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England

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# **Tuberculosis in North West England** Annual review (2018 data)

Data from 2000 to 2018

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Data presented in this report are correct as of March 2019, when they were extracted from the Enhanced TB Surveillance (ETS) system; before being cleaned and validated by June 2019.

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## Executive summary

The number of people with TB in England has continued to fall in 2018 to the lowest ever recorded national incidence of 8.3 per 100,000 population. This decline has also been seen within the North West of England, with a regional rate of 6.6 per 100,000 population; also the lowest rate ever recorded.

Tackling TB in underserved populations is a key priority for the TB Control Board in 2019-2020. Those in under-served populations (including migrants, refugees, asylum seekers and those with social risk factors, such as substance misuse, prison history and homelessness) have a higher risk of acquiring tuberculosis. TB control in this group of individuals has become a priority area across England. In the North West, 12.9% of 2018 cases had at least one social risk factor.

The majority of cases with at least one social risk factor were UK born (55.3%) and most of these UK born cases were White (80.8%). Clustering was more common in cases with social risk factors (29.7%) than in cases with no recorded social risk factors (17.2%)

In 2018, 39.9% of TB cases were resident in areas containing the 20% most socio-economically deprived populations in the North West. TB rates were highest among these areas of the North West (8.1 and 10.2 per 100,000 population in the 2 most deprived quintiles) compared with the least socio-economically deprived areas (3.2 per 100,000 population).

In 2018, the majority of TB cases reported in the North West (64.7%) were born outside the UK. Of cases born outside the UK, 22.0% were diagnosed within one year of entry; and 39.7% were diagnosed 11 or more years after entry.

Among 529 drug sensitive TB cases notified in 2017, 83.1% of those with an expected treatment duration of less than 12 months completed treatment within 12 months; a slight reduction compared to 2016 cases.

The data presented in this report, alongside recommendations made, highlight the challenges we face within the North West. Despite a positive trend in overall rates, a number of issues remain. The largest burden of disease falls in those populations which are socio-economically disadvantaged, although most new TB cases in the North West were born outside the UK.

Continued efforts to control TB in these groups represent an opportunity to reduce health inequalities, and this focus is reflected in this report's recommendations.

# Recommendations

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

1. TB rates were highest among the most socio-economically deprived areas of the North West (8.1 and 10.2 per 100,000 population in the 2 most deprived quintiles), compared with the least socio-economically deprived areas (3.2 per 100,000 population). Additionally, a high proportion of cases (38.9%) 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.
2. Overall, the proportion of cases with social risk factors has remained fairly consistent since 2009, although cases with social risk factors are more likely to be part of clusters. This highlights 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.
3. Of cases born abroad who were notified in 2018, a substantial 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 reduce the risk of future development of active disease. Work should continue to raise awareness about TB in migrant communities and their health care providers.
4. Almost two thirds of pulmonary cases in the North West started TB treatment within 4 months of symptom onset; however, this means that over 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.
5. Every effort should be made to increase the proportion of sputum smear results among pulmonary cases to enable better TB control.
6. 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.
7. 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; and the mechanism by which these improvements should be achieved. The North West TB Control Board (covering Greater Manchester, Cumbria, Lancashire, 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 performance and support development of local TB action plans.
8. The NHS should offer HIV testing for all those diagnosed with tuberculosis; and ensure that tests are done in line with national guidance [4].

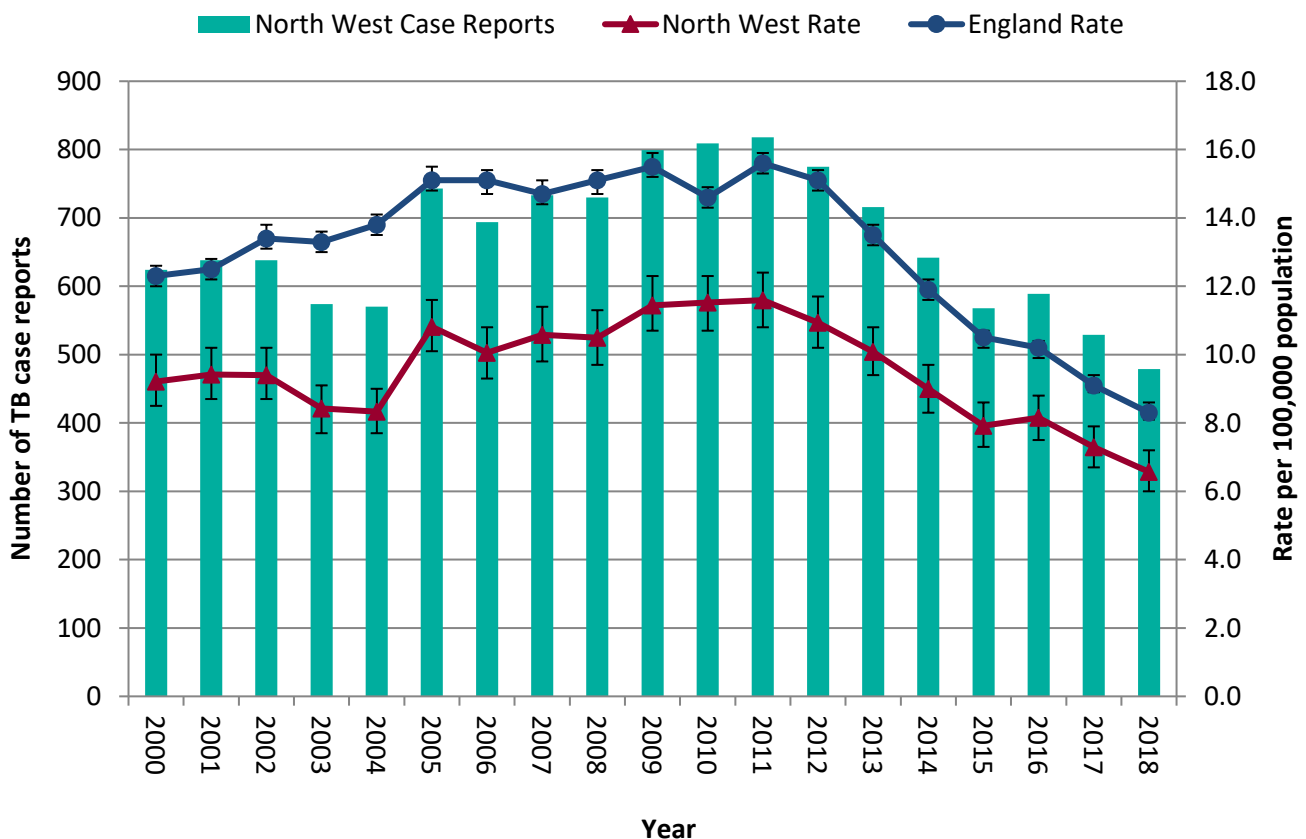
# 1. TB notifications and incidence

## Overall numbers, rates and geographical distribution

In 2018, 479 tuberculosis (TB) cases were reported among North West residents; a rate of 6.6 per 100,000 population (95% confidence interval (CI) 6.0-7.2). This was a 9.5% decrease compared to 2017 (529 cases; rate of 7.3 per 100,000 population, 95% CI 6.7-7.9). The North West TB rate remained below the England rate of 8.3 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 to 2018**



\* Error bars represent upper and lower 95% confidence intervals.

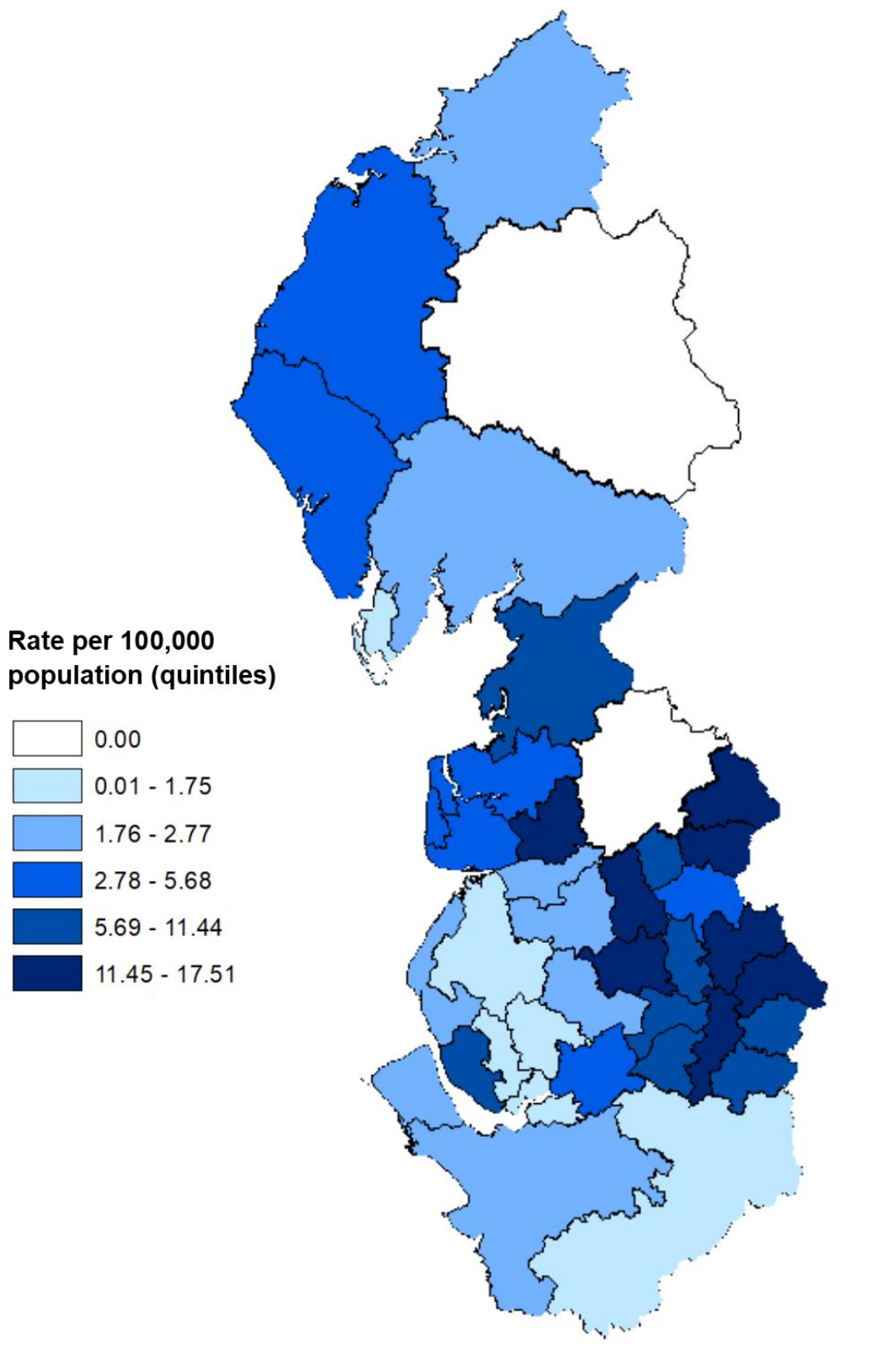
Among North West upper tier local authorities, the highest rates were in Pendle at 17.5 per 100,000 and Manchester at 16.4 per 100,000 population. The most significant changes in incidence occurred in Pendle, where rates increased from 9.9 per 100,000 population in 2017 to 17.5 per 100,000 population in 2018 (from 9 to 16 cases); and in

