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Tuberculosis in North West England: Annual review (2016 data)

Data from 2000 to 2016

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The Field Epidemiology Service (FES) supports Public Health England Centres and partner organisations through the application of epidemiological methods to inform public health action. FES does this in two 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 FES network, excellence and innovation is encouraged. We foster academic collaborations and take active part and lead in research, development and training.

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Contents

Data presented in this report are correct as of April 2017, when they were extracted from the Enhanced TB Surveillance (ETS) system; before being cleaned and validated by August 2017.

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Notes on the report

Intended audience

This report is aimed at healthcare professionals involved in the diagnosis and/or treatment of TB patients; commissioners involved in planning and financing TB services; public health professionals working in the control of TB or health of at-risk populations; researchers with an interest in TB; and government and non-governmental organisations working in the field of TB. This report is the annual update on TB epidemiology in the region for 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.

Data sources

This report presents detailed data on TB case notifications made to the Enhanced Tuberculosis Surveillance system (ETS) in England to the end of 2016. Data from notifications made to ETS from 2000 are updated annually to take into account denotifications, late notifications and other updates. The data presented in the current year's report supersedes data in previous reports.

Other data displays

The national report presenting recent epidemiology of TB in England is available at: www.gov.uk/government/publications/tuberculosis-in-england-annual-report

Additional high-level data on TB notifications in the UK to the end of 2016, and breakdowns by country, can be found in the Official Statistics for TB, Reports of cases of tuberculosis to enhanced tuberculosis surveillance systems: UK, 2000 to 2016. This is available at: www.gov.uk/government/collections/tuberculosis-and-other-mycobacterial-diseases-diagnosis-screening-management-and-data.

As part of the Collaborative TB Strategy for England 2015-2020, a suite of TB Strategy Monitoring Indicators have been developed: www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf

Where data for these indicators are presented in this report, the indicator name is shown; and a summary table of national-level indicators is presented in Appendix C. Data for indicators which are presented at upper tier local authority and clinical commissioning group can be found at: fingertips.phe.org.uk/profile/tb-monitoring

Executive summary

National

A total of 5,664 cases of tuberculosis (TB) were reported in England in 2016.[1] This corresponds to an incidence rate of 10.2 per 100,000 population similar to the previous year (10.5 per 100,000 in 2015).

Regional

A total of 600 new cases of TB were reported to the enhanced surveillance scheme in North West England in 2016. This corresponds to a regional incidence of 8.4 per 100,000 population, a slight increase from the previous year (7.9 per 100,000 in 2015; 568 cases).

Local

The North West local authorities with the highest incidence in 2016 were Blackburn with Darwen (25.9 per 100,000 population), Manchester (25.6 per 100,000 population) and Oldham (18.2 per 100,000 population).

Age groups

In 2016, age-specific incidence was highest in the 15-44 years age group at 11.1 per 100,000 population. The rate in the 0-14 age group remained low, increasing from 1.8 per 100,000 in 2015 to 2.8 per 100,000 in 2016.

Ethnic groups and origin

The greatest proportion of new TB cases in 2016 occurred in the White ethnic group (31%), followed by the Pakistani ethnic group (28%). TB in the White ethnic group increased by 22% (from 152 cases in 2015 to 185 cases in 2016); and in White cases that were born in the UK, there was an increase of 18% (from 131 cases in 2015 to 154 cases in 2016).

There has been an overall increase of 17% in UK born cases since 2015 (from 185 cases in 2015 to 217 cases in 2016). The number of new non-UK born cases has remained relatively stable (368 cases in 2015 compared with 370 cases in 2016).

In 2016, 63% of TB cases reported in the North West were born outside the UK. Of cases born outside the UK, 38% were in the Pakistani ethnic group; 27% were

diagnosed within one year of entry; and 42% were diagnosed 11 or more years after entry (similar proportions to 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 tuberculosis. TB control in this group of individuals has become a priority area across England. In the North West, the proportion of cases with at least one social risk factor has remained broadly stable from the previous year; 11.9% of cases in 2016 had at least one social risk factor (SRF). However, the proportion of cases with social risk factors has shown a small increase since 2011 (10.6% of cases with a SRF in 2011, compared to 11.9% in 2016), demonstrating that continued efforts are needed to control TB in this population. The majority of cases with at least one SRF were male (78%) and aged between 45 and 64 years (50%).

