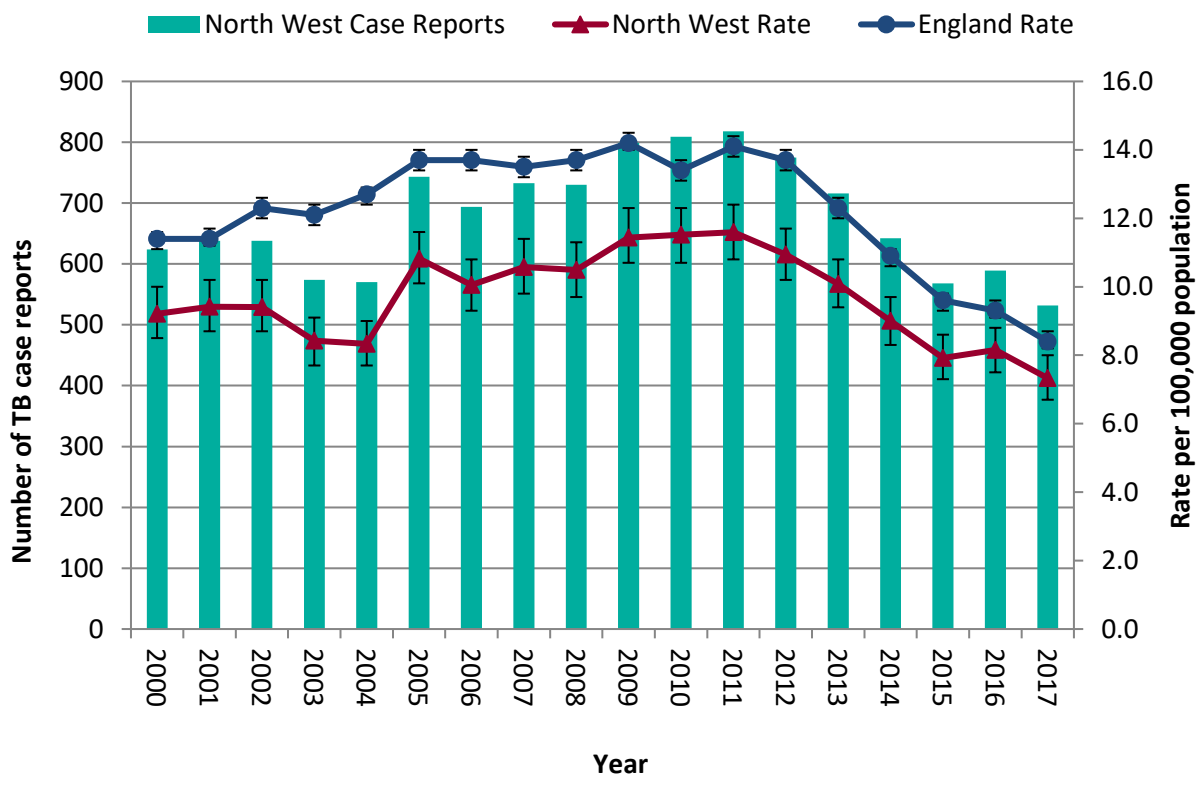
1. TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2017, 532 tuberculosis (TB) cases were reported among North West residents; a rate of 7.3 per 100,000 population (95% confidence interval (CI) 6.7-8.0). This was a 9.7% decrease compared to 2016 (589 cases; rate of 8.2 per 100,000 population, 95% CI 7.5-8.8). The North West TB rate remained below the England rate of 8.4 per 100,000 (Figure 1), and was the fourth highest of the 9 PHE Centre (PHEC) areas in England [1].

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

Figure 1: TB case reports and rates*, North West and England, 2000 – 2017

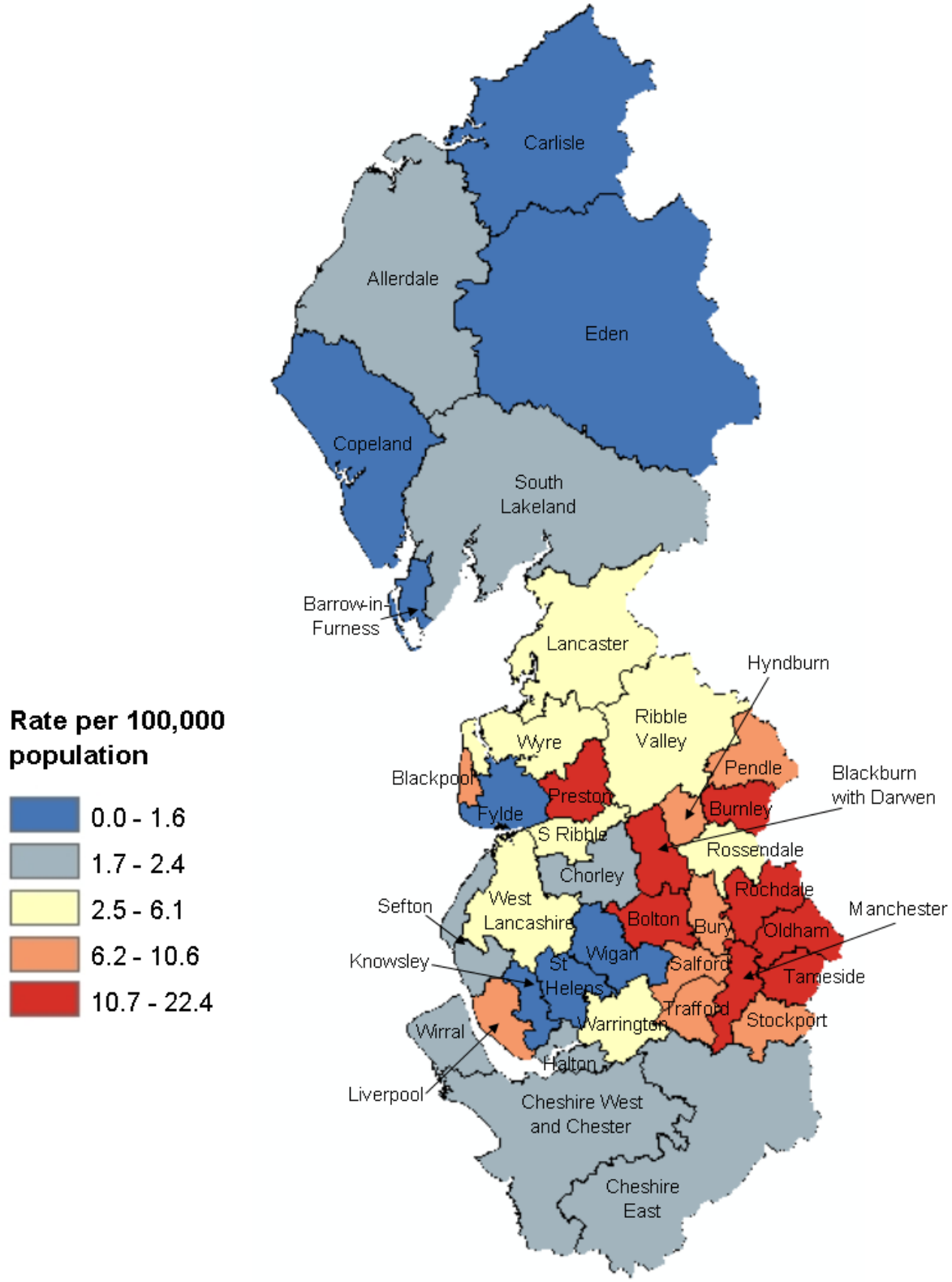


* Error bars represent upper and lower 95% confidence intervals

Among North West upper tier local authorities, the highest rates were in Manchester at 22.4 per 100,000; Blackburn with Darwen at 22.2 per 100,000 population; and Bolton and Oldham at 15.4 per 100,000 population. Rates in each of these areas decreased from the previous year.

Historically, there has been little change in the local authorities with the highest burden of TB in the North West. Similarly, the areas with the lowest burden have remained broadly consistent. In 2017, 6 of the 39 North West local authorities had zero notifications of TB: Barrow-in-Furness, Carlisle, Copeland, Eden, Fylde, and Knowsley.

Figure 2: TB rate per 100,000 population by upper tier local authority of residence, North West, 2017

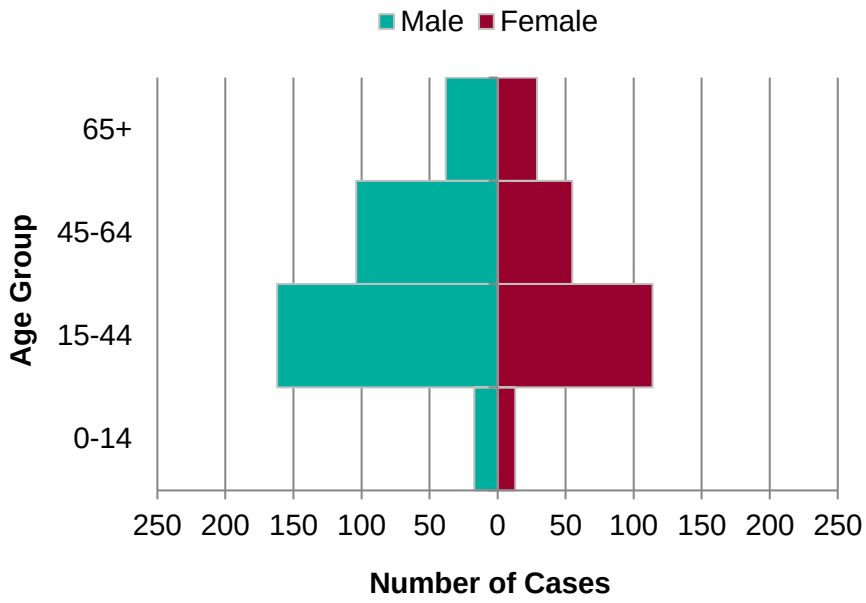


Demographic characteristics

Age and sex

In 2017, 60.3% of North West TB cases were male, and rates among males were higher than in females (9.0 per 100,000 in males and 5.7 per 100,000 in females); a similar pattern to previous years. There was a greater proportion of males than females across all age groups. The greatest disparity was in the 45-64 age group, in which 65.4% of cases were male and 34.6% were female (Figure 3). Thirty cases of TB in children aged 0-14 years were reported; fewer than in the previous year (36 cases reported in 2016).[1]

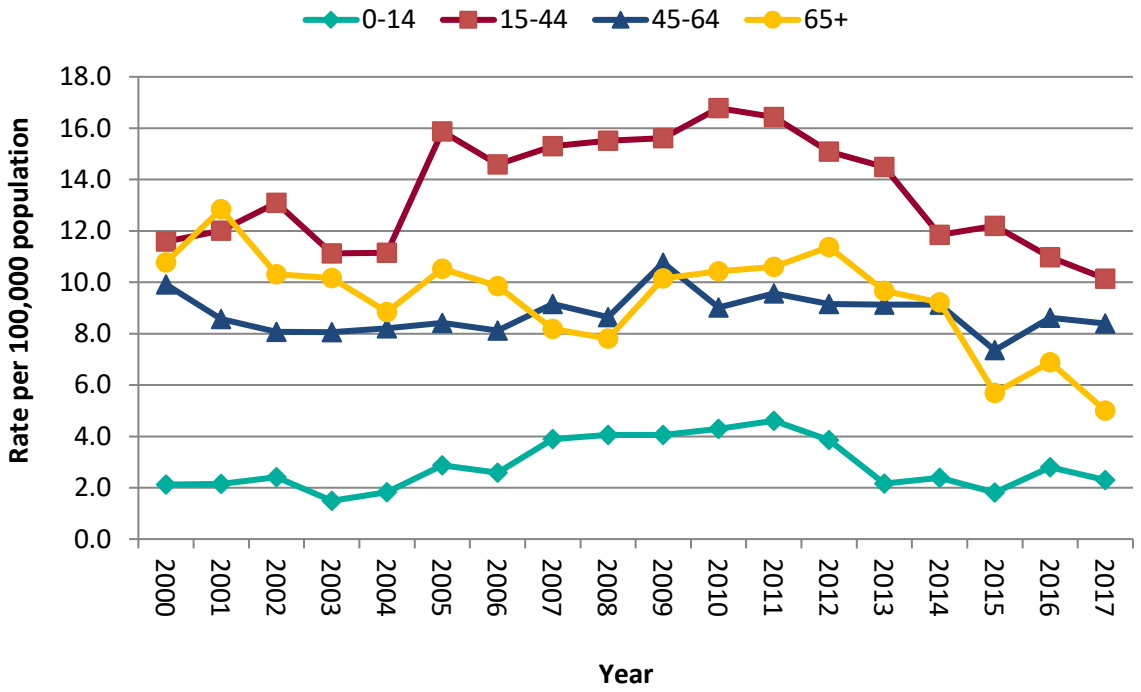
Figure 3: TB case reports by age and sex, North West, 2017



Rates were highest in residents aged 15-44 years (Figure 4). The rate in the 15-44 age group decreased slightly from 11.0 per 100,000 in 2016 to 10.1 per 100,000 in 2017. Rates across other age groups also decreased in 2017, with the greatest decrease seen in the 65+ years age group (from 6.9 per 100,000 in 2016 to 5.0 per 100,000 in 2017). The rate in the 0-14 age group decreased from 2.8 per 100,000 population in 2016 to 2.3 per 100,000 population in 2017.