Blackburn with Darwen, where rates decreased from 21.5 per 100,000 population in 2017 to 12.8 per 100,000 population in 2018 (from 32 to 19 cases).

In 2018, 2 of the 39 North West local authorities had zero notifications of TB: Eden and Ribble Valley.



**Figure 2: TB rate per 100,000 population by local authority of residence, North West, 2018**



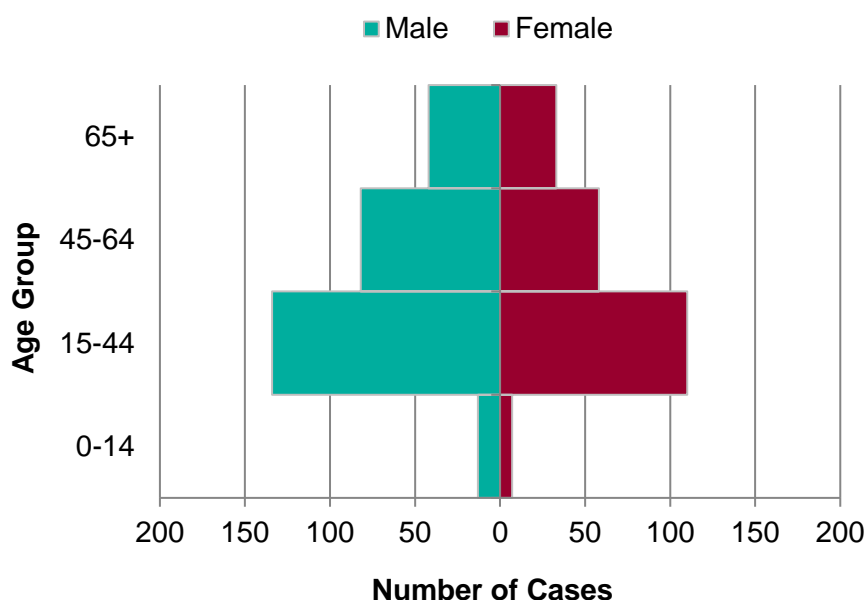
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## Demographic characteristics

### Age and sex

In 2018, 56.6% of North West TB cases were male, and rates among males were higher than in females (7.5 per 100,000 in males and 5.6 per 100,000 in females); a consistent pattern from previous years. There was a greater proportion of males than females across all age groups. There were 20 cases of TB reported in children aged 0-14 years; fewer than in the previous year (29 cases reported in 2017).<sup>1</sup>

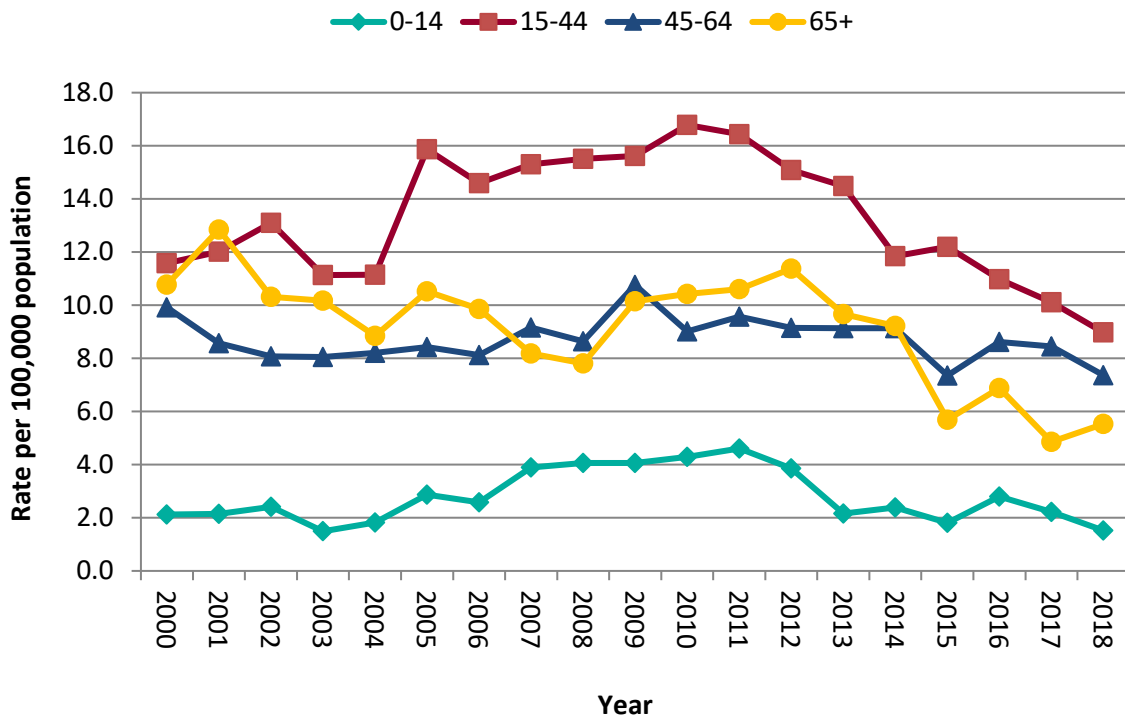
**Figure 3: TB case reports by age and sex, North West, 2018**



Rates were highest in residents aged 15-44 years (Figure 4). The rate in the 15-44 age group decreased slightly from 10.1 per 100,000 in 2017 to 9.0 per 100,000 in 2018. The rate in the 65+ age group increased slightly from 4.9 per 100,000 population in 2017 to 5.5 per 100,000 population in 2018.

<sup>1</sup> Twenty-seven cases aged 0-17 years were reported in 2018; an incidence of 1.7 per 100,000 population (compared with 37 cases and an incidence of 2.4 per 100,000 population reported in 2017).

**Figure 4: TB case rates by age group, North West, 2000 to 2018**



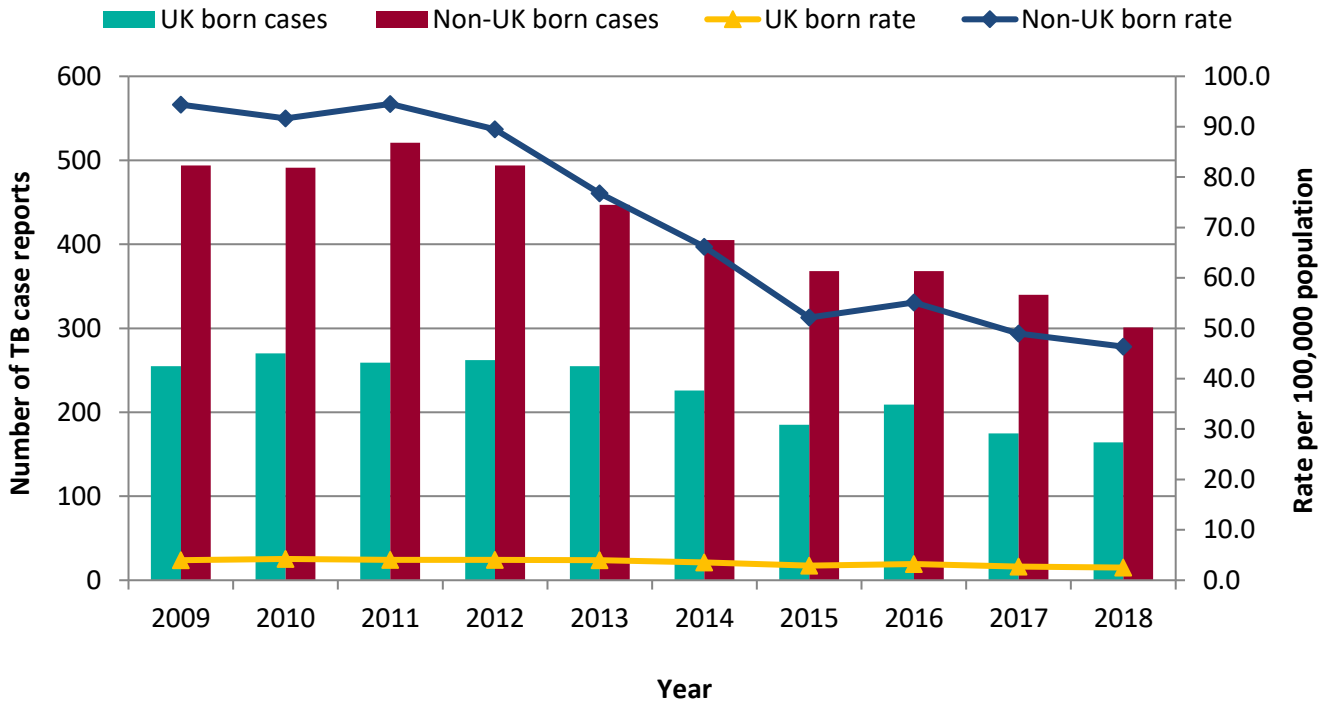
**Place of birth and time since entry to the UK**

In 2018, place of birth was known for 97.1% (465/479) of North West TB cases. Of these, 35.3% (164/465) were born in the UK; a similar proportion to previous years (34.0% in 2017; 36.2% in 2016).