63% of cases with at least one SRF were UK born and in this population the majority of cases were White (92%). In 2016, 33% of cases with SRFs had more than one risk factor, a decrease from 43% in 2015. 5.9% of cases in 2016 reported having all 4 social risk factors (homelessness, imprisonment, drug use and alcohol misuse); similar to previous years.

In 2016, 45% of TB cases were resident in areas considered to be the most socio-economically deprived in the North West compared to 7% who were resident in the least deprived areas. TB rates were highest in the most socio-economically deprived areas of the North West (11.5 per 100,000 population) compared with the least socio-economically deprived areas (3.5 per 100,000 population).

Clinical characteristics

More than half of the TB cases reported in the North West in 2016 had pulmonary disease (57%); a similar proportion to previous years (53% in 2015; 55% in 2014). Of those cases with pulmonary disease, 72% were confirmed by culture; a similar proportion to previous years (79% in 2015; 73% in 2014).

Treatment outcome

Among drug sensitive TB cases notified in 2015, 84% of those with an expected treatment duration of less than 12 months completed treatment within 12 months (compared with 84% of cases reported in 2014). The most common reasons for non-completion of treatment were death (8%) and being lost to follow up (5%). Of those that were lost to follow up, most had left the UK (62%).

Among drug sensitive TB cases with CNS (central nervous system), spinal, miliary or cryptic disseminated disease, 43% of those reported in 2015 had completed treatment within 12 months; 36% required continued treatment. A total of 72% had completed treatment at the last recorded outcome.

6 rifampicin resistant resistant TB cases were reported in 2014 (compared with 9 cases in 2013). 4 cases were still on treatment and 12 months and went on to complete at 24 months; 2 cases were lost to follow up.

Drug resistance

The proportion of culture positive cases with resistance to at least one first-line drug was 6% in 2016; similar to previous years (5% in 2015, 8% in 2014) and in line with national levels (7.5% in 2016).[1] A total of 6% (22/377) had isoniazid resistance; 1% (5/377) were resistant to rifampicin; and 1% (4/377) had multi-drug resistant TB (MDR-TB, resistant to isoniazid and rifampicin). There were 2 recorded cases of extensively drug resistant (XDR) TB in the North West in 2016.

Recommendations

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

1. 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 PHE's TB Strategy Monitoring Indicators Tool[3] to track their performance and to support development of local TB action plans.
2. The NHS should ensure complete and accurate information is recorded on the PHE Enhanced TB Surveillance (ETS) system, so that high quality surveillance data is available.
3. Specific interventions should be explored in those groups that have experienced increases in the number of cases during 2016; such as those born in Romania.
4. Underserved populations and those with social risk factors continue to experience a high burden of disease. Strategy and interventions should continue to focus on reducing TB rates in these groups and reducing social inequalities.
5. The NHS should continue to report treatment outcome for all cases, and review the reasons for low completion in some areas.
6. The NHS should offer HIV testing for all those diagnosed with tuberculosis; and ensure that tests are done in line with national guidance.[4]
7. The NHS should make every effort to increase the proportion of pulmonary cases with a sputum smear result to enable better TB control.
8. 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.
9. Commissioners should ensure TB services are commissioned in line with the Department of Health's toolkit and NICE TB guidelines; and consider collaborative commissioning for TB services across large geographical footprints, in order to ensure sufficient capacity and expertise are available for a high quality TB service.