[1] Thirty-eight cases aged 0-17 years were reported in 2017; an incidence of 2.5 per 100,000 population (compared with 50 cases and an incidence of 3.3 per 100,000 population reported in 2016).

Figure 4: TB case rates by age group, North West, 2000 – 2017



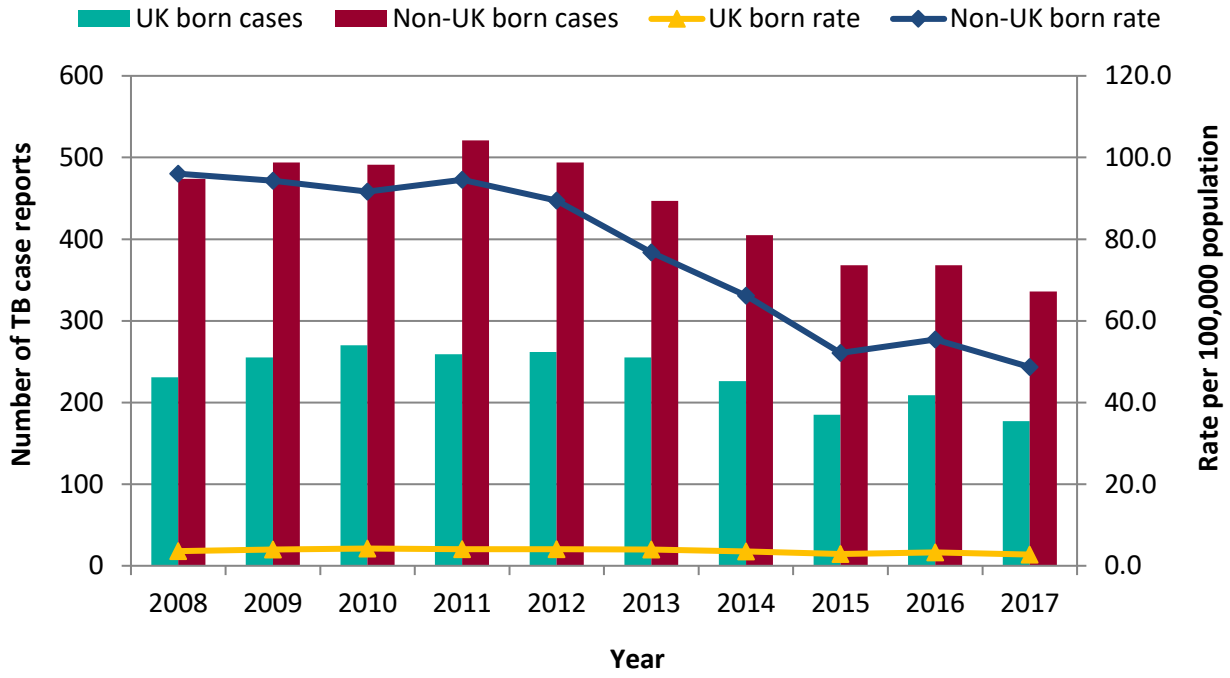
Place of birth and time since entry to the UK

In 2017, place of birth was known for 96.4% (513/532) of North West TB cases. Of these, 34.5% (177/513) were born in the UK; a similar proportion to previous years (36.2% in 2016; 33.5% in 2015).

In line with national trends [1], the rate of TB in the non-UK born population was considerably higher than rates among those born in the UK. In 2017, the rate in the non-UK born population was 17 times higher than the rate in the UK born, at 48.7 per 100,000 (Figure 5); lower than the previous year (55.4 per 100,000 in 2016). The rate in the UK born population remained low at 2.7 per 100,000 in 2017 (3.2 per 100,000 in 2016).

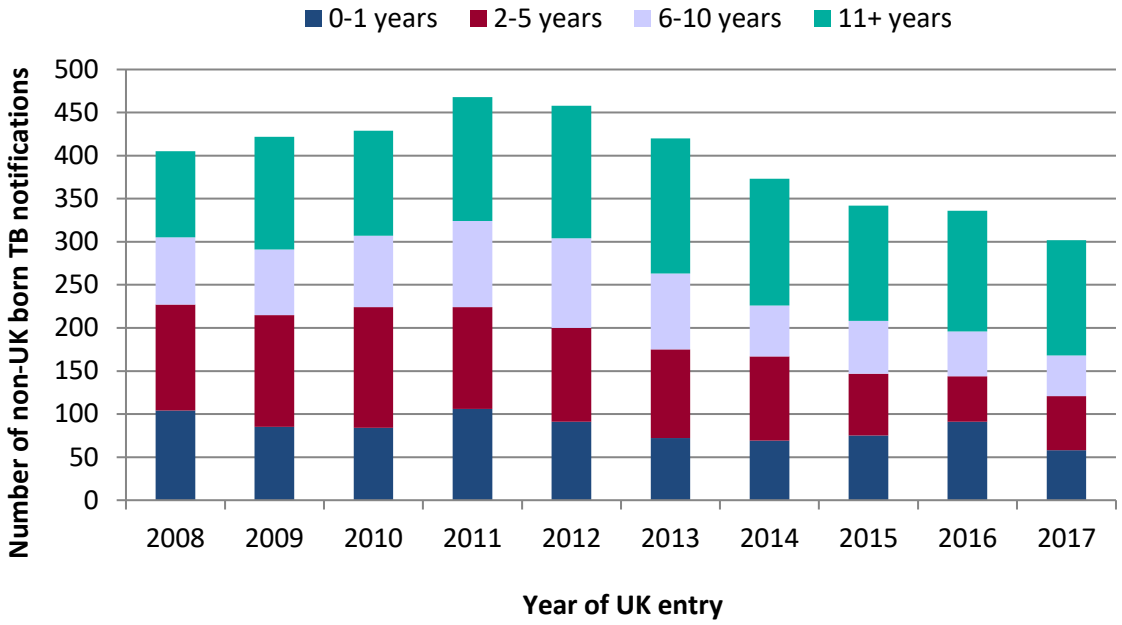
TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations

Figure 5: TB case reports and rates by place of birth, North West, 2008 – 2017



Year of entry was reported for 89.9% (302/336 cases) of non-UK born cases in 2017. Of these, 19.2% were notified less than 2 years after entry and 20.9% were notified 2 to 5 years after entry; meaning that, overall, 40.1% were notified within 5 years of entering the UK. A further 15.6% were notified 6-10 years after entry and 44.4% (134/302) of cases were notified to TB surveillance 11 or more years after entering the UK.

Figure 6: Time between entry to the UK and TB notification for non-UK born cases by year, North West, 2007 – 2017*



* Where year of entry was recorded.

Approximately one third of non-UK born TB cases reported in the North West in 2017 were born in Pakistan (Table 1), lower than in the previous year (37.4% in 2016 compared with 33.1% in 2017). The proportion of cases originating from India has gradually decreased since 2014 (from 20.1% in 2014 to 16.0% in 2017).

Table 1: Most common countries of birth of non-UK born TB cases, North West, 2017

Country of birth	Number of cases	Proportion of cases*	Median time since entry to UK (IQR)**
Pakistan	110	33.1%	14 (5-28)
India	53	16.0%	10 (5-23)
Eritrea	16	4.8%	2 (1-5)
Bangladesh	15	4.5%	17 (10-24)
Romania	10	3.0%	1 (1-2)
Sudan	10	3.0%	2 (0-4)
Others (each < 2%)	118	32.4%	0 (0-1)
Total*	332	100.0%	7 (1-17)

*Where country of birth was known

**Interquartile range (time in years)

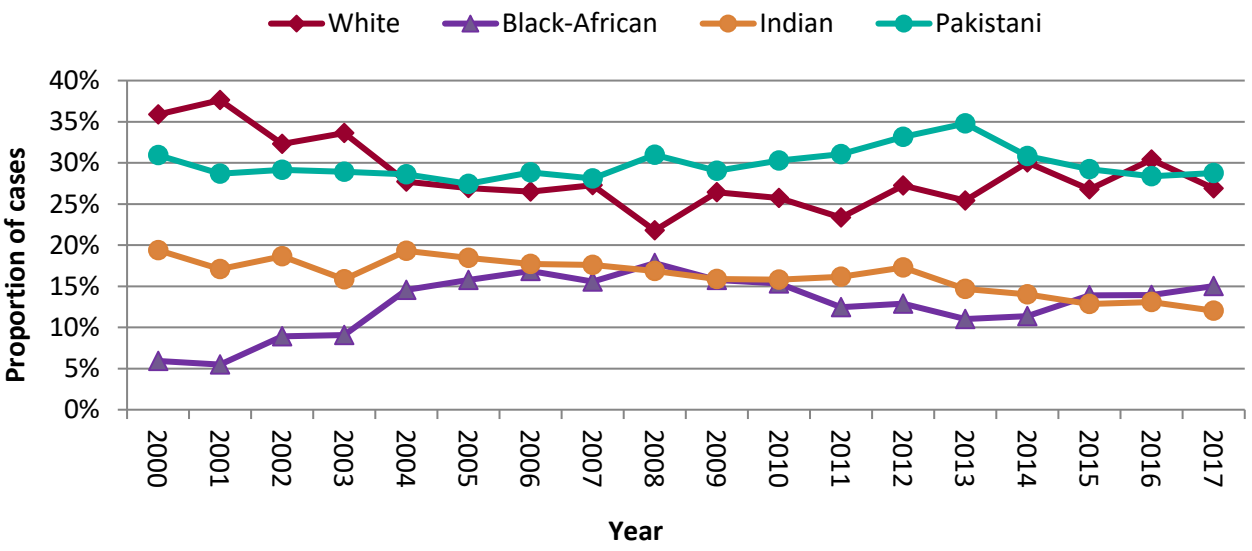
Of the most common countries of birth for non-UK born TB cases in 2017, those born in Romania, Eritrea and Sudan had the shortest median time between entry to the UK and TB notification. Nationally, the countries with the lowest median time (among the most common countries of birth for non-UK born TB cases) were Romania, Ethiopia and Sudan [1]. In the North West, the country with the longest median time between entry to the UK and notification was Bangladesh (17 years; IQR 10-24 years).