In line with national trends [1], the rate of TB in the non-UK born population was considerably higher than the rate of TB among those born in the UK. In 2018, the rate in the non-UK born population was 18 times higher than the rate in the UK born, at 46.4 per 100,000 (Figure 5); lower than the previous year (49.0 per 100,000 in 2017). The rate in the UK born population remained low at 2.5 per 100,000 in 2017 (2.7 per 100,000 in 2017).

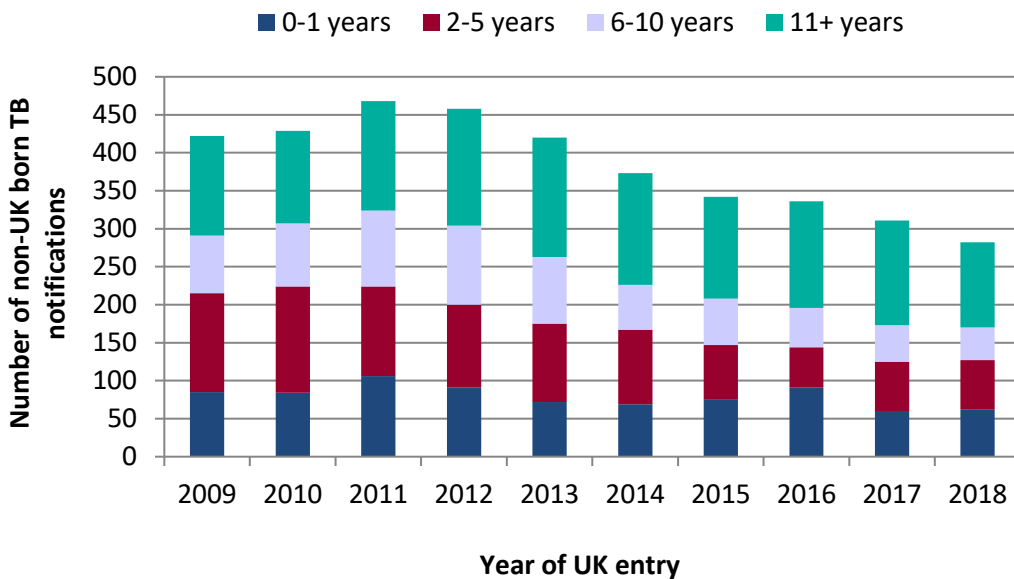
**TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations**

**Figure 5: TB case reports and rates by place of birth, North West, 2009 to 2018**



Year of entry was reported for 93.7% (282/301 cases) of non-UK born cases in 2018. Of these, 22.0% were notified less than 2 years after entry and 23.0% were notified 2 to 5 years after entry; meaning that, overall, 45.0% were notified within 5 years of entering the UK. A further 15.2% were notified 6-10 years after entry and 39.7% (112/282) 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, 2009 to 2018\***



\* Where year of entry was recorded.

Approximately one third of non-UK born TB cases reported in the North West in 2018 were born in Pakistan (Table 1), similar to the previous year (33.2% in 2017 compared with 33.0% in 2018). The proportion of cases originating from India has gradually decreased since 2014 (from 20.1% in 2014 to 14.1% in 2018).

**Table 1: Most common countries of birth of non-UK born TB cases, North West, 2018**

Country of birth	Number of cases	Proportion of cases*	Median time in years since entry to UK (IQR)**
Pakistan	98	33.0%	11 (3-23)
India	42	14.1%	13 (7-39)
Romania	20	6.7%	2 (0-3)
Eritrea	11	3.7%	2 (0-3)
Sudan	10	3.4%	1 (0-3)
Somalia	9	3.0%	4 (1-11)
Bangladesh	8	2.7%	7 (1-10)
Others (each < 2.5%)	99	33.3%	5 (1-14)
Total*	297	100.0%	6 (1-15)

\*Where country of birth was known

\*\*Interquartile range

Among the most common countries of birth for non-UK born TB cases in 2018, those born in Romania, Eritrea and Sudan had the shortest median time between entry to the UK and TB notification; the country with the longest median time between entry to the UK and notification was India (13 years; IQR 7-39 years).

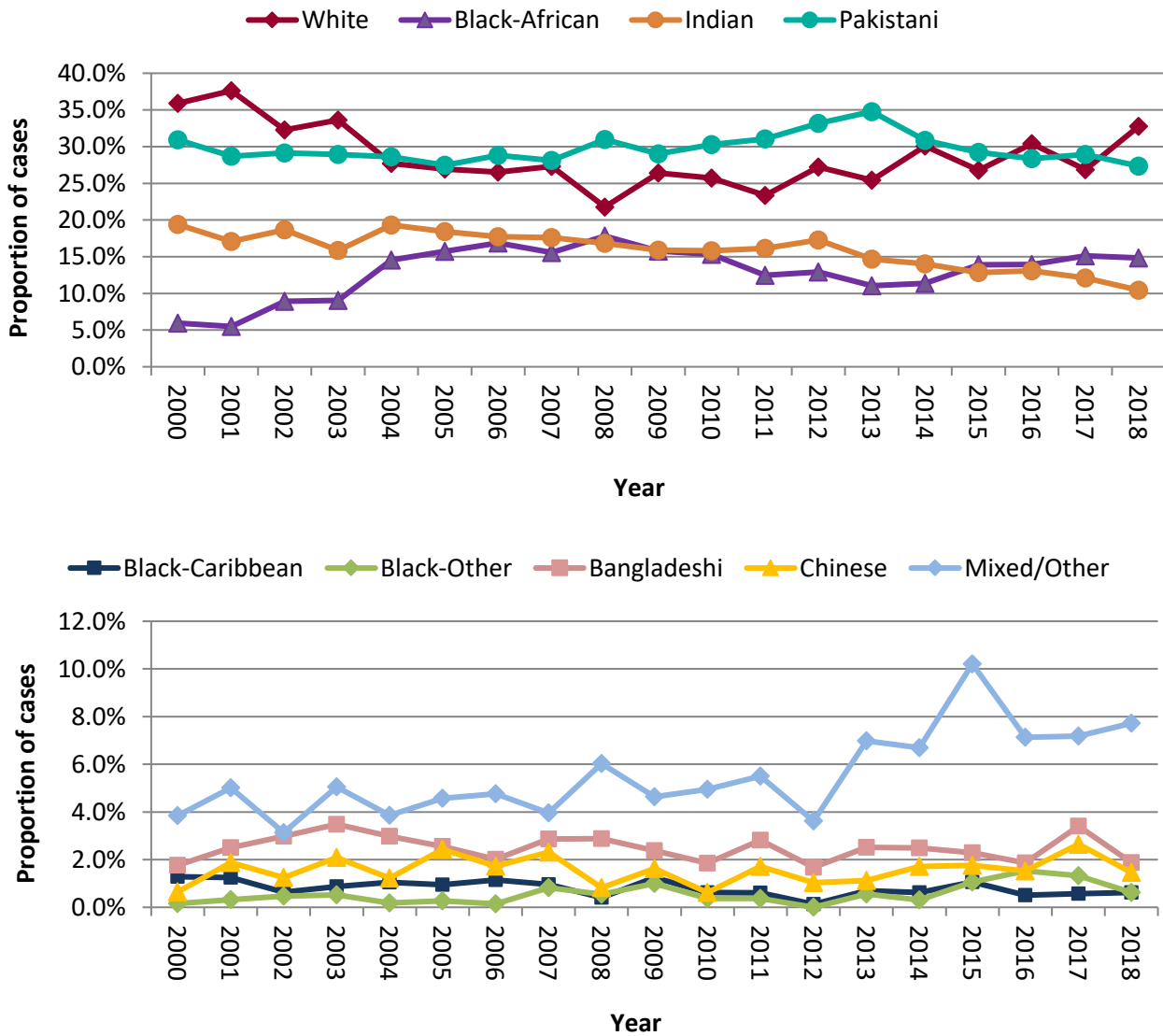
## Ethnic group

In 2018, ethnicity was known for 97.7% (468/479) of cases. The most common ethnic groups among all tuberculosis cases in the North West were the White and Pakistani ethnic groups (Figure 7). The proportion of White cases increased from 26.8% in 2017 to 32.8% in 2018. There were small decreases in the proportion of cases with Pakistani ethnicity (from 28.9% in 2017 to 27.3% in 2018) and Indian ethnicity (from 12.1% in 2017 to 10.4% in 2018).

Cases in the White ethnic group were more likely to be clustered (36.9%, 38/103) than those in non-White ethnic groups (9.1%, 18/198).