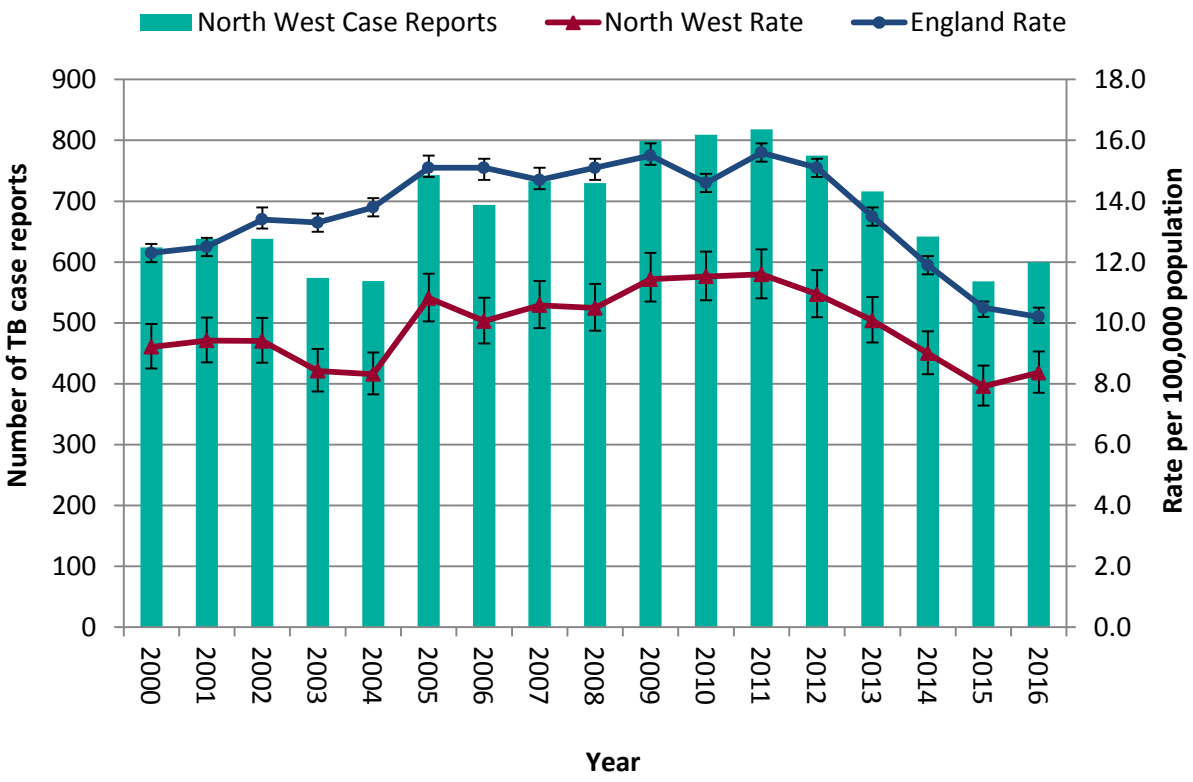
1. TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2016, 600 tuberculosis (TB) cases were reported among North West residents; a rate of 8.4 per 100,000 population (95% confidence interval (CI) 7.7-9.1). This was a 6% increase compared to 2015 (568 cases; rate of 7.9 per 100,000 population, 95% CI 7.3-8.6). The North West TB rate remained below the England rate of 10.2 per 100,000 (Figure 1), but was the third highest of all regions 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 – 2016