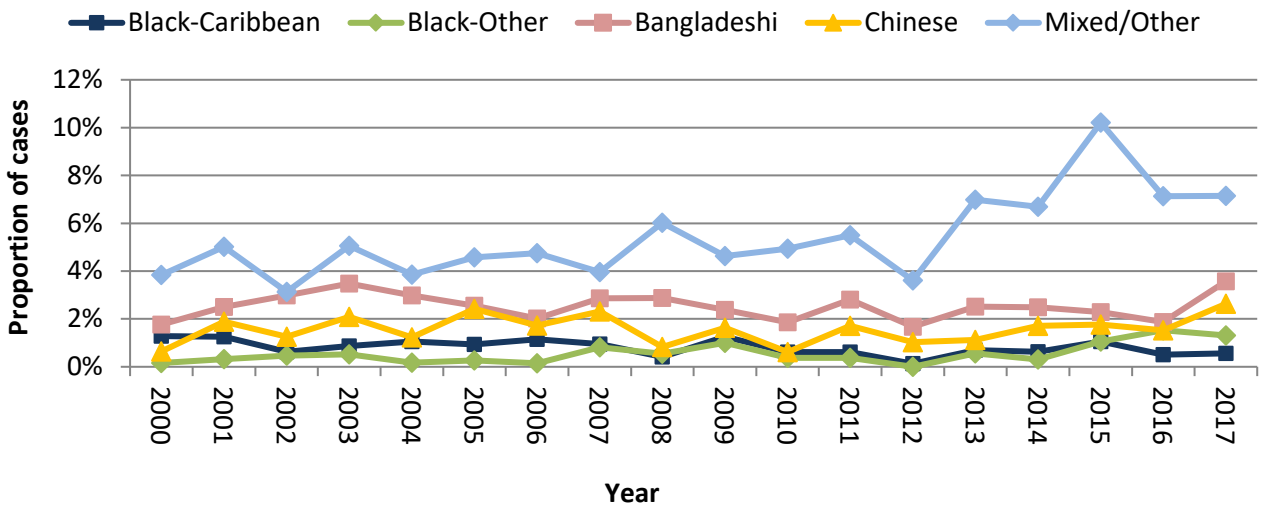
Ethnic group

In 2017, ethnicity was known for 97.9% (521/532) of cases. The most common ethnic groups among all tuberculosis cases in the North West were the Pakistani and White ethnic groups (Figure 7). The proportion of White cases decreased slightly from 30.4% in 2016 to 26.9% in 2017; the proportion of cases with Pakistani ethnicity remained stable overall (28.4% in 2016 and 28.8% in 2017). There was a slight increase in the proportion of cases with Bangladeshi ethnicity, from 1.9% in 2016 to 3.6% in 2017. The proportion of TB cases in other ethnic groups remained similar to 2016.

In terms of overall annual numbers, 6 of the 9 ethnic groups showed a decrease between 2016 and 2017. Numbers in the White ethnic group decreased by 20.1% (from 179 to 143 cases); in the Indian ethnic group by 16.9% (from 77 to 64 cases); and in the Pakistani ethnic group by 8.4% (from 167 to 153 cases). Of the groups experiencing an increase, the largest percentage increase was seen in the Bangladeshi ethnic group (72.7%, from 11 to 19 cases), followed by the Chinese ethnic group (55.6%, from 9 to 14 cases).

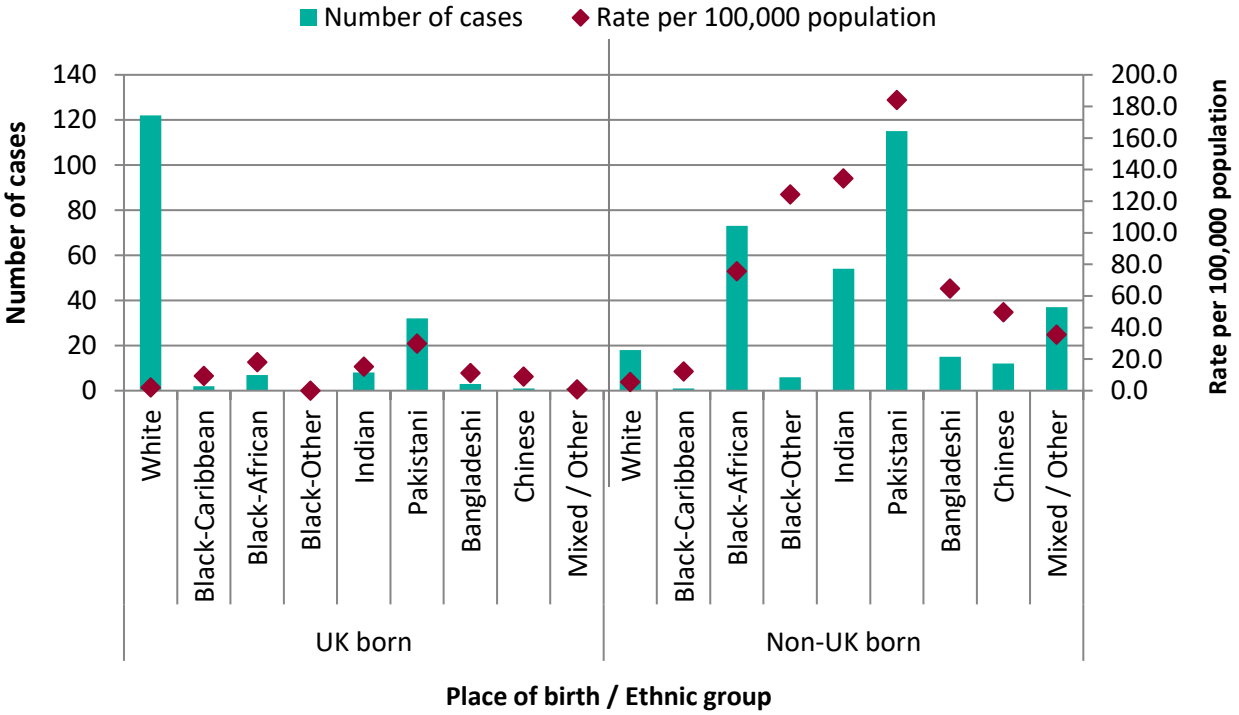
Figure 7: Proportion of TB cases by ethnic group, North West, 2000 – 2017





Of UK born TB cases in 2017, the greatest proportion (68.9%, 122/176) were in the White ethnic group, followed by the Pakistani ethnic group (18.1%, 32/176). Among the non-UK born, 34.7% (115/331) were in the Pakistani ethnic group; 22.1% (73/331) were in the Black-African ethnic group; and 16.3% (54/331) were in the Indian ethnic group.

Figure 8: TB case numbers and incidence by ethnic group and place of birth, North West, 2017



Among UK born TB cases in 2017, the highest rate occurred in the Pakistani ethnic group (29.8 per 100,000 population, 32 cases), followed by the Black-African ethnic group (17.9 per 100,000 population, 7 cases). Rates were highest among those born

outside the UK (Figure 8), with the highest rates occurring in the Pakistani ethnic group (183.9 per 100,000 population, 115 cases) and the Indian ethnic group (134.5 per 100,000 population, 54 cases).

These rates should be interpreted with caution, as population estimates, used as the denominators for the different ethnic groups were calculated using the Labour Force Survey [5], which is liable to sampling error for small population groups.[2]

Occupation

In 2017, information on occupation was known for 85.9% (372/433) of North West TB cases aged between 18 and 65 years; less than for the previous year (91.6% known in 2016). Of these, 43.3% (161/372) were not in education or employment; 7.5% (28/372) were healthcare workers; 7.8% (29/372) were either studying or working in education; and the remaining cases (40.9%, 152/372) were working in other occupations.
A significant proportion of TB cases working in education (82.8%, 24/29) and healthcare (75.0%, 21/28) were born outside the UK.

Clinical characteristics

Site of disease

In 2017, site of disease was known for 99.4% of TB cases in North West England. 45.4% had pulmonary disease (Table 2), lower than the national level of 54.4% [1]. Of the 240 pulmonary cases, 180 (75.0%) were culture confirmed (compared with 73.3% in 2016). The most common extra-pulmonary site was extra-thoracic lymph nodes, accounting for 21.7% of all cases. The majority of extra-pulmonary cases notified in 2017 were born outside the UK (76.4%, 211/276).

[2] 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 ethnic groups such as Black-Caribbean and Black-Other.

Table 2: Site of disease of TB cases, North West, 2017

Site of disease*	Number of cases	Proportion of cases
Pulmonary	240	45.4%
Miliary	11	2.1%
Laryngeal	1	0.2%
Extra-pulmonary	289	54.6%
Lymph nodes (extra-thoracic)	115	21.7%
IT lymph nodes	83	15.7%
Extra-pulmonary (other)	53	10.0%
Pleural	28	5.3%
Gastrointestinal	24	4.5%
Bone (other - not spine)	16	3.0%
CNS meningitis	14	2.6%
Bone (spine)	13	2.5%
CNS (other - not meningitis)	9	1.7%
Genitourinary	7	1.3%
Extra-pulmonary (unknown)	7	1.3%
Cryptic	1	0.2%

* With or without disease at another site

Previous diagnosis of tuberculosis

Information on previous history of TB was known for 89.3% (475/532) of North West cases in 2017. Of these, 6.3% (30/475) had received a previous diagnosis of TB; a similar proportion to previous years. For those with a previous history of TB reported, information on previous treatment was known for 76.7% (23/30) of cases; of these, 91.3% (21/23) were previously treated.

2. Laboratory confirmation of TB

Laboratory tests data collection

Data for all culture confirmed TB isolates from the Mycobacterium Reference Laboratories were matched to TB case notifications, and the results were used to report culture confirmation. Results for microscopy, PCR and histology were also collected in ETS [1].

Sputum smear

Of the 240 pulmonary cases in the North West in 2017, 54.2% (130/240) had a sputum smear result reported; the same as in the previous 2 years and lower than national levels (63.4%) [1]. 59.2% (77/130) of known North West sputum smear results were positive. Among pulmonary, sputum smear positive cases, 90.9% (70/77) were also culture confirmed.

Culture confirmation and speciation

A total of 60.9% (324/532) of all cases in 2017, both pulmonary and extra-pulmonary, were confirmed by culture in the North West; compared with 61.8% nationally [1]. Of the 240 pulmonary cases, 75.0% (180/240) were culture confirmed; in line with national levels (74.7%) [1]. Among extra-pulmonary cases in the North West, 49.8% (144/289) were culture confirmed, higher than national levels (46.6%) [1].

Culture confirmation was 30.0% (9/30) in those aged 0-14 years, lower than in other age groups (56.0% and over); most of these cases had extra-pulmonary disease (63.3%, 19/30). There was also variation among North West LAs: over half (63.6%, 21/33) of LAs with TB notifications in 2017 had culture confirmation for at least 60.0% of cases.

Among all culture confirmed cases, 96.3% (312/324) were identified with *Mycobacterium tuberculosis (M. tuberculosis)* infection, 1.9% (6/324) with *Mycobacterium bovis (M. bovis)* and 1.5% (5/324) with *Mycobacterium africanum (M. africanum)*. There were no cases of Mycobacterium tuberculosis complex or *Mycobacterium microti (M. microti)* recorded in 2017.