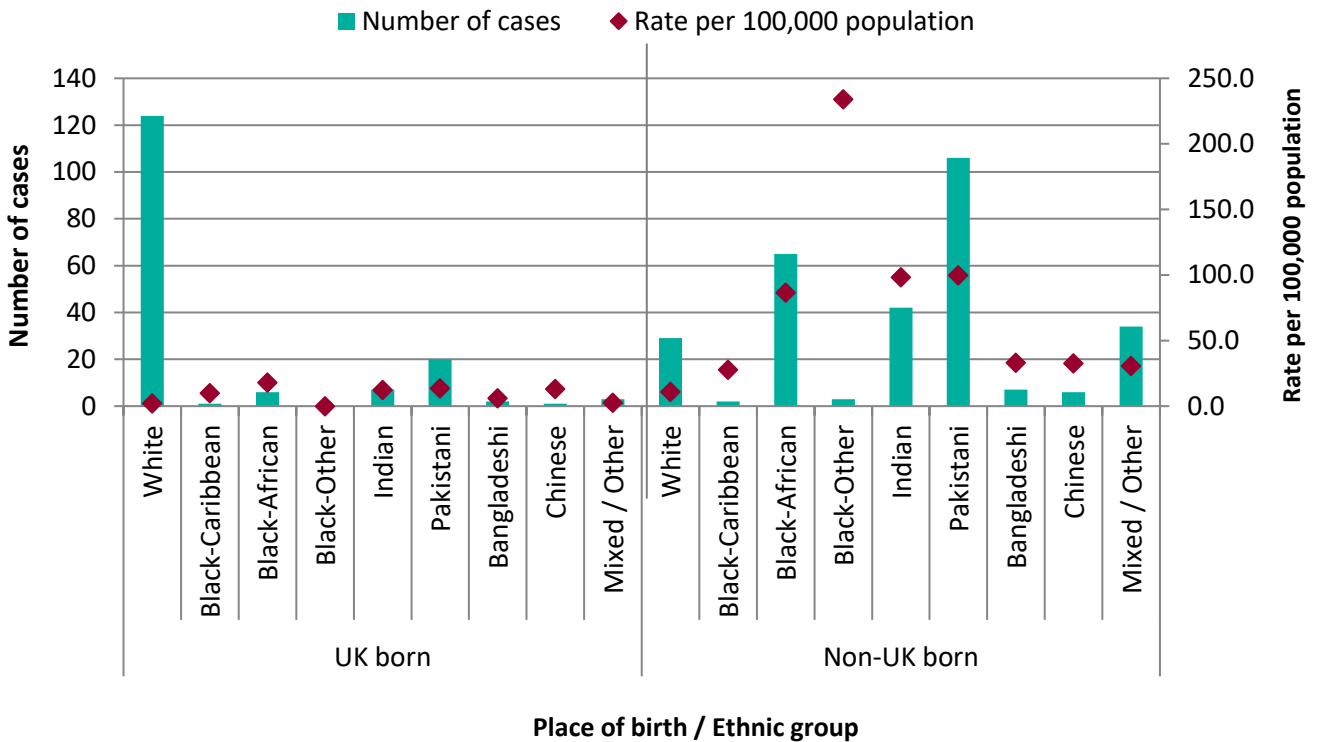
In terms of overall annual numbers, 7 of the 9 ethnic groups showed a decrease between 2017 and 2018. Numbers in the Pakistani ethnic group decreased by 14.4% (from 153 to 131 cases); in the Indian ethnic group by 21.9% (from 64 to 50 cases); and in the Black-African ethnic group by 11.3% (from 80 to 71 cases). Numbers in the White ethnic group increased by 10.6% (from 142 to 157 cases).

**Figure 7: Proportion of TB cases by ethnic group, North West, 2000 to 2018**



Of UK born TB cases in 2017, the greatest proportion (75.6%, 124/164) were in the White ethnic group, followed by the Pakistani ethnic group (12.2%, 20/164). Among the non-UK born, 36.1% (106/294) were in the Pakistani ethnic group; 22.1% (65/294) were in the Black-African ethnic group; and 14.3% (42/294) were in the Indian ethnic group.

**Figure 8: TB case numbers and incidence by ethnic group and place of birth, North West, 2018**



Among UK born TB cases in 2018, the highest rate occurred in the Black-African ethnic group (18.0 per 100,000 population, 6 cases), followed by the Pakistani ethnic group (13.7 per 100,000 population, 20 cases). Rates were highest among those born outside the UK (Figure 8), with the highest rates occurring in the Black-Other ethnic group (234.0 per 100,000 population, 3 cases) and the Pakistani ethnic group (99.8 per 100,000 population, 106 cases).

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

### Occupation

In 2018, occupation information was known for 88.2% (337/382) of North West TB cases aged between 18 and 65 years; similar to the previous year (87.1% known in 2017). Of these, 38.9% (131/337) were not in education or employment; 8.3% (28/337) were either studying or working in education; 8.0% (27/337) were healthcare workers; and the remaining cases (44.8%, 151/337) were working in other occupations.

<sup>2</sup> 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.

A significant proportion of TB cases working in healthcare (77.8%, 21/27) were born outside the UK.

## Clinical characteristics

### Site of disease

In 2018, site of disease was known for 99.6% of TB cases in North West England. Of these cases, 55.1% had pulmonary disease (Table 2), similar to the national level of 57.3% [1]. Of the 263 pulmonary cases, 77.2% (203 cases) were culture confirmed (compared with 75.1% in 2017). The most common extra-pulmonary site was extra-thoracic lymph nodes. Most extra-pulmonary cases notified in 2018 were born outside the UK (74.8%, 160/214).

**Table 2: Site of disease of TB cases, North West, 2018**

Site of disease*	Number of cases	Proportion of cases
Pulmonary	263	55.1%
Miliary	12	2.5%
Laryngeal	1	0.2%
Extra-pulmonary	214	44.9%
Extra-pulmonary (unknown)	122	25.6%
Lymph nodes (extra-thoracic)	102	21.4%
IT lymph nodes	74	15.5%
Extra-pulmonary (other)	41	8.6%
Pleural	35	7.3%
Gastrointestinal	26	5.5%
Bone (spine)	11	2.3%
Genitourinary	10	2.1%
CNS meningitis	8	1.7%
CNS (other - not meningitis)	8	1.7%
Bone (other - not spine)	4	0.8%
Cryptic	1	0.2%

\* With or without disease at another site



## Previous diagnosis of tuberculosis

Information on previous history of TB was known for 93.3% (447/479) of North West cases in 2018. Of these, 6.5% (29/447) 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 69.0% (20/29) of cases; of these, 100.0% (20/20) had previously received treatment.

## 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 263 pulmonary cases in the North West in 2018, 56.3% (148/263) had a sputum smear result reported; a similar proportion to previous years and lower than national levels (65.3%) [1]. Among cases with a known sputum smear result, 60.8% (90/148) were positive; 97.8% (88/90) of those with a positive sputum smear were also culture confirmed.

### Culture confirmation and speciation

A total of 64.9% (311/479) of all cases in 2018, both pulmonary and extra-pulmonary, were confirmed by culture in the North West; compared with 61.2% nationally [1]. Of the 263 pulmonary cases, 77.2% (203/263) were culture confirmed; similar to national levels (74.0%) [1]. Among extra-pulmonary cases in the North West, 50.5% (108/214) were culture confirmed, higher than national levels (44.2%) [1].

Culture confirmation was 40.0% (8/20) in those aged 0-14 years, lower than in other age groups (57.1% and over); most cases in this age group had pulmonary disease (75.0%, 6/8). There was also variation among North West local authorities (LAs): almost two thirds (64.9%, 24/37) of LAs with TB notifications in 2018 had culture confirmation for at least 60.0% of cases.

Among all culture confirmed cases, 98.7% (307/311) were identified with *Mycobacterium tuberculosis* (*M. tuberculosis*) infection; 0.6% (2/311) with *Mycobacterium microti* (*M.*

*microti*); 0.3% (1/311) with *Mycobacterium bovis* (*M. bovis*); and 0.3% (1/311) with *Mycobacterium africanum* (*M. africanum*).

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

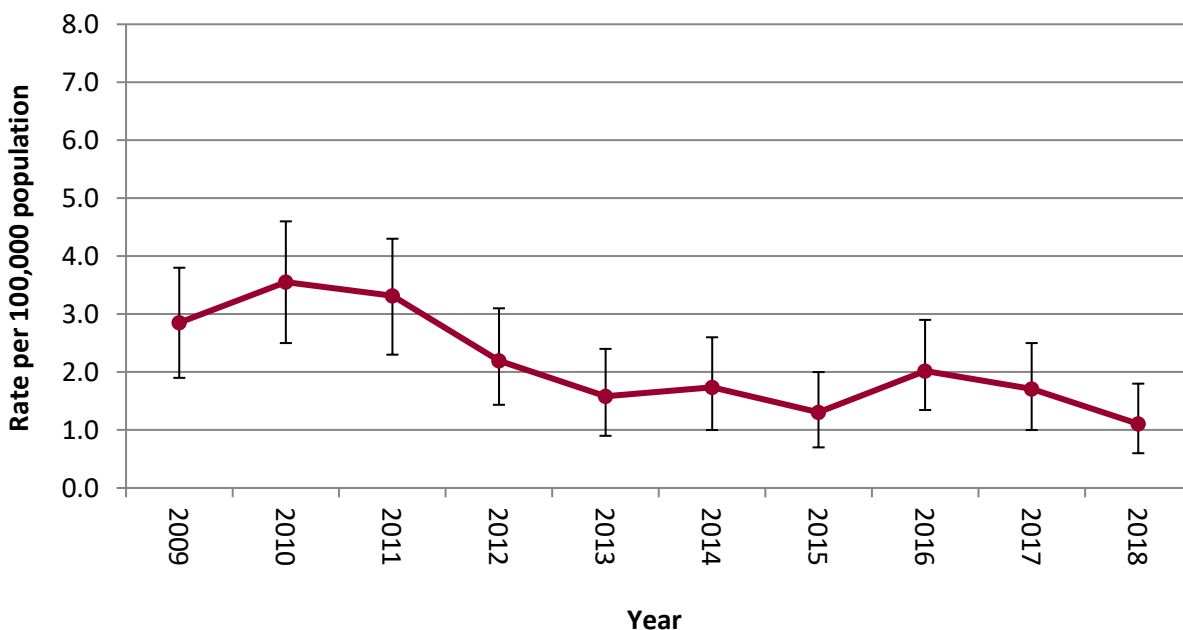
### 3. TB transmission

#### 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 1.1 per 100,000 in 2018, lower than in the previous year (1.7 per 100,000 in 2017). This is an overall decrease since the peak of 3.6 per 100,000 in 2010 (Figure 9) and is similar to the national rate of 1.2 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, 2009 to 2018**



\* Aged 0-14 years. Rates calculated using 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 2018, 311 cases of TB were confirmed by culture in the North West. Of those, 97.1% (302/311) had a WGS result that could be used to report relatedness (based on sequencing coverage and quality). Among those, 21.9% (66/302) were clustered with at least one other individual in England at a cut-off of 12 SNPs. 16.9% (51/302) were clustered at a cut-off of 5 SNPs, and 12.6% (38/302) were clustered at a cut-off of 2 SNPs.