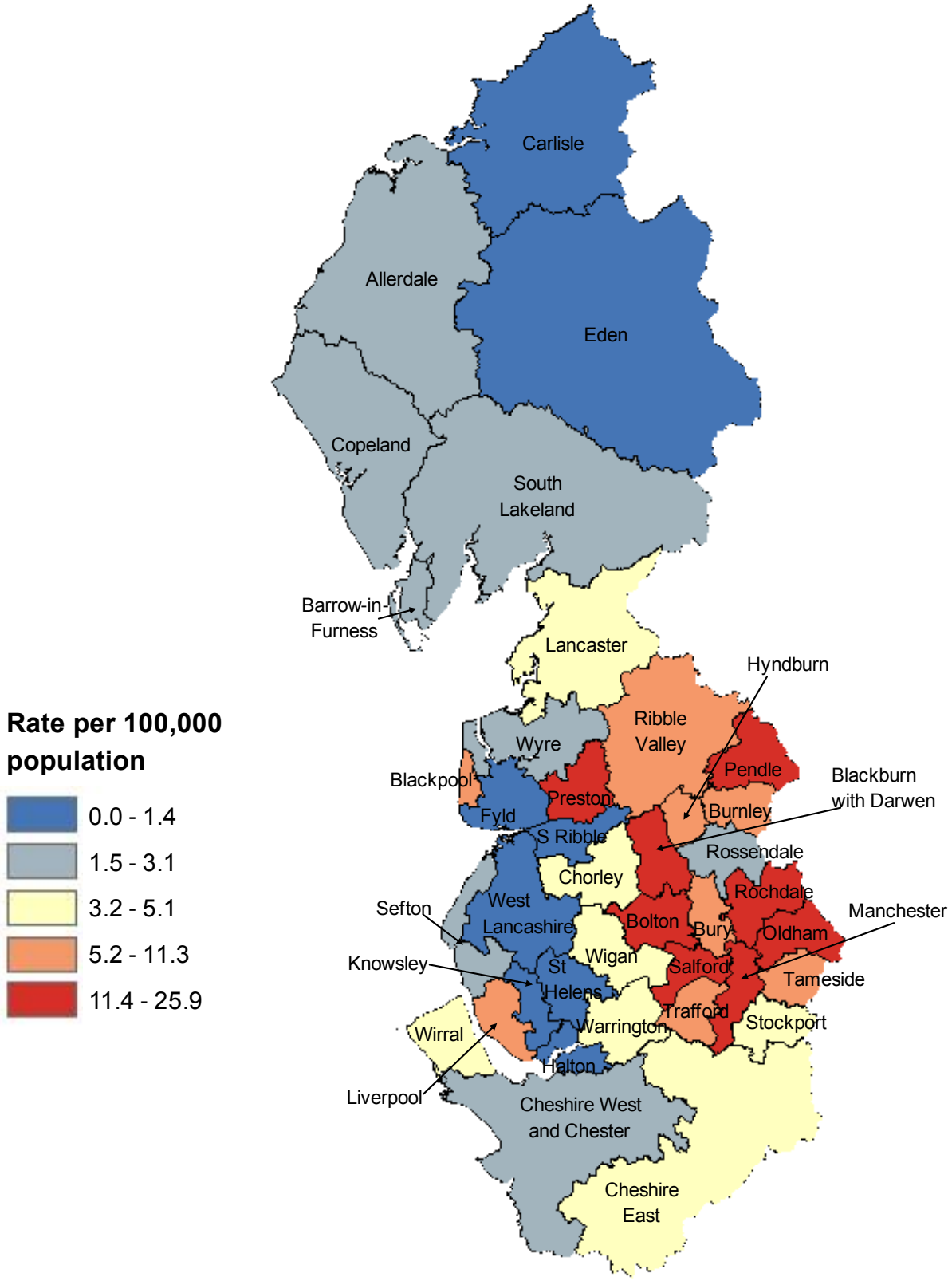


* Error bars represent upper and lower 95% confidence intervals.

Among North West upper tier local authorities, the highest rates were in Blackburn with Darwen at 25.9 per 100,000 population; Manchester at 25.6 per 100,000; and Oldham at 18.2 per 100,000. Rates in Blackburn with Darwen and Manchester increased slightly from the previous year: by 9% in Blackburn with Darwen and by 11% in Manchester. The rate in Oldham decreased by 22%.

Historically, there has been little change in the local authorities with the highest burden of TB in the North West. In line with previous years, the lowest burden areas in 2016 were Eden, Fylde, Halton and West Lancashire.