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

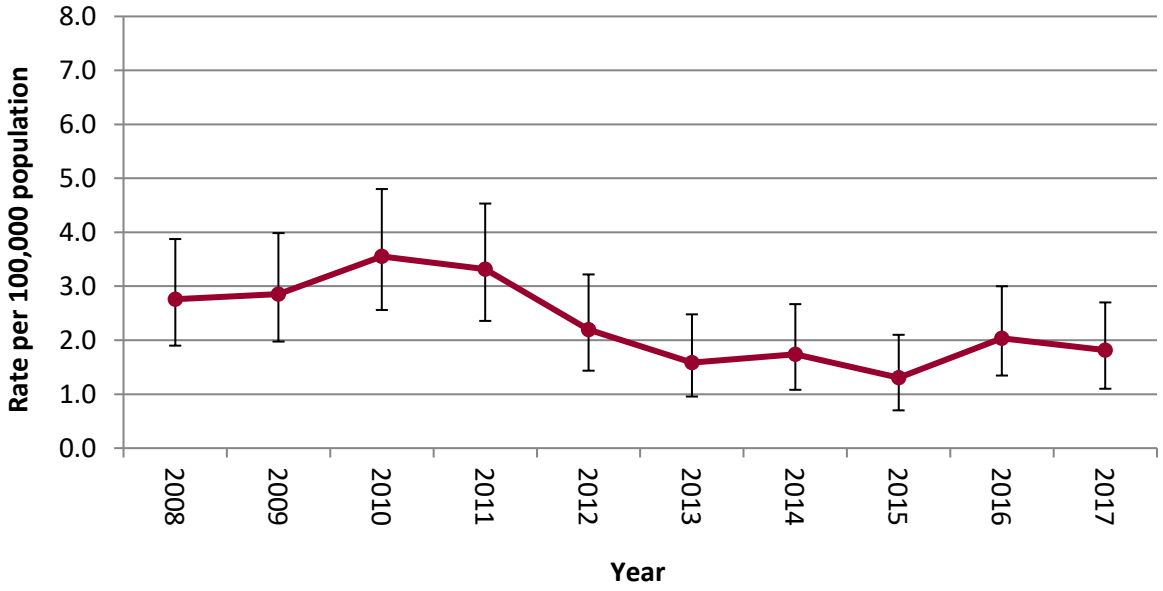
3. TB transmission

Incidence of TB in UK-born children

The incidence of TB in children is considered to be an acceptable, indirect indicator of recent transmission within communities, 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 the North West, the rate of TB in UK born children under 15 years of age was 1.8 per 100,000 in 2017, slightly lower than in the previous year (2.0 per 100,000 in 2016). This is an overall decrease since the peak of 3.6 per 100,000 in 2010 (Figure 9) but is higher than the national rate of 1.4 per 100,000 [1].

TB Monitoring Indicator 5: Incidence of TB in UK born children aged under fifteen years

Figure 9: Incidence of TB in UK-born children*, North West, 2008 – 2017



* Aged 0-14 years. Rates calculated using mid-year 2017 Labour Force Survey population estimates [5]. Error bars represent upper and lower 95% confidence intervals.

Strain typing and clustering

Whole genome sequencing (WGS) commenced in North and Central England in December 2016, replacing the previous MIRU-VNTR (mycobacterial interspersed repetitive units - variable number tandem repeats) method of strain typing. WGS provides single nucleotide polymorphism (SNP) differences between isolates and provides more precise information than MIRU-VNTR typing on how isolates relate to

each other [6][7][8]. Therefore WGS, together with additional clinical and epidemiological information, provides greater insight into whether people are likely to be part of the same transmission.

Epidemiologically linked patients involved in transmission are unlikely to be identified at SNP distances of more than 12 [8], therefore WGS clusters of TB are defined as patients with one 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 cases clustered and geographical distribution

In 2017, 324 cases of TB were confirmed by culture in the North West. Of those, 92.9% (301/324) had a WGS result that could be used to report relatedness (based on sequencing coverage and quality). Among North West TB cases, 22.9% (69/301) were clustered with at least one other individual in North and Central England at a cut-off of 12 SNPs. 16.9% (51/301) were clustered at a cut-off of 5 SNPS, and 12.3% (37/301) were clustered at a cut-off of 2 SNPs.

19.6% (59/301) cases were clustered with at least one other individual within the North West at a cut-off of 12 SNPs. 14.6% (44/301) were clustered at a cut-off of 5 SNPS, and 11.6% (35/301) were clustered at a cut-off of 2 SNPs.

Size of clusters

Of the 22 North West clusters identified at a 12 SNP cut-off in 2017, 74.6% (44/59) consisted of fewer than 5 cases, with almost half (47.5%, 28/59) consisting of only 2 cases; one quarter comprised 5 or more cases (25.4%, 15/59). The median cluster size was 2 cases (range 2 to 5 cases). Cluster sizes will grow as more years of data are accumulated.

Cluster lineage

In 2017, 64.4% (38/59) of cases in North West clusters with a 12 SNP cut-off had strains of Euro-American lineage; 15.3% (9/59) were of Delhi Central Asian lineage; 15.3% (9/59) were of Beijing lineage; and 5.1% (3/59) were of *M. bovis* lineage.

Characteristics of cases in clusters[3]

Of the 59 cases notified in 2017 which clustered within the North West at a 12 SNP cut-off, 66.1% (39/59) were male and 52.5% (31/59) were aged 15 to 44 years. Children aged under 15 years comprised 6.8% (4/59) of clustered cases.

The proportion of clustering at 12 SNPs was higher among those born in the UK (41.9%) compared with outside the UK (9.6%). Of those born outside the UK, half (42.1%, 8/16) were notified within 5 years of entering the UK and 37.5% (6/16) were notified more than 10 years after entry. Most clustered North West cases notified in 2017 were in the White ethnic group (67.8%, 40/59).

Among 2017 cases clustering at 12 SNPs within the North West, 86.4% (51/59) had pulmonary TB. Of those, 52.9% (27/51) were smear positive; however, this figure is distorted by the fact that sputum smear results were missing for 25.5% (13/51) of pulmonary cases. 5.1% (3/59) of clustered cases had received a previous diagnosis of TB.

One quarter (25.0%, 11/44) had at least one social risk factor (current or previous history of prison, homelessness, alcohol use and/or drug use); however, three quarters (75.0%, 33/44) recorded having no social risk factors. Isoniazid resistance was observed in 8.5% (5/59) of cases, and multi-drug resistant (MDR-TB) cases comprised 1.7% (1/59) of clustered cases.

[3] Relating to cases notified in 2017 which clustered within the North West at a 12 SNP cut-off. Cases with missing or unknown information are excluded from denominators unless otherwise specified.

4. Delay from onset of symptoms to start of treatment

Time symptomatic

The time between onset of symptoms and starting treatment was available for 82.8% of North West cases notified in 2017. This proportion has decreased in recent years, from 92.6% in 2015 and 87.4% in 2016. The median number of days between symptom onset and treatment start was 98 (Table 4). This was lower among those with pulmonary disease at 93 days, and higher among extra-pulmonary cases at 108 days. Among pulmonary cases, 35.2% (68/193) were treated within 2 months of symptom onset, and 63.2% (122/193) were treated within 4 months.

TB Monitoring Indicator 6: Proportion of pulmonary TB cases starting treatment within 2 months of symptom onset (England, PHEC and UTLA data shown on Fingertips)

TB Monitoring Indicator 7: Proportion of pulmonary TB cases starting treatment within 4 months of symptom onset (England, PHEC and UTLA data shown on Fingertips)

Table 3: Time between symptom onset and treatment start*, North West, 2017

	Median days (IQR)	0-2 months		2-4 months		>4 months	
		n	%	n	%	n	%
Extra-pulmonary	108 (49-237)	71	29.8	55	23.1	112	47.1
Pulmonary	93 (51-165)	68	35.2	54	28.0	71	36.8
Pulmonary smear positive	92 (46-163)	21	33.9	20	32.3	21	33.9
All Cases	98 (49-186)	2	66.7	0	0.0	1	33.3

* Excluding asymptomatic cases, and those with missing onset dates

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

Among pulmonary cases, treatment delays of more than 4 months occurred in 38.1% of males and 34.3% of females. Of the 33 local authorities with notifications of pulmonary TB in 2017, 12 had at least half of their cases treated more than 4 months after symptom onset. Among UK born cases of pulmonary TB, the greatest proportion (40.2%) were treated within 2 months of symptom onset; whereas the greatest proportion of non-UK born pulmonary cases (46.4%) were treated over 4 months after symptom onset.

There was also variation among ethnic groups: 28.6% (22/77) of cases (with known onset and treatment dates) in the White ethnic group were treated within 2 months of symptom onset, compared with 45.5% (35/77) with delays of more than 4 months. In the Black-African ethnic group, 43.5% (10/23) were treated within 2 months of symptom onset, while 21.7% (9/23) had treatment delays of more than 4 months.

5. TB outcome in drug sensitive cohort

Drug sensitive cohort

For the purposes of TB outcome reporting, the drug sensitive cohort excludes all TB cases with rifampicin resistant TB (initial or amplified), including MDR-TB (initial or amplified) and non-culture confirmed cases treated as MDR-TB [9]. Under this definition, cases with resistance to isoniazid, ethambutol and/or pyrazinamide but without resistance to rifampicin are included in the drug sensitive cohort. For TB outcomes in the drug resistant cohort, see Chapter 6.

Treatment outcomes for the drug sensitive cohort are reported separately for cases with an expected treatment duration of less than 12 months and cases with central nervous system (CNS) disease, spinal, cryptic disseminated or miliary disease.

For cases with an expected treatment duration of less than 12 months, TB outcomes at 12 months are reported. This group excludes cases with CNS (central nervous system) disease, who have an expected treatment duration of 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.

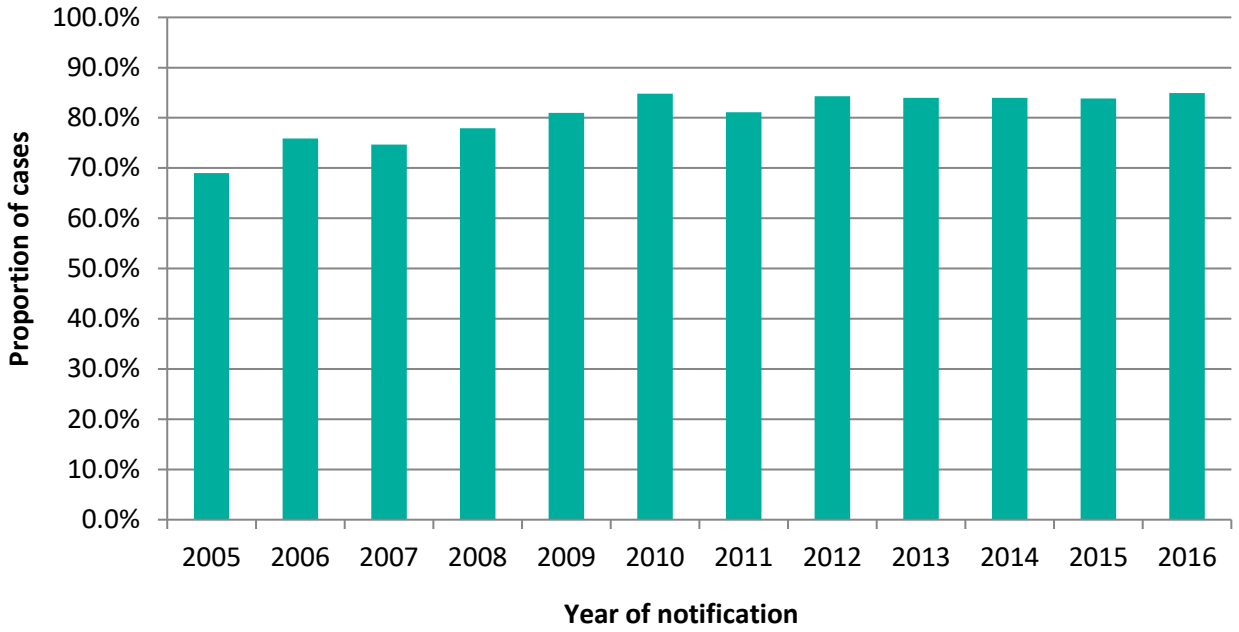
For cases with CNS, spinal, cryptic disseminated or miliary disease, the last recorded treatment outcome is reported.