18.5% (56/302) cases were clustered with at least one other individual within the North West at a cut-off of 12 SNPs. 14.9% (45/302) were clustered at a cut-off of 5 SNPs, and 11.6% (35/302) were clustered at a cut-off of 2 SNPs.

## Size of clusters

Of cases clustering within the North West at a 12 SNP cut-off, 53.6% (30/56) consisted of only 2 cases; 46.4% (26/56) consisted of 3-4 cases. The median cluster size was 2 cases (range 2 to 4 cases). Cluster sizes will grow as more years of data are accumulated.

## Cluster lineage

In 2018, 80.4% (45/56) of cases clustering in the North West with a 12 SNP cut-off had strains of Euro-American lineage, while 19.6% (11/56) were of Delhi Central Asian lineage.

### Characteristics of cases in clusters<sup>3</sup>

Of the 56 cases notified in 2018 which clustered within the North West at a 12 SNP cut-off, 58.9% (33/56) were male and 58.9% (33/56) were aged 15 to 44 years. Children aged under 15 years comprised 5.4% (3/56) of clustered cases.

The proportion of clustering at 12 SNPs was higher among those born in the UK (72.2%, 39/54) compared with outside the UK (27.8%, 15/54). Of those born outside the UK, 69.2% (9/13) were notified within 5 years of entering the UK. Most clustered North West cases notified in 2018 were in the white ethnic group (67.9%, 38/56).

Among 2018 cases clustering at 12 SNPs within the North West, 87.5% (49/56) had pulmonary TB. Of those, 51.0% (25/49) were smear positive; however, this figure is distorted by the fact that sputum smear results were missing for 32.7% (16/49) of pulmonary cases.

Those with a previous diagnosis of TB comprised 7.1% (4/56) of clustered North West cases (12 SNPs). Cases with at least one social risk factor (current or previous history of prison, homelessness, alcohol use and/or drug use) comprised 22.9% (11/48); however, 77.1% (37/48) recorded having no social risk factors. Isoniazid resistance was observed in 3.6% (2/56) of cases.

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<sup>3</sup> Relating to cases notified in 2018 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 start of treatment was available for 82.5% of North West cases notified in 2018. The median number of days between symptom onset and treatment start was 92 (Table 4). This was lower among those with pulmonary disease at 79 days, and higher among extra-pulmonary cases at 105 days. Among pulmonary cases, 40.2% (86/214) were treated within 2 months of symptom onset, and 65.4% (140/214) were treated within 4 months.

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

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

**Table 3: Time between symptom onset and treatment start\*, North West, 2018**

	Median days (IQR)	0-2 months		2-4 months		>4 months	
		n	%	n	%	n	%
Extra-pulmonary	105 (54-214)	55	31.1%	47	26.6%	75	42.4%
Pulmonary	79 (37-168)	86	40.2%	54	25.2%	74	34.6%
Pulmonary smear positive	61 (32-139)	40	50.0%	18	22.5%	22	27.5%
All Cases	92 (46-183)	142	36.2%	101	25.8%	149	38.0%

\* 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 29.8% of males and 41.1% of females. Of the 35 local authorities with notifications of pulmonary TB in 2018, 9 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 (40.0%) were treated within 2 months of symptom onset; similarly, the greatest proportion of non-UK born pulmonary cases (40.3%) were treated within 2 months of symptom onset.

There was also variation among ethnic groups: 38.9% (37/95) of cases (with known onset and treatment dates) in the White ethnic group were treated within 2 months of symptom onset, compared with 35.8% (34/95) with treatment delays of more than 4 months. In the Black-African ethnic group, 60.9% (14/23) were treated within 2 months of symptom onset, while 13.0% (3/23) had treatment delays of more than 4 months. Half of the cases in the 'Mixed/Other' ethnic group had a treatment delay of more than 4 months (10/20).

## 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, 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
- 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: Proportion of drug sensitive TB cases with full course of treatment completed by 12 months**

In 2017, 529 TB cases were notified in the North West; 90.4% (478/529) 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 83.1% (397/478), which was slightly lower than the previous year (Figure 11).

**Figure 10: Treatment completion at 12 months for drug sensitive cases with expected treatment duration of 12 months or less, North West, 2006 to 2017\***



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

Among cases that did not complete treatment within 12 months (16.3%, 78/478), the most common reasons for not completing treatment were still being on treatment (6.3%, 30/478) and death (5.2%, 25/478).

**Table 4: TB outcome at 12 months for drug sensitive cases with expected treatment duration of 12 months, North West, cases notified in 2017\***

TB outcome	n	%
Treatment completed	397	83.1%
Died	25	5.2%
Lost to follow up	19	4.0%
Still on treatment	30	6.3%
Treatment stopped	4	0.8%
Not evaluated**	3	0.6%
Total	478	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

Among the 25 deaths, the relationship between TB and death was unknown for 48.0% (12/25). Among the 13 cases for which information was recorded, TB caused 3 deaths;



contributed to 5; and was incidental to 5. The median age of those who died was 52 years; 7 cases (28.0%) were diagnosed at post-mortem.

Older cases were less likely to complete treatment: 71.4% (40/56) of those aged 65 years or older completed treatment within 12 months, compared with at least 87.0% of cases in the 0-14 and 15-44 years age groups. The 65+ years age group also had a higher proportion of deaths (16.1%, 9/56).

Treatment completion was 84.4% (260/308) among the non-UK born, and slightly lower in the UK born at 81.4% (127/156). A greater proportion of UK born cases died before completing treatment (8.3%, 20/196) than those born abroad (4.3%, 13/156). The proportion of females completing treatment within 12 months was 85.5% (159/186), compared with 81.5% (238/292) of males.

**TB Monitoring Indicator 17: Number and 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, 88.1% (289/328) completed treatment within 12 months, compared with 67.6% (25/37) of cases with known risk factors.

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

Of the 49 cases with CNS, spinal, miliary or cryptic disseminated disease in 2017, 73.5% (36/49) had completed treatment at the last recorded outcome (Table 6). 61.2% (30/49) completed treatment within 12 months, while 18.4% (9/49) remained on treatment; 12.2% (6/49) completed treatment after 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 notified in 2017\***

TB outcome	n	%
Treatment completed	36	73.5%
Died	6	12.2%
Lost to follow up	2	4.1%
Still on treatment	3	6.1%
Treatment stopped	2	4.1%
Not evaluated**	0	0.0%
Total	49	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 6 deaths, TB caused death in one case, contributed to death in 3 cases and was incidental to death in one case. In one case, 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 2017, ranging from 4.5% to 8.8% overall. Of the 527 drug sensitive cases notified in 2017, 32 cases (6.1%) died. Of these, the relationship between TB and death was unknown for 40.6% (13/32). TB contributed to 28.1% (9/32) of deaths; was incidental to 18.8% (6/32) of deaths; and caused 12.5% (4/32) of deaths. 40.6% (13/32) 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. 4.0% (21/527) of cases were lost to follow up in 2017. Of these, 85.7% (18/21) were born outside the UK; and 52.4% (11/21) had left the UK. Males accounted for 81.0% (17/21) of cases lost to follow up; 85.7% (18/21) of cases were in the 15-44 age group.

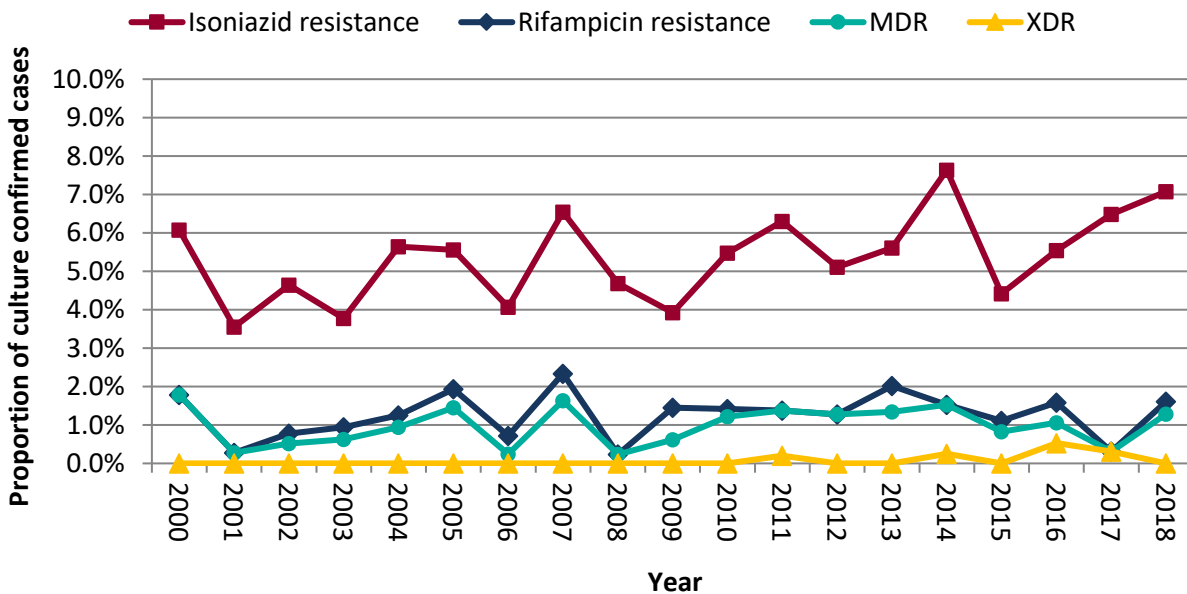
## 6. Drug resistant TB (including outcomes in the drug resistant cohort)

### Drug resistance

Resistance to one or more TB antibiotic drugs 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 one injectable agent and at least one fluoroquinolone [10].