Figure 2: TB rate per 100,000 population by upper tier local authority of residence, North West, 2016

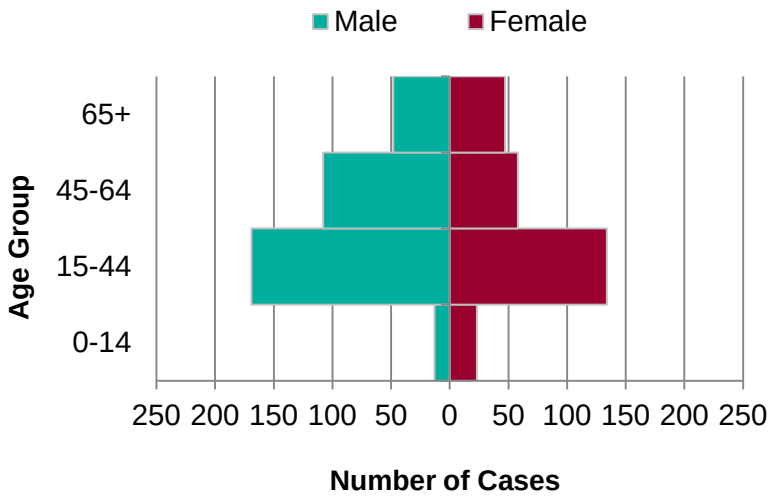


Demographic characteristics

Age and sex

In 2016, 56% of North West TB cases were male, and rates among males were higher than in females (9.6 per 100,000 in males and 7.2 per 100,000 in females); a similar pattern to previous years. There was a greater proportion of males than females across all age groups except in the 0-14 years age group. The greatest disparity was in the 45-64 age group, in which 65% of cases were male and 35% were female (Figure 3). 36 cases of TB in children aged 0-14 years were reported; more than in the previous year (23 cases reported in 2015).*

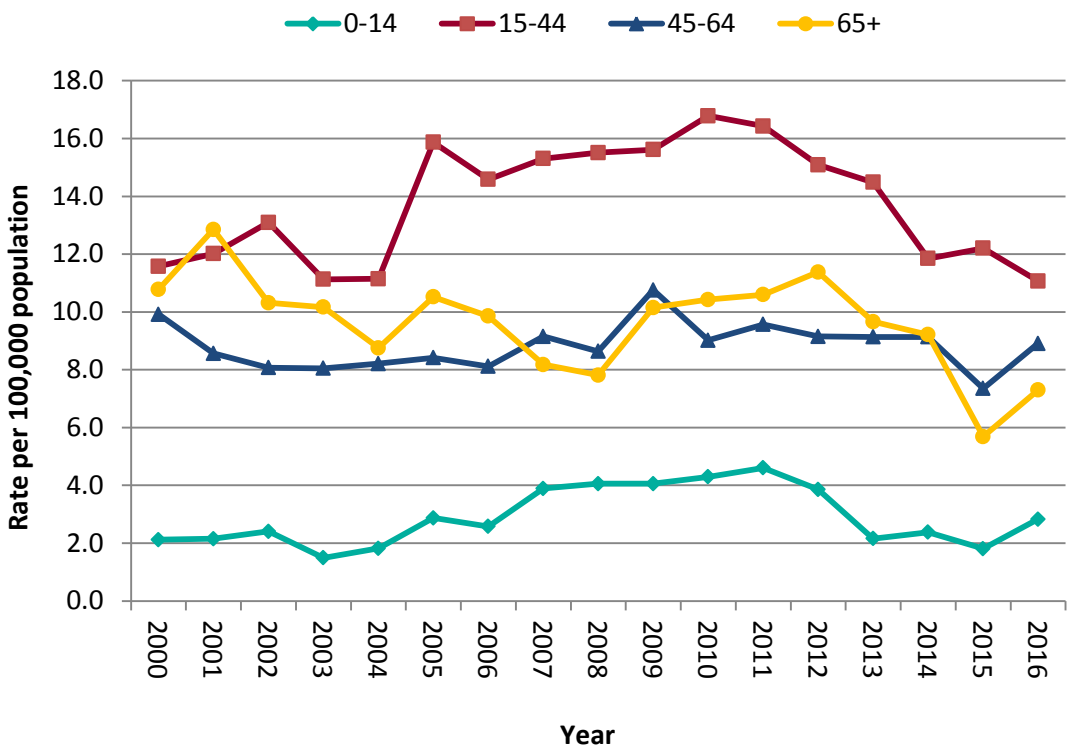
Figure 3: TB case reports by age and sex, North West, 2016



Rates were highest in residents aged 15-44 years (Figure 4). The rate in the 15-44 age group decreased slightly from 12.2 per 100,000 in 2015 to 11.1 per 100,000 in 2016. Rates across all other age groups increased in 2016, with the largest increase seen in the 45-64 and 65+ years age groups. The rate in the 0-14 age group increased from 1.8 per 100,000 population in 2015 to 2.8 per 100,000 population in 2016.