1: Outcomes for TB cases with expected duration of treatment less than 12 months

TB Monitoring Indicator 10: Number and proportion of drug sensitive TB cases with full course of treatment completed by 12 months

In 2016, 589 TB cases were notified in the North West; 90.3% (532/589) of which were expected to complete treatment within 12 months (excluding rifampicin resistant TB and cases with CNS, spinal, miliary or cryptic disseminated disease). Treatment completion for this group was 85.0% (452/532), which was slightly higher than in previous years (Figure 11).

Figure 10: Treatment completion at 12 months for drug sensitive cases with expected treatment duration of 12 months, North West, 2005 – 2016*



* Excludes rifampicin resistant TB, and cases with CNS, spinal, miliary or cryptic disseminated disease

Among cases that did not complete treatment within 12 months (14.1%, 75/532), the most common reasons for not completing treatment were death (6.4%, 34/532) and being lost to follow up (4.7%, 25/532).

Table 4: TB outcome at 12 months for drug sensitive cases with expected treatment duration of 12 months, North West, cases diagnosed in 2016*

TB outcome	n	%
Treatment completed	452	85.0%
Died	34	6.4%
Lost to follow up	25	4.7%
Still on treatment	16	3.0%
Treatment stopped	4	0.8%
Not evaluated**	1	0.2%
Total	532	100.0%

* Excludes initial and amplified to rifampicin resistant TB and MDR-TB cases and MDR-TB treated cases and those with CNS, spinal, miliary or cryptic disseminated TB
** Not evaluated includes missing, unknown and transferred out

Of the 34 deaths, the relationship between TB and death was unknown for 52.9% (18/34). Among the 16 cases for which information was recorded, TB caused no deaths; contributed to 3; and was incidental to 13.

The median age of those who died was 68 years; 9 cases (26.5%) were diagnosed at post-mortem. Older cases were less likely to complete treatment: 73.5% (61/83) of those aged 65 years or older completed treatment within 12 months, compared with at least 86.0% of cases in younger age groups. The 65 years and over age group also had a higher proportion of cases who died (25.5%, 21/83).

Treatment completion was 86.5% (283/327) among the non-UK born, and slightly lower in the UK born at 82.1% (161/196). A greater proportion of UK born cases died before completing treatment (10.2%, 20/196) than those born abroad (4.3%, 14/327). The proportion of females completing treatment within 12 months was 88.4% (205/232), compared with 82.3% (247/300) of males.

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

Of drug-sensitive cases with no recorded social risk factors, 88.6% completed treatment within 12 months, compared with 61.7% of cases with known risk factors.

2: Outcomes for drug sensitive cohort of cases with CNS, spinal, miliary or cryptic disseminated TB

Of the 50 cases with CNS, spinal, miliary or cryptic disseminated disease in 2016, 80.0% (40/50) had completed treatment at the last recorded outcome (Table 6). 68.0% (34/50) completed treatment within 12 months, while 14.0% (7/50) remained on treatment. Twelve per cent (6/50) completed treatment in more than 12 months.

Table 5: TB outcome at last recorded outcome for drug sensitive cohort with CNS, spinal, miliary or cryptic disseminated disease, North West, cases diagnosed in 2016*

TB outcome	n	%
Treatment completed	40	80.0%
Died	5	10.0%
Lost to follow up	2	4.0%
Still on treatment	1	2.0%
Treatment stopped	1	2.0%
Not evaluated**	1	2.0%
Total	50	100.0%

* Excludes initial and amplified to rifampicin resistant TB and MDR-TB cases and MDR-TB treated cases and only includes drug sensitive cases with CNS, spinal, miliary or cryptic disseminated TB
** Not evaluated includes missing, unknown and transferred out

Of the 5 deaths, TB caused death in one case, contributed to death in one case and was incidental to death in 4 cases. In 2 cases, the relationship between TB and death was unknown.

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

The proportion of cases in the entire drug sensitive cohort who had died at the last recorded outcome remained fairly stable from 2004 to 2016, ranging from 4.5% to 8.8% overall (6.7% in 2016). Of the 582 drug sensitive cases notified in 2016, 39 cases (6.7%) died. Of these, the relationship between TB and death was unknown for 51.3% (20/39). TB was incidental to 35.9% (14/39) of deaths; contributed to 10.3% (4/39) of deaths; and caused 2.6% (1/39) of deaths. 64.1% (25/39) of deaths were in cases aged 65 years and over.

The proportion of drug sensitive cases that were lost to follow up at the last recorded outcome has remained reasonably stable since 2004, ranging from 2.8% to 5.5% overall. 4.6% (27/582) of cases were lost to follow up in 2016. Of these, 77.8% (21/27) were born outside the UK; and 37.0% (10/27) had left the UK. Males accounted for 74.1% (20/27) of cases lost to follow up; 81.5% (22/27) were in the 15-44 age group.

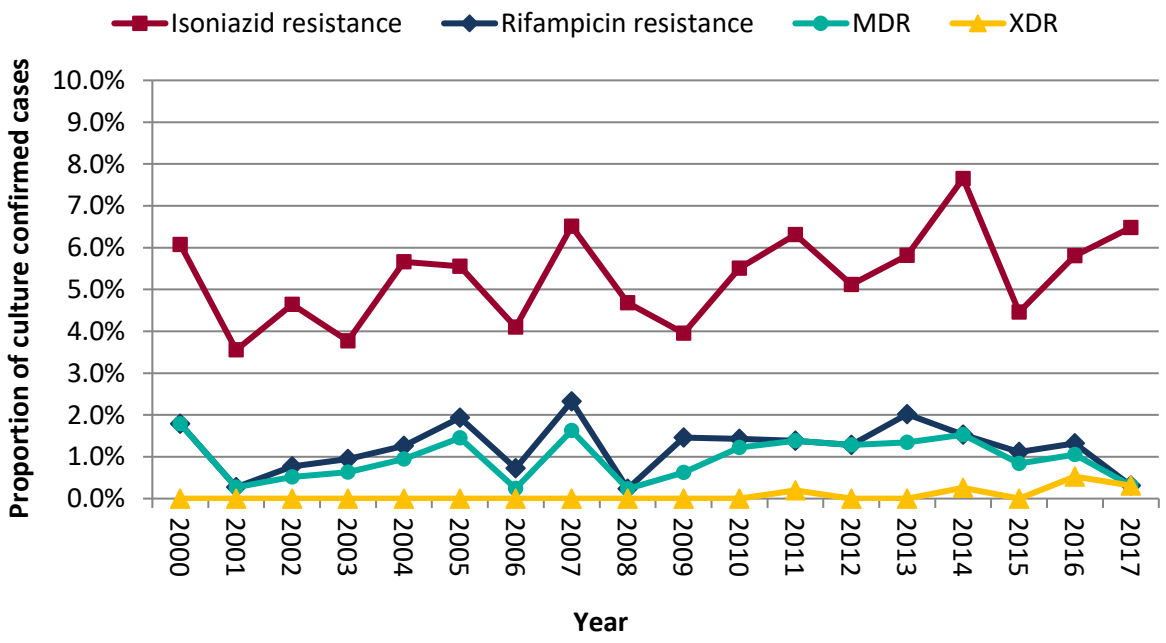
6. Drug resistant TB (including outcomes in the drug resistant cohort)

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 (e.g. amikacin, capreomycin, kanamycin), fluoroquinolones (e.g. 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 one injectable agent and at least one fluoroquinolone [10].

In 2017, 9.0% (29/324) of culture confirmed TB cases were resistant to one or more first line drugs. 6.5% (21/324 cases) had isoniazid resistance (Figure 11); a slight increase from the previous 2 years (4.5% in 2015; 5.8% in 2016). 0.3% (1/324 cases) were rifampicin-resistant and also classified as MDR-TB and XDR-TB, a lower proportion than in previous years.

Figure 11: Proportion of drug resistant TB cases, North West, 2000 – 2017*



* Culture confirmed cases with resistance to at least one first-line drug (isoniazid, rifampicin, pyrazinamide or ethambutol)

Most drug resistant cases were male (62.1%, 18/29), and most were aged between 15 and 44 years old (41.4%, 12/29). Almost two thirds had pulmonary disease (65.5%, 19/29); and, of these, 42.1% (8/19) had a positive sputum smear result.

Of drug resistant cases notified in 2016, 65.2% (15/23) had completed treatment at the last recorded outcome, compared with 82.4% (14/17) in 2015. The most common reasons for not completing treatment were still being on treatment (26.1%, 6/23) and being lost to follow up (8.7%, 2/23).

TB outcome at 24 months for cases with rifampicin resistant disease

In 2015, 4 culture confirmed cases had rifampicin resistant TB, and 3 of these cases also had MDR-TB. All 3 MDR cases were non-UK born males aged 15-44 years.

At 12 months, none of the 4 rifampicin resistant cases had completed treatment; all 4 were still on treatment. At 24 months, 3 had completed treatment and one case was still on treatment (Table 7).

Table 6: TB outcome at 24 months for culture confirmed cases with rifampicin resistant disease, North West, cases diagnosed in 2015

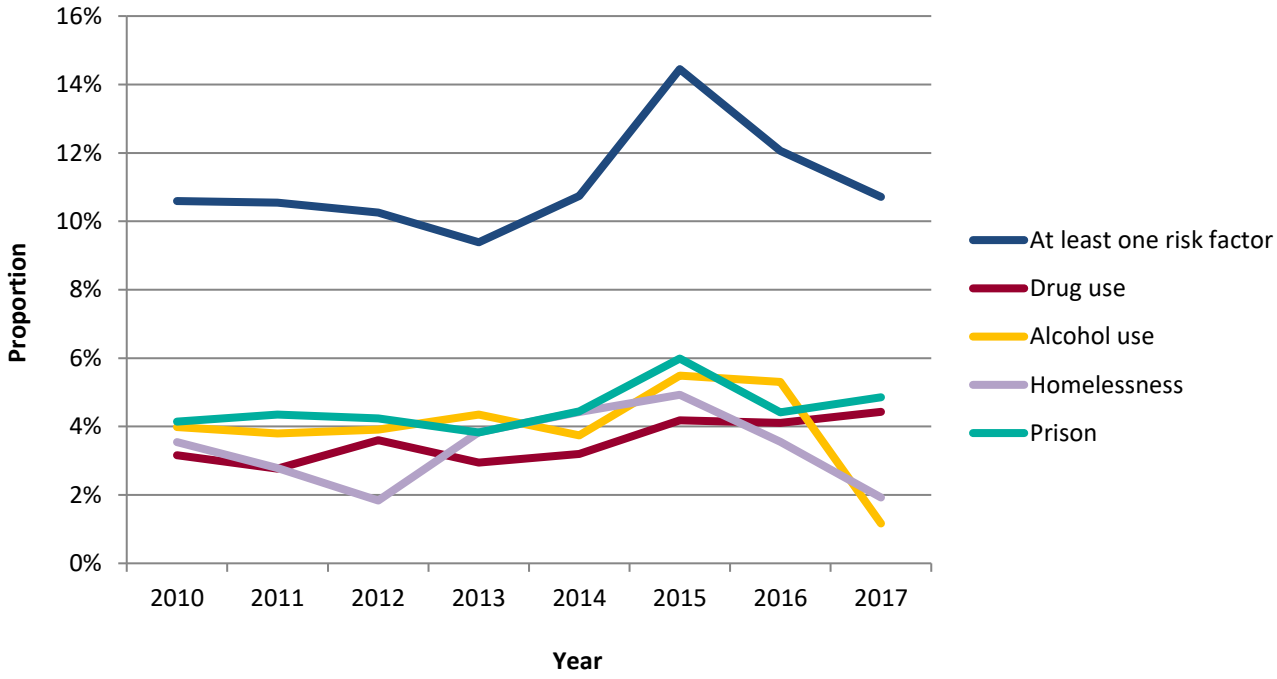
TB outcome	n	%
Treatment completed	3	75.0%
Died	0	0.0%
Lost to follow up	0	0.0%
Still on treatment	1	25.0%
Treatment stopped	0	0.0%
Total	4	100.0%

7. TB in under-served populations

Social risk factors

Information on social risk factors (homelessness, drug and alcohol misuse and imprisonment) has been available since 2009. In 2017, information on social risk factors was recorded for 72.5% (364/502) of TB cases in the North West aged 15 years and over, and 10.7% (39/364) of these cases had at least one social risk factor (Table 8). Where information on individual risk factors was known, 4.9% (18/371) reported imprisonment, 1.2% (5/429) reported alcohol misuse, 4.4% (19/429) reported drug use and 1.9% (8/415) reported homelessness.