In 2018, 13.8% (43/311) of culture confirmed North West TB cases were resistant to one or more first line drugs. 7.1% (22/311 cases) had isoniazid resistance (Figure 11); an increase from previous years (5.5% in 2016; 6.5% in 2017) which is also reflected nationally [1]. A further 1.6% (5/311 cases) were rifampicin-resistant and 1.3% (4/311) were classified as MDR-TB, similar to previous years.

**Figure 11: Proportion of drug resistant TB cases, North West, 2000 to 2018\***



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

Most drug resistant cases were aged between 15 and 44 years (55.8%, 24/43), with similar proportions of males (48.8%, 21/43) and females (51.2%, 22/43). Most cases had pulmonary disease (60.5%, 26/43); and, of these, 42.3% (11/26) had a positive sputum smear result.

Of drug resistant cases notified in 2017, 65.5% (19/29) had completed treatment at the last recorded outcome, compared with 87.0% (20/23) in 2016. The most common reasons for not completing treatment were still being on treatment (20.7%, 6/29) and death (10.3%, 3/29).

### TB outcome at 24 months for cases with rifampicin resistant disease

In 2016, 6 culture confirmed cases had rifampicin resistant TB, and 4 of these cases also had MDR-TB. Three MDR cases were non-UK born males aged 15-44 years.

At 12 months, one of the 6 rifampicin resistant cases had completed treatment; 4 were still on treatment and one was lost to follow up. At 24 months, 3 cases 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 2016**

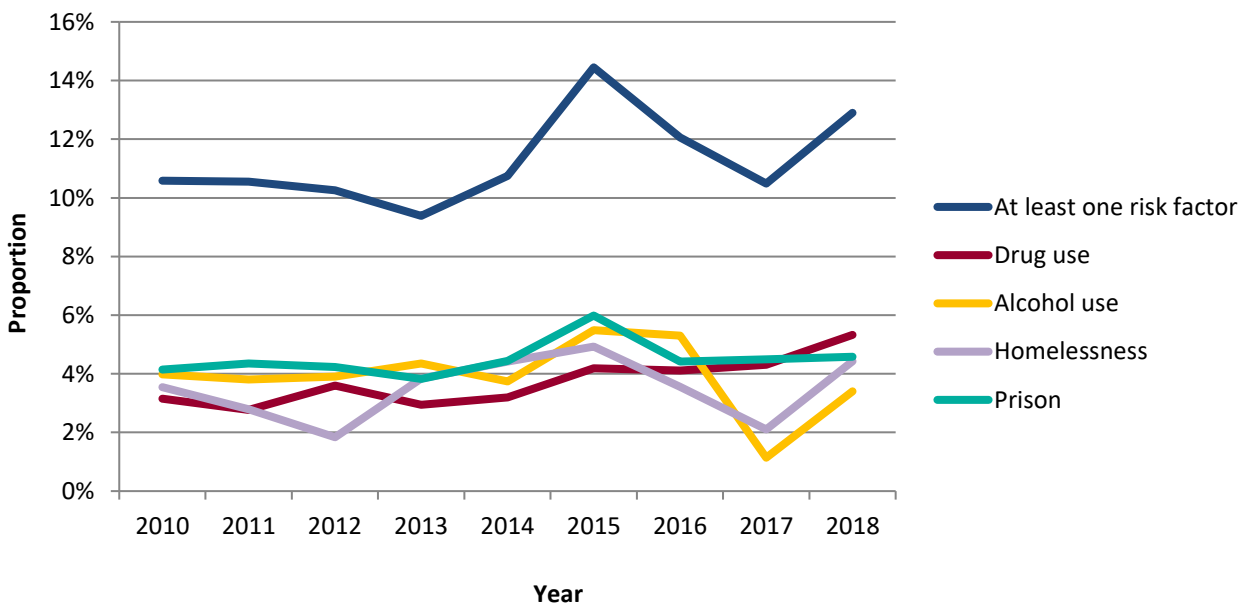
<b>TB outcome</b>	<b>n</b>	<b>%</b>
Treatment completed	4	66.7%
Died	0	0.0%
Lost to follow up	1	16.7%
Still on treatment	1	16.7%
Treatment stopped	0	0.0%
<b>Total</b>	<b>6</b>	<b>100.0%</b>

## 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 2018, information on social risk factors was recorded for 81.0% (372/459) of TB cases in the North West aged 15 years and over, and 12.9% (48/372) of these cases had at least one social risk factor (Table 8). Where information on individual risk factors was known, 5.3% (22/413) reported drug use; 4.6% (17/371) reported imprisonment, 4.4% (18/406) reported homelessness; and 3.4% (14/411) reported alcohol misuse.

**Figure 12: Social risk factors among TB cases\*, North West, 2010 to 2018**



\* 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 (91.7%, 44/48) and 52.1% (25/48) were in the 15 to 44 years age group. Over half of cases (55.3%, 26/47) with at least one social risk factor were UK born; lower than the previous year (63.2%, 24/38, in 2017). Among UK born cases, 80.8% (21/26) 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 occurred in the Black-African ethnic group (47.6%, 10/21).

Clustering was more common in cases with social risk factors. Among culture confirmed cases with at least one social risk factor, 29.7% (11/37) were clustered with another North West case at a cut-off of 12 SNPs. In culture confirmed cases with no recorded social risk factors, only 17.2% (37/215) were clustered with another North West case at a cut-off of 12 SNPs.

Directly observed therapy (DOT) was received in 36.9% (14/39) of 2018 cases with at least one social risk factor (for cases where use of DOT was recorded). Of those, 8 cases had current or previous imprisonment; 8 had current or previous homelessness; 6 cases had current or previous history of alcohol use; and 5 cases had current or previous drug use. Nine of the 14 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 2017 had died at the last recorded outcome (15.4%, 6/39) compared to cases with no social risk factors (3.3%, 12/360).

### Socio-economic deprivation

In 2018, 39.9% (191/479) of TB cases were resident in the most socio-economically deprived areas of the North West, compared to only 7.5% (36/479) 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 (8.1 and 10.2 per 100,000 population, respectively) compared with the least socio-economically deprived quintile (3.2 per 100,000 population).

**Figure 13: Rate of TB by socio-economic deprivation quintile\*, North West, 2018**



\* 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

Information on HIV testing was available for 92.9% (418/450) of North West cases reported in 2018 (with previously unknown HIV status and excluding those diagnosed post-mortem). Of these, 94.5% (395/418) were offered and received an HIV test; similar to previous years (94.3% in 2017 and 96.0% in 2016). The remaining cases did not receive a test: 4.5% (19/418) were not offered a test; 0.7% (3/418) were offered a test but did not receive it; and 0.2% (1/418) refused testing.

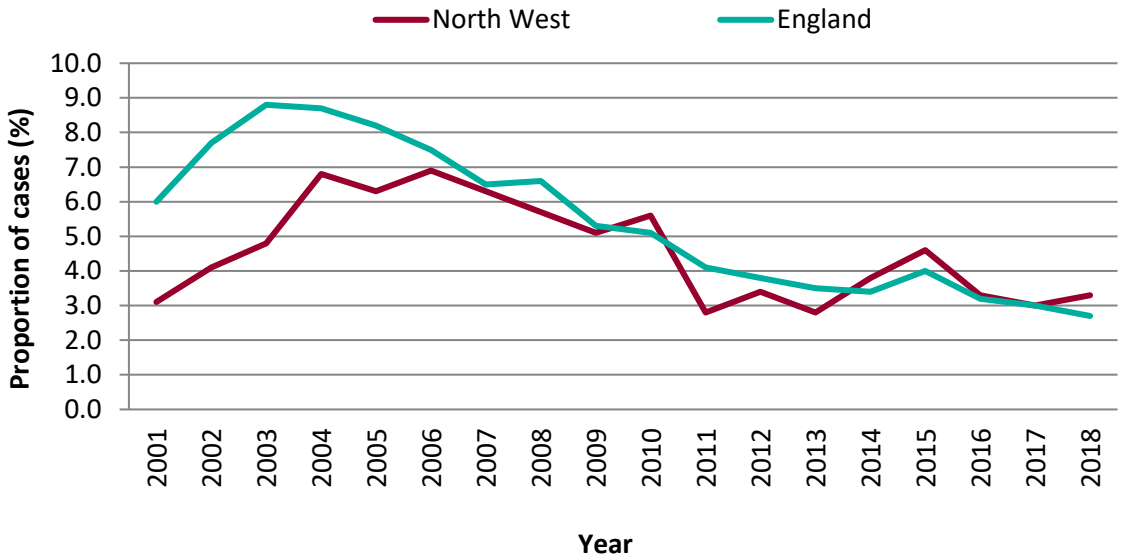
Cases born outside the UK were more likely to be offered a test (97.3%, 256/263) than UK born cases (93.1%, 134/144). Cases in certain age groups were also more likely to be offered a test: 92.5% (211/228) of cases in the 15-44 years age group were offered an HIV test, compared with 82.2% (60/73) of cases aged 65 years and over and 80.0% (16/20) 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% (15/16) in Pendle to 100.0% in Blackburn with Darwen (18/18) and Oldham (30/30). In 26 of the 37 local authorities (70.3%) where TB cases were notified in 2018, 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). In 2018, 3.3% of North West TB cases aged 15 years and over were co-infected with HIV, similar to the proportion of co-infected cases across England (2.7%) [1].

**Figure 14: Proportion of notified and un-notified TB cases matched to an HIV case\*, North West and England, 2001 to 2018**



\* 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 41.1% (197/479) of North West cases in 2018; similar to previous years. The proportion of cases with known BCG vaccination status was higher in younger age groups: 75.0% (15/20) in cases aged 0-14 years, compared with 33.6% to 42.6% of cases aged 15 and over. Of cases with known information, 64.0% (126/197) had reportedly received BCG vaccination (73.3%, 11/15, for cases aged 0-14 years).<sup>4</sup>

BCG vaccination data was available for 47.0% (77/164) of UK born cases, compared with 39.2% (118/301) of cases born outside the UK. Among cases with available information, 68.8% (53/77) of UK born cases had received BCG vaccination, a higher proportion than in cases born outside the UK (60.2%, 71/118).