* 50 cases aged 0-17 years were reported in 2016; an incidence of 1.6 per 100,000 population (compared with 36 cases and an incidence of 1.2 per 100,000 population reported in 2015).

Figure 4: TB case rates by age group, North West, 2000 – 2016



Place of birth and time since entry to the UK

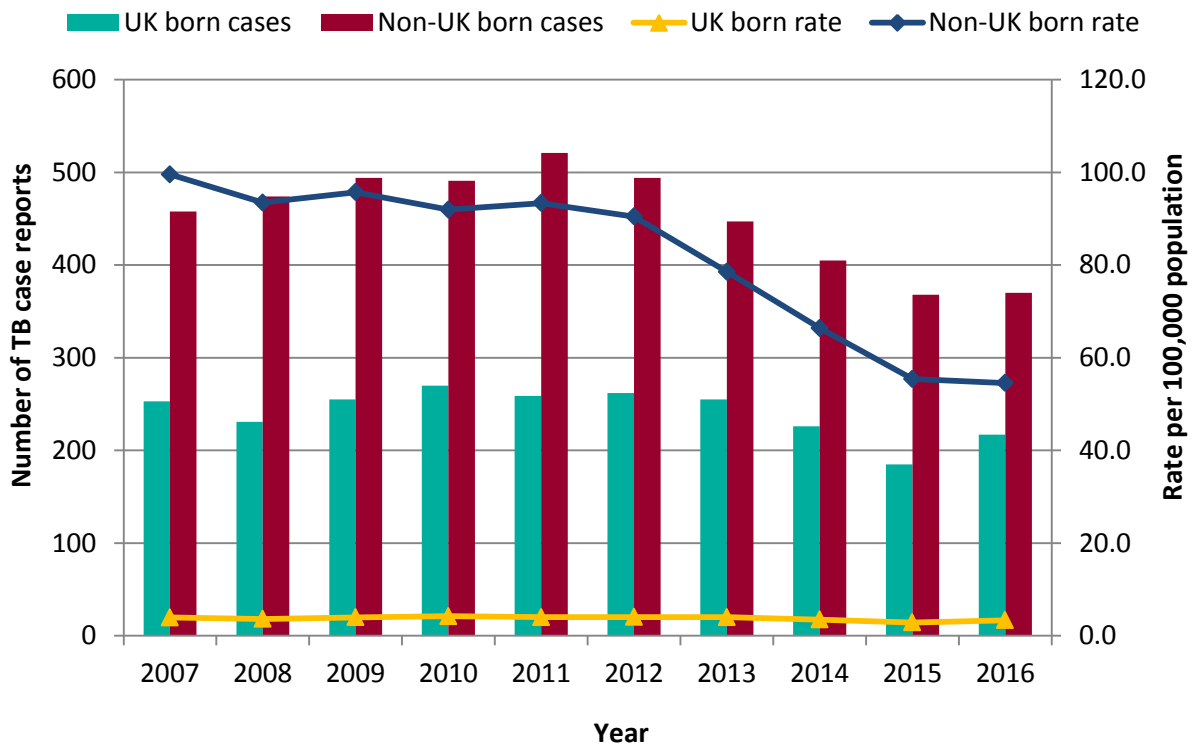
In 2016, place of birth was known for 98% (587/600) of North West TB cases. Of these, 37% (217/587) were born in the UK; a similar proportion to previous years (33% in 2015; 36% in 2014).

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 2016, the rate in the non-UK born population was 16 times higher than the rate in the UK born, at 54.6 per 100,000 (Figure 5); lower than the previous year (55.4 per 100,000 in 2015).