Figure 12: Social risk factors among TB cases*, North West, 2010 – 2017



* For cases aged 15 years and over, where information on individual risk factors was recorded

Most cases with at least one social risk factor were male (79.5%, 31/39) and 56.4% (22/39) were in the 15 to 44 years age group. 62.2% of cases (23/37) with at least one social risk factor were UK born; less than the previous year (73.5%, 36/49, in 2016). Among UK born cases, 95.7% (22/23) of cases with at least one social risk factor were in the White ethnic group. Of non-UK born cases with at least one social risk factor, the highest proportion was in the Black-African ethnic group (50.0%, 7/14).

Twenty per cent (6/30) of cases with at least one social risk factor received directly observed therapy (DOT) in 2017 (for cases where use of DOT was recorded). Of those, 2 cases had current or previous history of alcohol use; all 6 had current or previous

drug use; 2 cases had current or previous imprisonment; and 3 cases had current or previous homelessness. Five of the 6 cases receiving DOT had more than one social risk factor recorded.

A higher proportion of drug sensitive cases with at least one social risk factor notified in 2016 had died at the last recorded outcome (14.0%, 7/50) compared to cases with no social risk factors (5.2%, 21/401).

Socio-economic deprivation

In 2017, 42.3% (225/532) of TB cases were resident in the most socio-economically deprived areas of the North West, compared to only 6.0% (32/532) of the population living in the least socio-economically deprived areas (Figure 14). Similarly, TB rates were highest in the most socio-economically deprived and the second most socio-economically deprived quintiles (9.7 and 11.5 per 100,000 population, respectively) compared with the least socio-economically deprived quintile (2.9 per 100,000 population).

Figure 13: Rate of TB by socio-economic deprivation quintile*, North West, 2017

* Denominator data: 2015 Index of Multiple Deprivation (Department for Communities and Local Government) and 2016 Mid-Year Lower Super Output Area Population Estimates (Office for National Statistics), licensed under the Open Government Licence.

8. TB-HIV co-infection and HIV testing among TB cases

HIV testing

TB Monitoring Indicator 16: Proportion of TB cases offered an HIV test (England, PHEC, UTLA and CCG data shown on Fingertips)

Information on HIV testing was available for 94.0% (469/499) of North West cases reported in 2017 (with previously unknown HIV status and excluding those diagnosed post-mortem). Of these, 93.2% (437/469) were offered and received an HIV test, similar to previous years (95.6% in 2016 and 95.7% in 2015). The remaining cases did not receive a test: 5.1% (24/469) were not offered a test; 1.3% (6/469) were offered a test but did not receive it; and 0.4% (2/469) refused testing.

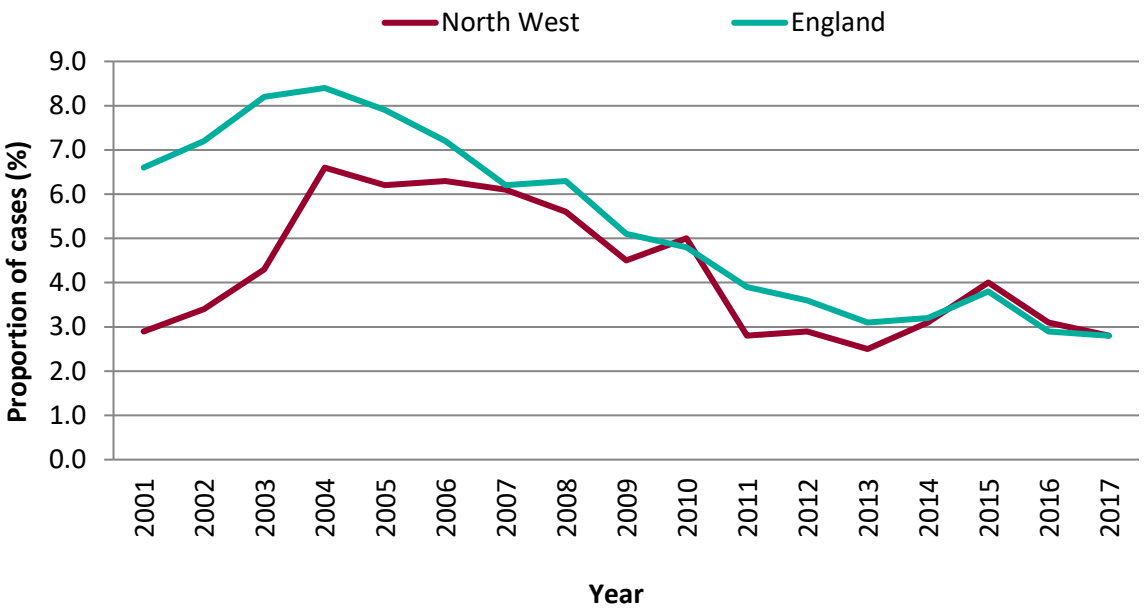
Cases born outside the UK were more likely to be offered a test (97.0%, 293/302) than UK born cases (92.2%, 142/154). Cases in certain age groups were also more likely to be offered a test: over 90.0% of cases in the 15-44 and 45-64 years age groups were offered an HIV test, compared with 81.3% (52/64) of cases aged 65 years and over and 73.3% (22/30) of cases aged 0-14 years.

Information on HIV testing also varied by geographical area. In areas of the North West with the highest TB incidence, the proportion of cases with completed HIV testing information varied from 93.8% (30/32) in Blackburn with Darwen to 100.0% (20/20) in Preston. In 21 of the 33 local authorities (63.6%) where TB cases were notified in 2017, 100% of eligible cases were offered an HIV test.

TB-HIV co-infection

The proportion of North West TB cases co-infected with HIV has generally declined since 2004, in line with the national trend (Figure 15) [1]. In 2017, 2.8% of North West TB cases aged 15 years and over were co-infected with HIV, equal to the proportion of co-infected cases across England.

Figure 14: Proportion of notified and un-notified TB cases matched to an HIV case*, North West and England, 2001 – 2017



* Includes TB and HIV co-infected cases aged 15 years and older. 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.

9. BCG vaccination

BCG vaccination status

Information on BCG vaccination status was available for 39.8% (212/532) of North West cases in 2017; lower than in previous years and showing a steady decrease since 2013 (52.4%). The proportion of cases with known BCG vaccination status was higher in younger age groups: 53.3% (16/30) of cases aged 0-14 years, compared with 37.7% to 39.9% of cases aged 15 and over. Of cases with known information, 59.9% (127/212) had reportedly received BCG vaccination (50.0%, 8/16, for cases aged 0-14 years). [4]

BCG vaccination data was available for approximately half of UK born cases (50.3%, 89/177), compared with 36.3% (122/336) of cases born outside the UK. Among cases with available information, 61.8% (55/89) of UK born cases had received BCG vaccination, a slightly higher proportion than in cases born outside the UK (58.2%, 71/122).

[4] Information was recorded for 55.3% (21/38) of cases aged 0-17 years; 52.4% (11/21) of which had received BCG vaccination.

10. Latent TB infection testing and treatment

The national programme of latent TB infection (LTBI) testing and treatment began in 2015. The programme targets new migrants from high incidence countries aged 16-35 years (who have entered the UK within the last 5 years and have been previously living in a high incidence country for 6 months or longer) [1]. 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[5] 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].

The number of eligible LTBI tests reported in the North West increased from 587 in 2016 to 830 in 2017. The number of tests also increased nationally among all other TB Control Boards (TBCBs) [1]. The proportion of positive LTBI tests in 2017 (of those with a known result) was 21.1% (166/786), similar to the previous year (21.2% in 2016) and higher than reported nationally (16.8%) [1].

Of those estimated to be eligible for treatment, uptake increased from 45.0% (59/131) in 2016 to 71.4% (130/182) in 2017. Treatment uptake varied by CCG, from 46.3% (25/54) in Bolton CCG to 98.0% (49/50) in Blackburn with Darwen CCG. Treatment completion decreased from 68.4% (39/57) in 2016 to 56.9% (70/123) in 2017; there was also a decrease nationally from 84.5% to 71.1% [1]. Treatment completion also varied among CCGs, from 48.0% (24/50) on North and Central Manchester CCG to 76.0% (19/25) in Bolton CCG. These figures have been calculated to take into consideration that treatment uptake and completion can be subject to pathway delays, which may lower the observed figures (as eligible patients may still be on the pathway at the time of reporting).

[5] 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

Overall, numbers and rates of TB in North West England have decreased each year since 2011, and incidence remains below the national level. The regional rate decreased by 10.1% between 2016 and 2017, reflecting a decrease of 8.7% among non-UK born TB cases and 15.3% among the UK born.

UK-born cases were more likely to have reported social risk factors, resulting in poorer recognition of symptoms and difficulties accessing healthcare and highlighting the need for extra support for vulnerable cases with complex needs. Delays in diagnosis could lead to worse outcomes for a case and increased risk of transmission of infection to others.

The ethnic groups with the highest proportion of total cases were the Pakistani and White ethnic groups. Of cases born abroad who were notified in 2017, the greatest proportion had been resident in the UK for at least 11 years, demonstrating the importance of timely identification and treatment of migrants from high incidence TB countries who have latent TB infection, in order to prevent the future development of active TB disease.

Rates across all age groups decreased in 2017, with the largest decrease seen in the 65+ years age group. The rate in the 0-14 age group decreased, reflecting a parallel decrease in the rate among UK born children.

Overall, the proportion of cases with social risk factors has remained fairly consistent since 2009, indicating that underserved populations must remain a priority for intervention. This report clearly demonstrates that the largest burden of disease falls in those populations which are also socio-economically disadvantaged. Continued efforts to control TB in these groups represents an opportunity to reduce health inequalities.

More than half of pulmonary cases in 2017 had a sputum smear result, although the proportion was lower than in the previous 2 years. This is an important indication of infectiousness and should be obtained for all cases where possible.

In 2017, 22.9% of North West cases with a WGS result were found to cluster with at least one other case (at a cut-off of 12 SNPs) at UK level; 19.6% were clustered with other cases within the North West. Almost half of North West clusters consisted of only 2 people.

Almost two-thirds of pulmonary cases in the North West started TB treatment within 4 months of symptom onset; however, this means that almost a third of cases started

treatment more than 4 months after symptom onset, which may have increased the opportunity for TB transmission.

The proportion of drug sensitive (and non-CNS, spinal, miliary or cryptic disseminated) TB cases in the North West completing treatment within 12 months increased slightly to 85.0% (among cases notified in 2016). One of the most commonly reported reasons for not completing treatment was death; but, for most of these cases, information on the relationship between TB and death was unknown. This information is important to determine if these deaths were preventable.

Among cases that were offered HIV testing, uptake was 93.2% in 2017; 5.1% of cases were not offered a test. Some case groups including children (aged under 15 years) and those aged over 65 years, were less likely to be offered a test. Testing results were available for 94.3% of cases; and in 21 of the 33 local authorities where TB was notified in 2017, 100% of eligible cases were offered an HIV test. UK guidance recommends all TB cases should be offered an HIV test regardless of age, ethnic group or place of residence [4].