<sup>4</sup> Information was recorded for 66.7% (18/27) of cases aged 0-17 years; 72.2% (13/18) 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<sup>5</sup> 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].

Treatment data was available for 3 North West CCGs in 2018: Blackburn with Darwen CCG, Bolton CCG and Manchester CCG. Treatment uptake increased in all 3 areas from the previous year (a trend which is reflected nationally), and varied between 72.2% and 93.6%. The proportion of eligible cases completing treatment was available for Blackburn with Darwen CCG only; this remained similar to previous years at 78.0%. Nationally, treatment completion decreased from 65.7% in 2017 to 58.3% in 2018 [1].

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) [1].

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<sup>5</sup> High incidence is here defined as >20.0 cases per 100,000; high burden is defined as  $\geq 0.5\%$  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 9.9% between 2017 and 2018, reflecting a decrease of 11.5% among non-UK born TB cases and 6.3% 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, as well as increased risk of transmission to others.

The ethnic groups with the highest proportion of cases were the White and Pakistani ethnic groups. Of cases born abroad who were notified in 2018, the greatest proportion had been resident in the UK for at least 11 years, demonstrating the importance of timely identification and treatment of migrants arriving from high incidence TB countries who have latent TB infection, and maintaining awareness about TB among migrant populations. Cases in the White ethnic group and cases with social risk factors were more likely to be in clusters. This highlights the importance of targeting these groups as, in addition to having increased risk of transmission, they are likely to be more complex to manage, therefore increasing demand on services.

Rates across most age groups decreased in 2018, with a small increase 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 (between 9.4% and 14.4%) 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 2018 had a sputum smear result, consistent with previous years. This is an important indication of infectiousness and should be obtained for all cases where possible.

In 2018, 21.9% 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 England level; 18.5% were clustered with other cases within the North West. The median size of North West clusters was only 2 cases.

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 decreased slightly to 83.1% (among cases notified in 2017). One of the most commonly reported reasons for not completing treatment was death; but, for many 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 94.5% in 2018; 4.5% 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 92.9% of cases; and in 26 of the 37 local authorities where TB was notified in 2018, 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 [www.gov.uk/government/publications/tuberculosis-in-england-annual-report](http://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: UK, 2000 to 2018'. This is available at [www.gov.uk/government/statistics/reports-of-cases-of-tb-to-uk-enhanced-tuberculosis-surveillance-systems](http://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 [www.gov.uk/government/publications/collaborative-tuberculosis-strategy-for-england](http://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 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).

Data from the HIV and AIDS Reporting System (HARS) were matched with TB data for those aged 15 years and above, to determine cases of TB-HIV co-infection.

### 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 June 2019.



## Proportions

All proportions in this report are calculated using a denominator of 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/qifs.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.

## Appendix C: TB among North West residents

**Table Bi: TB case numbers by local authority of residence, North West, 2009 to 2018**

Local Authority	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Allerdale	0	<5	0	<5	<5	<5	<5	<5	<5	5
Barrow-in-Furness	<5	<5	<5	5	<5	<5	<5	<5	0	<5
Blackburn with Darwen	62	74	42	56	59	34	35	37	32	19
Blackpool	11	12	31	20	12	19	9	14	11	6
Bolton	75	66	61	47	58	56	43	50	44	34
Burnley	15	10	13	11	9	<5	<5	6	10	11
Bury	24	14	21	23	16	25	17	11	19	14
Carlisle	0	0	<5	12	<5	<5	<5	<5	0	<5
Cheshire East	6	8	12	9	21	12	18	17	7	6
Cheshire West and Chester	8	10	8	8	11	12	11	7	8	6
Chorley	<5	<5	<5	9	6	<5	<5	<5	<5	<5
Copeland	0	<5	0	<5	<5	0	<5	<5	0	<5
Eden	0	0	0	<5	<5	<5	0	0	0	0
Fylde	8	<5	<5	<5	<5	<5	<5	0	0	<5
Halton	<5	<5	0	0	<5	5	<5	0	<5	<5
Hyndburn	11	6	11	9	14	4	9	6	5	9
Knowsley	<5	<5	5	<5	5	<5	<5	<5	0	<5
Lancaster	<5	8	8	8	<5	5	<5	7	9	10
Liverpool	45	61	42	48	41	36	41	34	38	31
Manchester	203	198	220	181	166	135	122	135	121	90
Oldham	36	52	46	50	43	53	54	40	36	34
Pendle	27	19	25	18	19	15	11	13	9	16
Preston	23	33	46	35	28	22	17	24	21	17
Ribble Valley	<5	0	<5	<5	<5	<5	0	<5	<5	0
Rochdale	47	41	42	35	23	39	26	31	25	32
Rossendale	<5	5	<5	<5	<5	<5	<5	<5	<5	<5
Salford	29	36	24	24	30	26	32	28	21	20
Sefton	9	10	7	17	6	9	6	8	5	6
South Lakeland	5	<5	6	7	<5	7	0	<5	<5	<5
South Ribble	<5	<5	9	<5	<5	6	<5	<5	<5	<5
St. Helens	<5	<5	5	5	<5	5	<5	<5	<5	<5
Stockport	14	10	28	15	16	19	14	13	18	17
Tameside	46	35	33	34	22	19	16	21	29	24
Trafford	31	23	27	39	31	26	22	25	19	19
Warrington	12	12	6	9	14	9	8	9	5	7
West Lancashire	<5	<5	<5	<5	<5	<5	<5	0	<5	<5
Wigan	16	15	9	7	14	11	14	15	5	8
Wirral	10	16	10	11	11	6	10	13	6	8
Wyre	<5	5	9	8	5	0	<5	<5	<5	<5
Cheshire and Merseyside	98	126	95	109	114	97	100	91	74	69
Cumbria and Lancashire	180	193	212	211	183	136	108	129	118	118
Greater Manchester	521	490	511	455	419	409	360	369	337	292
NORTH WEST	799	809	818	775	716	642	568	589	529	479

**Table Bii: TB rate per 100,000 population by local authority of residence, North West, 2009 to 2018**

Local Authority	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Allerdale	0.0	1.0	0.0	2.1	2.1	4.1	2.1	3.1	2.1	5.1
Barrow-in-Furness	2.9	5.8	5.8	7.3	2.9	1.5	3.0	3.0	0.0	1.5
Blackburn with Darwen	42.4	50.4	28.4	37.9	39.9	23.1	23.7	24.9	21.5	12.8
Blackpool	7.7	8.4	21.8	14.1	8.5	13.5	6.4	10.0	7.9	4.3
Bolton	27.5	24.0	22.0	16.8	20.7	19.9	15.3	17.6	15.4	11.9
Burnley	17.2	11.5	14.9	12.6	10.4	2.3	3.4	6.9	11.4	12.4
Bury	13.1	7.6	11.3	12.4	8.6	13.3	9.1	5.8	10.0	7.4
Carlisle	0.0	0.0	0.9	11.1	3.7	0.9	2.8	0.9	0.0	2.8
Cheshire East	1.6	2.2	3.2	2.4	5.6	3.2	4.8	4.5	1.8	1.6
Cheshire West and Chester	2.4	3.0	2.4	2.4	3.3	3.6	3.3	2.1	2.4	1.8
Chorley	1.9	0.9	2.8	8.3	5.4	3.6	1.8	3.5	1.7	2.6
Copeland	0.0	2.8	0.0	2.8	2.9	0.0	1.4	1.4	0.0	2.9
Eden	0.0	0.0	0.0	1.9	1.9	1.9	0.0	0.0	0.0	0.0
Fylde	10.6	2.6	1.3	2.6	2.6	3.9	1.3	0.0	0.0	3.8
Halton	1.6	1.6	0.0	0.0	1.6	4.0	1.6	0.0	1.6	1.6
Hyndburn	13.6	7.4	13.7	11.2	17.5	5.0	11.2	7.5	6.2	11.1
Knowsley	2.7	2.0	3.4	1.4	3.4	2.0	1.4	0.7	0.0	1.3
Lancaster	0.7	5.8	5.8	5.7	2.9	3.6	1.4	4.9	6.3	6.9
Liverpool	9.8	13.2	9.0	10.2	8.7	7.6	8.5	7.0	7.7	6.3
Manchester	42.0	40.2	43.7	35.5	32.3	26.0	23.0	24.9	22.2	16.4
Oldham	16.2	23.2	20.4	22.1	18.9	23.2	23.5	17.2	15.4	14.4
Pendle	30.2	21.3	27.9	20.1	21.1	16.7	12.2	14.4	9.9	17.5
Preston	16.7	23.8	32.8	24.9	20.0	15.7	12.1	17.0	14.9	12.0
Ribble Valley	7.0	0.0	1.7	1.7	3.5	1.7	0.0	5.1	3.4	0.0
Rochdale	22.4	19.5	19.8	16.5	10.8	18.3	12.1	14.3	11.4	14.5
Rossendale	3.0	7.4	1.5	2.9	4.4	5.8	5.8	2.9	4.3	2.8
Salford	12.7	15.5	10.2	10.1	12.6	10.8	13.1	11.3	8.4	7.9
Sefton	3.3	3.7	2.6	6.2	2.2	3.3	2.2	2.9	1.8	2.2
South Lakeland	4.8	3.8	5.8	6.8	2.9	6.8	0.0	1.9	1.9	1.9
South Ribble	3.7	2.8	8.2	1.8	3.7	5.5	3.6	0.9	2.7	2.7
St. Helens	1.1	2.3	2.9	2.8	1.7	2.8	1.1	1.1	1.7	0.6
Stockport	5.0	3.5	9.9	5.3	5.6	6.6	4.9	4.5	6.2	5.8
Tameside	21.2	16.0	15.0	15.4	10.0	8.6	7.2	9.4	12.9	10.7
Trafford	13.9	10.2	11.9	17.1	13.5	11.2	9.4	10.7	8.1	8.0
Warrington	6.0	6.0	3.0	4.4	6.8	4.4	3.9	4.3	2.4	3.3
West Lancashire	0.9	3.6	0.9	0.9	1.8	2.7	1.8	0.0	2.6	1.8
Wigan	5.1	4.7	2.8	2.2	4.4	3.4	4.3	4.6	1.5	2.5
Wirral	3.1	5.0	3.1	3.4	3.4	1.9	3.1	4.0	1.9	2.5
Wyre	1.9	4.6	8.4	7.4	4.6	0.0	0.9	2.7	3.6	3.6
Cheshire and Merseyside	4.1	5.2	3.9	4.5	4.7	4.0	4.1	3.7	3.0	2.8
Cumbria and Lancashire	9.2	9.9	10.8	10.7	9.3	6.9	5.5	6.5	5.9	5.9
Greater Manchester	19.7	18.4	19.0	16.8	15.4	15.0	13.1	13.3	12.0	10.4
NORTH WEST	11.4	11.5	11.6	10.9	10.1	9.0	7.9	8.2	7.3	6.6