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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 North West TB Control Board and North West clinical leadership group.

Aim of report

This report describes the recent epidemiology of TB in the North West, providing an update on local trends, identifying areas of high burden of disease, at-risk population groups, and opportunities for interventions and prevention of future cases.

Further TB information

The national report of TB in England is available at https://www.gov.uk/government/publications/tuberculosis-in-england-annual-report. Additional data on TB notifications in the UK to the end of 2017, 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 2017’. This is available at https://www.gov.uk/government/statistics/reports-of-cases-of-tb-to-uk-enhanced-tuberculosis-surveillance-systems.

As part of the Collaborative TB Strategy for England 2015-2020, TB Strategy Monitoring Indicators are available at https://www.gov.uk/government/publications/collaborative-tuberculosis-strategy-for-england. Where data for these indicators are 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.

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 2017. 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).

HIV data from Survey of Prevalent HIV Infections Diagnosed (SOPHID) and HIV & AIDS New Diagnoses Database (HANDD) were matched with TB data for those aged 15 years and above.

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 August 2018.

Proportions

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

Population denominators

Tuberculosis rates by geographical area, 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) [http://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 the North West was carried out on cases that clustered in the North West and were notified between 2016 and 2017.

Appendix C: TB among North West residents

Table Bi: TB case numbers by local authority of residence, North West, 2008 – 2017

Local Authority	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Allerdale	1	0	1	0	2	2	4	2	3	2
Barrow-in-Furness	1	2	4	4	5	2	1	2	2	0
Blackburn with Darwen	53	62	74	42	56	59	34	35	37	33
Blackpool	16	11	12	31	20	12	19	9	14	11
Bolton	63	75	66	61	47	58	56	43	50	44
Burnley	3	15	10	13	11	9	2	3	6	10
Bury	8	24	14	21	23	16	25	17	11	19
Carlisle	2	0	0	1	12	4	1	3	1	0
Cheshire East	9	6	8	12	9	21	12	18	17	7
Cheshire West and Chester	5	8	10	8	8	11	12	11	7	8
Chorley	1	2	1	3	9	6	4	2	4	2
Copeland	0	0	2	0	2	2	0	1	1	0
Eden	2	0	0	0	1	1	1	0	0	0
Fylde	1	8	2	1	2	2	3	1	0	0
Halton	1	2	2	0	0	2	5	2	0	2
Hyndburn	26	11	6	11	9	14	4	9	6	5
Knowsley	4	4	3	5	2	5	3	2	1	0
Lancaster	0	1	8	8	8	4	5	2	7	8
Liverpool	50	45	61	42	48	41	36	41	34	39
Manchester	171	203	198	220	181	166	135	122	135	122
Oldham	46	36	52	46	50	43	53	54	40	36
Pendle	19	27	19	25	18	19	15	11	13	9
Preston	33	23	33	46	35	28	22	17	24	21
Ribble Valley	3	4	0	1	1	2	1	0	3	2
Rochdale	51	47	41	42	35	23	39	26	31	25
Rossendale	2	2	5	1	2	3	4	4	2	3
Salford	34	29	36	24	24	30	26	32	28	22
Sefton	12	9	10	7	17	6	9	6	8	5
South Lakeland	2	5	4	6	7	3	7	0	2	2
South Ribble	3	4	3	9	2	4	6	4	1	3
St. Helens	4	2	4	5	5	3	5	2	2	2
Stockport	24	14	10	28	15	16	19	14	13	18
Tameside	29	46	35	33	34	22	19	16	21	30
Trafford	19	31	23	27	39	31	26	22	25	19
Warrington	9	12	12	6	9	14	9	8	9	5
West Lancashire	2	1	4	1	1	2	3	2	0	3
Wigan	9	16	15	9	7	14	11	14	15	5
Wirral	10	10	16	10	11	11	6	10	13	6
Wyre	2	2	5	9	8	5	0	1	3	4
Cheshire and Merseyside	104	98	126	95	109	114	97	100	91	74
Cumbria and Lancashire	172	180	193	212	211	183	136	108	129	118
Greater Manchester	454	521	490	511	455	419	409	360	369	340
NORTH WEST	730	799	809	818	775	716	642	568	589	532

Table Bii: TB rate per 100,000 population by local authority of residence, North West, 2008 – 2017

Local Authority	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Allerdale	1.0	0.0	1.0	0.0	2.1	2.1	4.1	2.1	3.1	2.1
Barrow-in-Furness	1.4	2.9	5.8	5.8	7.3	2.9	1.5	3.0	3.0	0.0
Blackburn with Darwen	36.6	42.4	50.4	28.4	37.9	39.9	23.1	23.7	24.9	22.2
Blackpool	11.2	7.7	8.4	21.8	14.1	8.5	13.5	6.4	10.0	7.9
Bolton	23.3	27.5	24.0	22.0	16.8	20.7	19.9	15.3	17.6	15.4
Burnley	3.4	17.2	11.5	14.9	12.6	10.4	2.3	3.4	6.9	11.4
Bury	4.4	13.1	7.6	11.3	12.4	8.6	13.3	9.1	5.8	10.0
Carlisle	1.9	0.0	0.0	0.9	11.1	3.7	0.9	2.8	0.9	0.0
Cheshire East	2.5	1.6	2.2	3.2	2.4	5.6	3.2	4.8	4.5	1.8
Cheshire West and Chester	1.5	2.4	3.0	2.4	2.4	3.3	3.6	3.3	2.1	2.4
Chorley	0.9	1.9	0.9	2.8	8.3	5.4	3.6	1.8	3.5	1.7
Copeland	0.0	0.0	2.8	0.0	2.8	2.9	0.0	1.4	1.4	0.0
Eden	3.8	0.0	0.0	0.0	1.9	1.9	1.9	0.0	0.0	0.0
Fylde	1.3	10.6	2.6	1.3	2.6	2.6	3.9	1.3	0.0	0.0
Halton	0.8	1.6	1.6	0.0	0.0	1.6	4.0	1.6	0.0	1.6
Hyndburn	32.0	13.6	7.4	13.7	11.2	17.5	5.0	11.2	7.5	6.2
Knowsley	2.7	2.7	2.0	3.4	1.4	3.4	2.0	1.4	0.7	0.0
Lancaster	0.0	0.7	5.8	5.8	5.7	2.9	3.6	1.4	4.9	5.6
Liverpool	11.0	9.8	13.2	9.0	10.2	8.7	7.6	8.5	7.0	7.9
Manchester	35.8	42.0	40.2	43.7	35.5	32.3	26.0	23.0	24.9	22.4
Oldham	20.7	16.2	23.2	20.4	22.1	18.9	23.2	23.5	17.2	15.4
Pendle	21.3	30.2	21.3	27.9	20.1	21.1	16.7	12.2	14.4	9.9
Preston	23.8	16.7	23.8	32.8	24.9	20.0	15.7	12.1	17.0	14.9
Ribble Valley	5.2	7.0	0.0	1.7	1.7	3.5	1.7	0.0	5.1	3.4
Rochdale	24.3	22.4	19.5	19.8	16.5	10.8	18.3	12.1	14.3	11.4
Rossendale	3.0	3.0	7.4	1.5	2.9	4.4	5.8	5.8	2.9	4.3
Salford	15.0	12.7	15.5	10.2	10.1	12.6	10.8	13.1	11.3	8.8
Sefton	4.4	3.3	3.7	2.6	6.2	2.2	3.3	2.2	2.9	1.8
South Lakeland	1.9	4.8	3.8	5.8	6.8	2.9	6.8	0.0	1.9	1.9
South Ribble	2.8	3.7	2.8	8.2	1.8	3.7	5.5	3.6	0.9	2.7
St. Helens	2.3	1.1	2.3	2.9	2.8	1.7	2.8	1.1	1.1	1.1
Stockport	8.5	5.0	3.5	9.9	5.3	5.6	6.6	4.9	4.5	6.2
Tameside	13.4	21.2	16.0	15.0	15.4	10.0	8.6	7.2	9.4	13.4
Trafford	8.6	13.9	10.2	11.9	17.1	13.5	11.2	9.4	10.7	8.1
Warrington	4.5	6.0	6.0	3.0	4.4	6.8	4.4	3.9	4.3	2.4
West Lancashire	1.8	0.9	3.6	0.9	0.9	1.8	2.7	1.8	0.0	2.6
Wigan	2.9	5.1	4.7	2.8	2.2	4.4	3.4	4.3	4.6	1.5
Wirral	3.2	3.1	5.0	3.1	3.4	3.4	1.9	3.1	4.0	1.9
Wyre	1.8	1.9	4.6	8.4	7.4	4.6	0.0	0.9	2.7	3.6
Cheshire and Merseyside	4.4	4.1	5.2	3.9	4.5	4.7	4.0	4.1	3.7	3.0
Cumbria and Lancashire	8.8	9.2	9.9	10.8	10.7	9.3	6.9	5.5	6.5	5.9
Greater Manchester	17.3	19.7	18.4	19.0	16.8	15.4	15.0	13.1	13.3	12.1
NORTH WEST	10.5	11.4	11.5	11.6	10.9	10.1	9.0	7.9	8.2	7.3

Table Biii: TB case numbers and rates by age and sex, North West, 2017

	Female		Male	
Age Group	**Number**	**Rate**	**Number**	**Rate**
0-14	13	2.0	17	2.5
15-44	114	8.4	162	11.8
45-64	55	5.7	104	11.1
65+	29	4.0	38	6.2

Table Biv: Drug resistance among TB cases with culture confirmed disease, North West, 2008 – 2017

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Culture confirmed	427	481	490	507	469	447	392	359	379	324
Drug resistant*	21	23	28	32	24	29	30	17	23	29
% Drug resistant	5%	5%	6%	6%	5%	6%	8%	5%	6%	9%

* Resistance to at least one first-line drug (isoniazid, rifampicin, pyrazinamide or ethambutol)

Appendix D: Baseline data for TB strategy monitoring indicators, North West & England, 2000-2017

	Indicator 1: Overall TB incidence per 100,000 population			
	North West		England	
Year	Number of cases	Rate	Number of cases	Rate
2000	624	9.2	6,044	12.3
2001	638	9.4	6,169	12.5
2002	638	9.4	6,675	13.4
2003	574	8.4	6,631	13.3
2004	570	8.3	6,930	13.8
2005	743	10.8	7,658	15.1
2006	694	10.1	7,682	15.1
2007	733	10.6	7,577	14.7
2008	730	10.5	7,809	15.1
2009	799	11.4	8,112	15.5
2010	809	11.5	7,676	14.6
2011	818	11.6	8,280	15.6
2012	775	10.9	8,084	15.1
2013	716	10.1	7,265	13.5
2014	642	9.0	6,472	11.9
2015	568	7.9	5,731	10.5
2016	589	8.2	5,616	10.2
2017	532	7.3	5,102	9.2

	Indicator 2: TB incidence in UK born and non-UK born populations							
	North West				England			
	UK born		Non-UK born		UK born		Non-UK born	
Year	Number of cases	Rate	Number of cases	Rate	Number of cases	Rate	Number of cases	Rate
2000	261	-	348	-	1,830	4.1	3,329	79.6
2001	299	-	327	-	1,889	4.3	3,431	79.1
2002	258	-	352	-	1,852	4.2	4,111	90.5
2003	235	-	330	-	1,703	3.8	4,326	90.8
2004	198	-	358	-	1,791	4.0	4,571	95.2
2005	244	-	468	-	1,804	4.0	5,186	100.7
2006	229	-	426	-	1,729	3.9	5,175	92.9
2007	253	-	458	-	1,799	4.0	5,135	85.5
2008	231	3.6	474	96.0	1,867	4.2	5,417	86.0
2009	255	4.0	494	94.3	1,907	4.2	5,662	86.8
2010	270	4.2	491	91.6	1,814	4.0	5,515	83.1
2011	259	4.0	521	94.5	1,958	4.3	6,021	85.9
2012	262	4.1	494	89.5	2,003	4.4	5,841	81.4
2013	255	4.0	447	76.7	1,842	4.0	5,258	70.6
2014	226	3.5	405	66.2	1,756	3.8	4,611	60.2
2015	185	2.9	368	52.1	1,530	3.3	4,097	51.3
2016	209	3.2	368	55.4	1,454	3.1	4,093	49.4
2017	177	2.7	336	48.7	1,454	3.1	3,556	41.1

	Indicator 5: Incidence of TB in UK born children aged under fifteen			
	North West		England	
Year	Number of cases	Rate	Number of cases	Rate
2000	19	-	209	2.3
2001	20	-	229	2.5
2002	19	-	228	2.6
2003	18	-	179	2.0
2004	15	-	264	3.0
2005	22	-	247	2.8
2006	23	-	209	2.4
2007	30	-	290	3.4
2008	33	2.8	294	3.4
2009	34	2.9	257	2.9
2010	42	3.6	238	2.7
2011	39	3.3	234	2.6
2012	26	2.2	254	2.9
2013	19	1.6	195	2.2
2014	21	1.7	187	2.1
2015	16	1.3	156	1.7
2016	25	2.0	162	1.8
2017	22	1.8	130	1.4

Year	Indicator 6: Number and proportion of pulmonary TB cases starting treatment within two months of symptom onset			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	118	44.4	-	-
2001	132	47.8	-	-
2002	124	41.5	-	-
2003	124	44.1	-	-
2004	99	36.7	-	-
2005	139	40.9	-	-
2006	123	39.9	-	-
2007	128	37.6	-	-
2008	116	39.1	-	-
2009	130	45.5	-	-
2010	120	44.0	-	-
2011	125	44.6	1317	45.0
2012	125	43.4	1371	44.1
2013	95	38.2	1224	41.2
2014	120	39.3	1159	39.5
2015	108	40.1	1181	42.3
2016	117	40.3	1069	38.6
2017	68	35.2	971	38.8

Year	Indicator 7: Number and proportion of pulmonary TB cases starting treatment within four months of symptom onset			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	188	70.7	-	-
2001	210	76.1	-	-
2002	224	74.9	-	-
2003	201	71.5	-	-
2004	197	73.0	-	-
2005	242	71.2	-	-
2006	228	74.0	-	-
2007	255	75.0	-	-
2008	209	70.4	-	-
2009	210	73.4	-	-
2010	199	72.9	-	-
2011	203	72.5	2172	74.3
2012	204	70.8	2293	73.8
2013	161	64.7	2122	71.5
2014	219	71.8	2046	69.7
2015	190	70.6	2015	72.1
2016	200	69.0	1907	68.8
2017	122	63.2	1721	68.8

Year	Indicator 8: Number and proportion of pulmonary TB cases that were culture confirmed			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	193	52.3	1,860	52.1
2001	253	66.2	2,034	56.4
2002	265	69.2	2,622	64.9
2003	216	63.5	2,584	66.1
2004	213	67.4	2,740	68.4
2005	271	66.1	2,985	69.2
2006	264	71.9	2,980	69.4
2007	293	72.7	2,850	68.7
2008	277	74.9	2,904	67.8
2009	317	72.7	3,006	68.1
2010	312	73.8	2,867	70.5
2011	298	72.5	3,075	71.7
2012	286	73.3	2,949	70.4
2013	265	74.9	2,711	72.9
2014	255	72.6	2,486	73.1
2015	238	78.5	2,246	74.1
2016	247	73.3	2,314	76.9
2017	180	75.0	2,066	74.7

Year	Indicator 9: Number and proportion of microbiologically confirmed cases with drug susceptibility testing reported for the four first line agents			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	279	99.6	2,779	99.4
2001	366	100.0	3,123	99.2
2002	388	100.0	3,793	98.6
2003	316	99.4	3,799	99.2
2004	315	99.1	4,020	98.6
2005	412	99.5	4,532	98.9
2006	412	99.3	4,607	98.7
2007	425	98.8	4,366	98.2
2008	420	98.4	4,429	97.6
2009	477	99.2	4,520	96.8
2010	486	99.2	4,513	97.9
2011	503	99.2	4,896	97.3
2012	462	98.5	4,786	97.7
2013	445	99.6	4,286	97.6
2014	390	99.5	3,831	97.7
2015	356	99.2	3,426	98.1
2016	375	98.9	3,445	96.1
2017	314	96.9	3,045	96.6

Year	Indicator 10: Number and proportion of drug sensitive TB cases with full course of treatment completed by 12 months			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	267	45.3	3,638	63.6
2002	450	74.9	4,114	67.4
2003	386	73.2	4,197	69.5
2004	320	61.3	4,432	70.1
2005	476	69.0	4,887	70.3
2006	476	75.9	5,217	75.5
2007	490	74.7	5,296	78.2
2008	515	77.9	5,605	80.3
2009	591	81.0	5,920	81.9
2010	602	84.8	5,652	82.9
2011	596	81.1	6,031	82.1
2012	579	84.3	6,022	83.8
2013	544	84.0	5,511	85.6
2014	471	84.0	4,855	84.9
2015	415	83.8	4,189	83.7
2016	452	85.0	4,201	84.4
2017	-	-	-	-

Year	Indicator 11: Number and proportion of drug sensitive TB cases lost to follow-up at last reported outcome			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	19	3.0	237	3.9
2002	27	4.3	296	4.5
2003	13	2.3	290	4.4
2004	16	2.8	333	4.9
2005	30	4.1	380	5.0
2006	31	4.5	413	5.4
2007	38	5.3	345	4.6
2008	40	5.5	368	4.8
2009	33	4.2	354	4.4
2010	41	5.1	342	4.5
2011	36	4.4	425	5.2
2012	29	3.8	365	4.6
2013	26	3.7	297	4.1
2014	21	3.3	275	4.3
2015	30	5.3	250	4.4
2016	27	4.6	219	3.9
2017	-	-	-	-

Year	Indicator 12: Number and proportion of drug sensitive TB cases that had died at last reported outcome			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	45	7.1	377	6.1
2002	45	7.1	437	6.6
2003	58	10.2	407	6.2
2004	40	7.1	402	5.9
2005	40	5.4	447	5.9
2006	45	6.5	430	5.7
2007	42	5.8	432	5.8
2008	39	5.3	436	5.6
2009	47	5.9	419	5.2
2010	36	4.5	382	5.0
2011	46	5.7	382	4.7
2012	45	5.9	390	4.9
2013	44	6.2	336	4.7
2014	56	8.8	354	5.5
2015	49	8.7	346	6.1
2016	39	6.7	304	5.5
2017	-	-	-	-

Year	Indicator 13: Number and proportion of TB cases with rifampicin resistance or MDR-TB with treatment completed at 24 months			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	-	-	-	-
2002	-	-	-	-
2003	-	-	-	-
2004	3	75.0	37	52.1
2005	6	75.0	39	62.9
2006	3	100.0	40	50.0
2007	5	50.0	30	42.3
2008	0	0.0	45	57.7
2009	6	85.7	40	51.9
2010	3	42.9	38	48.1
2011	4	57.1	48	50.5
2012	5	83.3	58	61.7
2013	4	44.4	50	58.8
2014	4	66.7	36	52.2
2015	3	75.0	39	58.2
2016	-	-	-	-
2017	-	-	-	-

Year	Indicator 14: Number and proportion of TB cases with rifampicin resistance or MDR-TB lost to follow-up at last reported outcome			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	-	-	-	-
2002	-	-	-	-
2003	-	-	-	-
2004	0	0.0	9	12.7
2005	1	12.5	9	14.5
2006	0	0.0	8	10.0
2007	1	10.0	6	8.5
2008	0	0.0	10	12.8
2009	0	0.0	11	14.3
2010	2	28.6	9	11.4
2011	1	14.3	18	18.9
2012	0	0.0	10	10.6
2013	1	11.1	14	16.5
2014	2	33.3	13	18.8
2015	0	0.0	5	7.5
2016	-	-	-	-
2017	-	-	-	-

Year	Indicator 15: Number and proportion of TB cases with rifampicin resistance or MDR-TB that had died at last reported outcome			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	-	-	-	-
2002	-	-	-	-
2003	-	-	-	-
2004	0	0.0	4	5.6
2005	0	0.0	4	6.5
2006	0	0.0	3	3.8
2007	2	20.0	10	14.1
2008	0	0.0	7	9.0
2009	0	0.0	4	5.2
2010	0	0.0	1	1.3
2011	0	0.0	6	6.3
2012	0	0.0	4	4.3
2013	2	22.2	4	4.7
2014	0	0.0	2	2.9
2015	0	0.0	5	7.5
2016	-	-	-	-
2017	-	-	-	-

Year	Indicator 16: Number and proportion of TB cases offered an HIV test			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	-	-	-	-
2002	-	-	-	-
2003	-	-	-	-
2004	-	-	-	-
2005	-	-	-	-
2006	-	-	-	-
2007	-	-	-	-
2008	-	-	-	-
2009	-	-	-	-
2010	-	-	-	-
2011	-	-	-	-
2012	451	90.2	5,204	93.2
2013	541	87.0	5,788	93.6
2014	547	94.6	5,401	95.4
2015	477	97.0	4,947	96.3
2016	531	96.5	5,016	97.0
2017	445	94.9	4,447	96.1

Year	Indicator 17: Number and proportion of drug sensitive TB cases with at least one social risk factor who completed treatment within 12 months			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	-	-	-	-
2002	-	-	-	-
2003	-	-	-	-
2004	-	-	-	-
2005	-	-	-	-
2006	-	-	-	-
2007	-	-	-	-
2008	-	-	-	-
2009	-	-	-	-
2010	30	60.0	371	73.5
2011	36	67.9	370	71.3
2012	36	75.0	393	74.9
2013	36	76.6	401	77.3
2014	31	67.4	362	74.9
2015	48	80.0	388	74.9
2016	29	61.7	366	76.1
2017	-	-	-	-

Year	Indicator 18: Number and proportion of culture confirmed TB cases with any first line drug resistance			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	17	6.1	193	6.9
2001	13	3.6	224	7.1
2002	20	5.2	297	7.8
2003	13	4.1	308	8.1
2004	19	6.0	326	8.1
2005	25	6.1	346	7.6
2006	19	4.6	370	8.0
2007	31	7.2	332	7.5
2008	21	4.9	305	6.8
2009	23	4.8	369	8.0
2010	28	5.8	321	7.0
2011	32	6.4	413	8.3
2012	24	5.2	358	7.4
2013	29	6.5	332	7.7
2014	30	7.7	286	7.3
2015	17	4.8	253	7.3
2016	23	6.1	263	7.4
2017	29	9.1	265	8.5

Year	Indicator 19: Number and proportion of culture confirmed TB cases with multi-drug resistant TB			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	5	1.8	28	1.0
2001	1	0.3	22	0.7
2002	2	0.5	35	0.9
2003	2	0.6	49	1.3
2004	3	0.9	45	1.1
2005	6	1.4	41	0.9
2006	1	0.2	54	1.2
2007	7	1.6	49	1.1
2008	1	0.2	50	1.1
2009	3	0.6	59	1.3
2010	6	1.2	65	1.4
2011	7	1.4	81	1.6
2012	6	1.3	77	1.6
2013	6	1.3	68	1.6
2014	6	1.5	52	1.3
2015	3	0.8	45	1.3
2016	4	1.1	53	1.5
2017	1	0.3	45	1.4