**Table Biii: TB case numbers and rates by age and sex, North West, 2018**

Age Group	Female		Male	
	Number	Rate	Number	Rate
0-14	7	1.1	13	1.9
15-44	110	8.1	134	9.8
45-64	58	6.0	82	8.8
65+	33	4.5	42	6.8

**Table Biv: Drug resistance among TB cases with culture confirmed disease, North West, 2009 to 2018**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Culture confirmed	484	493	508	470	446	393	362	379	324	311
Drug resistant*	23	28	32	24	28	30	17	23	29	43
% Drug resistant	5%	6%	6%	5%	6%	8%	5%	6%	9%	14%

\* 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 to 2017

Year	Indicator 1: Overall TB incidence per 100,000 population			
	North West		England	
	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	7,266	13.5
2014	642	9.0	6,473	11.9
2015	568	7.9	5,736	10.5
2016	589	8.2	5,618	10.2
2017	529	7.3	5,070	9.1
2018	479	6.6	4,655	8.3

Year	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	
	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	-	474	-	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	2,004	4.4	5,840	81.4
2013	255	4.0	447	76.8	1,842	4.0	5,260	70.6
2014	226	3.5	405	66.2	1,757	3.8	4,611	60.2
2015	185	2.9	368	52.1	1,532	3.3	4,100	51.3
2016	209	3.2	368	55.1	1,456	3.2	4,093	49.4
2017	175	2.7	340	49.0	1,426	3.1	3,571	41.2
2018	164	2.5	301	46.4	1,297	2.8	3,283	39.0

Year	Indicator 5: Incidence of TB in UK born children aged under fifteen			
	North West		England	
	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	-	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	157	1.7
2016	25	2.0	163	1.8
2017	21	1.7	127	1.4
2018	14	1.1	110	1.2

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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	121	44.2	-	-
2001	132	47.5	-	-
2002	124	41.1	-	-
2003	124	44.0	-	-
2004	99	36.5	-	-
2005	139	40.9	-	-
2006	123	39.9	-	-
2007	128	37.6	-	-
2008	117	39.3	-	-
2009	130	45.5	-	-
2010	120	43.8	-	-
2011	126	44.2	1,339	44.9
2012	127	43.1	1,390	43.9
2013	98	38.6	1,240	41.2
2014	121	38.9	1,174	39.5
2015	111	40.4	1,199	42.1
2016	120	40.3	1,093	38.3
2017	76	36.2	992	38.1
2018	86	40.2	963	40.6

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	194	70.8	-	-
2001	211	75.9	-	-
2002	225	74.5	-	-
2003	201	71.3	-	-
2004	198	73.1	-	-
2005	242	71.2	-	-
2006	228	74.0	-	-
2007	254	74.7	-	-
2008	210	70.5	-	-
2009	210	73.4	-	-
2010	199	72.6	-	-
2011	205	71.9	2,210	74.1
2012	208	70.5	2,334	73.7
2013	165	65.0	2,156	71.6
2014	221	71.1	2,071	69.6
2015	195	70.9	2,050	72.0
2016	204	68.5	1,960	68.7
2017	133	63.3	1,778	68.2
2018	140	65.4	1,681	70.8

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	201	53.2	1,920	52.7
2001	255	66.2	2,100	57.2
2002	268	69.3	2,631	64.7
2003	217	63.6	2,614	66.2
2004	214	67.5	2,753	68.3
2005	271	66.1	3,012	69.2
2006	265	72.2	3,009	69.5
2007	291	72.2	2,848	68.4
2008	278	74.9	2,921	67.7
2009	318	72.9	3,023	68.1
2010	317	74.4	2,902	70.7
2011	303	72.5	3,139	72.0
2012	293	73.8	3,012	70.6
2013	270	75.2	2,770	73.3
2014	261	73.1	2,521	73.2
2015	245	78.8	2,296	74.4
2016	253	73.8	2,374	77.0
2017	190	75.1	2,129	75.6
2018	203	77.2	1,972	74.0

Year	<b>Indicator 9: Number and proportion of microbiologically confirmed cases with drug susceptibility testing reported for the four first line agents</b>			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	279	99.6	2,779	99.4
2001	366	100.0	3,141	99.2
2002	388	100.0	3,784	98.6
2003	316	99.4	3,801	99.2
2004	316	99.1	4,014	98.6
2005	412	99.5	4,532	98.9
2006	415	99.3	4,611	98.7
2007	423	98.8	4,355	98.3
2008	420	98.4	4,431	97.7
2009	481	99.4	4,520	96.8
2010	488	99.0	4,495	97.3
2011	504	99.2	4,890	96.9
2012	463	98.5	4,784	97.6
2013	442	99.1	4,247	96.6
2014	391	99.5	3,834	97.5
2015	359	99.2	3,440	98.1
2016	373	98.4	3,442	95.9
2017	314	96.9	3,070	96.8
2018	307	98.7	2,773	97.3

Year	<b>Indicator 10: Number and proportion of drug sensitive TB cases with full course of treatment completed by 12 months</b>			
	North West		England	
	Number of cases	Proportion	Number of cases	Proportion
2000	-	-	-	-
2001	267	45.5	3,628	63.7
2002	450	75.0	4,113	67.4
2003	384	73.1	4,191	69.6
2004	320	61.3	4,426	70.1
2005	469	68.9	4,878	70.3
2006	475	75.9	5,211	75.5
2007	489	74.7	5,289	78.2
2008	514	77.9	5,602	80.3
2009	589	80.9	5,918	81.9
2010	602	84.8	5,650	82.9
2011	594	81.1	6,024	82.1
2012	579	84.3	6,016	83.8
2013	544	84.0	5,504	85.7
2014	469	83.9	4,848	84.9
2015	415	84.0	4,199	83.9
2016	451	85.1	4,223	85.0
2017	397	83.1	3,796	84.7
2018	-	-	-	-

Year	<b>Indicator 11: Number and proportion of drug sensitive TB cases lost to follow-up at last reported outcome</b>			
	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	291	4.4
2004	16	2.8	333	4.9
2005	30	4.1	381	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	298	4.1
2014	21	3.3	274	4.3
2015	29	5.2	251	4.4
2016	29	5.0	227	4.1
2017	21	4.0	210	4.2
2018	-	-	-	-

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	436	6.6
2003	58	10.2	407	6.2
2004	40	7.1	402	5.9
2005	40	5.4	448	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	335	4.7
2014	56	8.8	354	5.5
2015	49	8.7	346	6.1
2016	39	6.7	305	5.5
2017	32	6.1	264	5.3
2018	-	-	-	-

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	38	64.4
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	51	60.0
2014	4	66.7	38	52.8
2015	3	75.0	41	61.2
2016	4	66.7	45	65.2
2017	-	-	-	-
2018	-	-	-	-

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	8	13.6
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	14	19.4
2015	0	0.0	5	7.5
2016	1	16.7	7	10.1
2017	-	-	-	-
2018	-	-	-	-



Year	<b>Indicator 15: Number and proportion of TB cases with rifampicin resistance or MDR-TB that had died at last reported outcome</b>			
	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	3	5.1
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	2.8
2015	0	0.0	5	7.5
2016	0	0.0	6	8.7
2017	-	-	-	-
2018	-	-	-	-

Year	<b>Indicator 16: Number and proportion of TB cases offered an HIV test</b>			
	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	5,205	93.2
2013	541	87.0	5,788	93.6
2014	547	94.6	5,402	95.4
2015	477	97.0	4,951	96.3
2016	533	96.9	5,024	97.0
2017	456	96.0	4,554	96.5
2018	399	95.5	4,091	96.8

Year	<b>Indicator 17: Number and proportion of drug sensitive TB cases with at least one social risk factor who completed treatment within 12 months</b>			
	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	373	73.6
2011	36	67.9	371	71.5
2012	36	75.0	394	74.9
2013	36	76.6	402	77.2
2014	31	67.4	361	74.9
2015	49	81.7	392	75.5
2016	29	61.7	368	76.5
2017	25	67.6	358	74.7
2018	-	-	-	-

Tuberculosis in North West England: annual review (2018 data)

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	228	7.2
2002	20	5.2	296	7.8
2003	13	4.1	308	8.0
2004	19	6.0	324	8.0
2005	25	6.1	346	7.6
2006	19	4.6	371	8.0
2007	31	7.3	331	7.5
2008	21	4.9	307	6.9
2009	23	4.8	371	8.1
2010	28	5.7	323	7.1
2011	32	6.3	413	8.3
2012	24	5.2	360	7.4
2013	28	6.3	327	7.6
2014	30	7.7	286	7.3
2015	17	4.7	255	7.3
2016	23	6.1	265	7.5
2017	29	9.1	269	8.6
2018	43	13.9	322	11.4

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	23	0.7
2002	2	0.5	34	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	76	1.6
2013	6	1.3	67	1.6
2014	6	1.5	53	1.4
2015	3	0.8	45	1.3
2016	4	1.1	53	1.5
2017	1	0.3	44	1.4
2018	4	1.3	34	1.2