The rate in the UK born population increased slightly from 2.9 per 100,000 in 2015 to 3.4 per 100,000 in 2016. This figure is similar to previous years (3.5 per 100,000 population in 2014; 4.0 per 100,000 population in 2013).

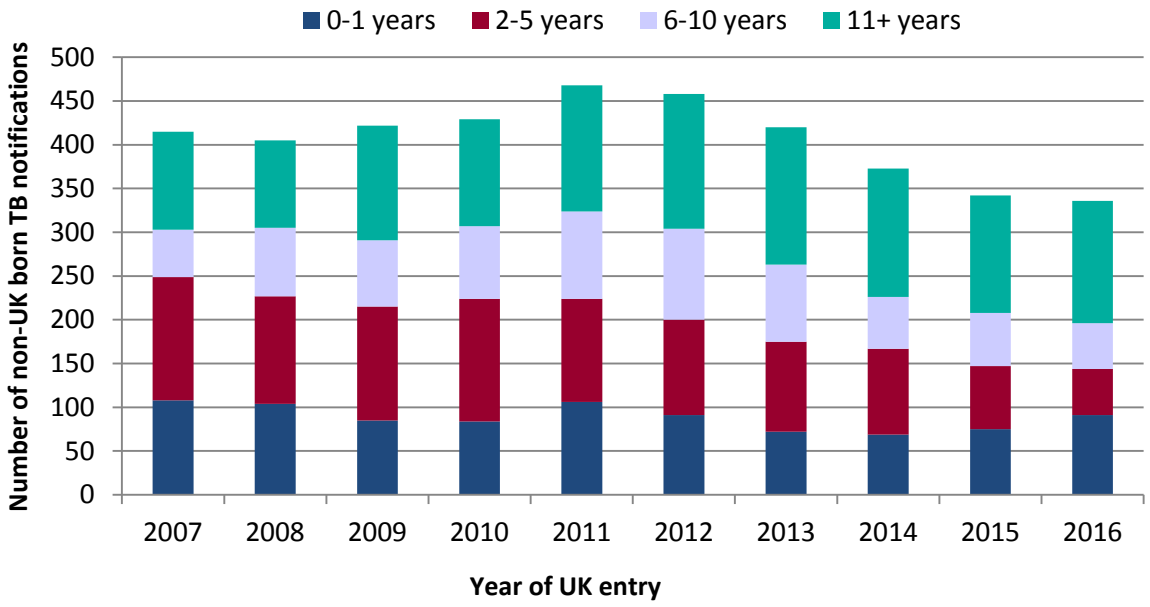
TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations

Figure 5: TB case reports and rates by place of birth, North West, 2007 – 2016



Year of entry was reported for 91% (336/370 cases) of non-UK born cases in 2016. Of these, 27% were notified less than 2 years after entry and 16% were notified 2 to 5 years after entry; meaning that, overall, 43% were notified within 5 years of entering the UK. A further 15% were notified 6 to 10 years after entry and 42% (140/336) 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 – 2016*



* Where year of entry was recorded.

Approximately 2 in 5 non-UK born TB cases reported in the North West in 2016 were born in Pakistan (Table 1), a higher proportion than reported nationally (11.5%); approximately one sixth originated from India, lower than the national average (18.1%).[1] Of the places of birth with greater than 10 cases in 2016, Romania saw the largest increase in notifications (from 4 cases in 2015 to 16 cases in 2016). The largest decline in notifications was in the Indian born population with a decline of 8% (from 65 cases in 2015 to 60 cases in 2016).

Table 1: Most common countries of birth of non-UK born TB cases, North West, 2016

Country of birth	Number of cases	Proportion of cases*	Median time since entry to UK (IQR)**
Pakistan	136	37%	13 (4-29)
India	60	16%	10 (4-18)
Romania	16	4%	1 (0-1)
Eritrea	14	4%	1 (0-3)
Somalia	13	4%	10 (6-14)
Sudan	10	3%	1 (0-1)
Others (each < 2%)	116	32%	1 (0-1)
Total*	365	100%	6 (1-15)

*Where country of birth was known

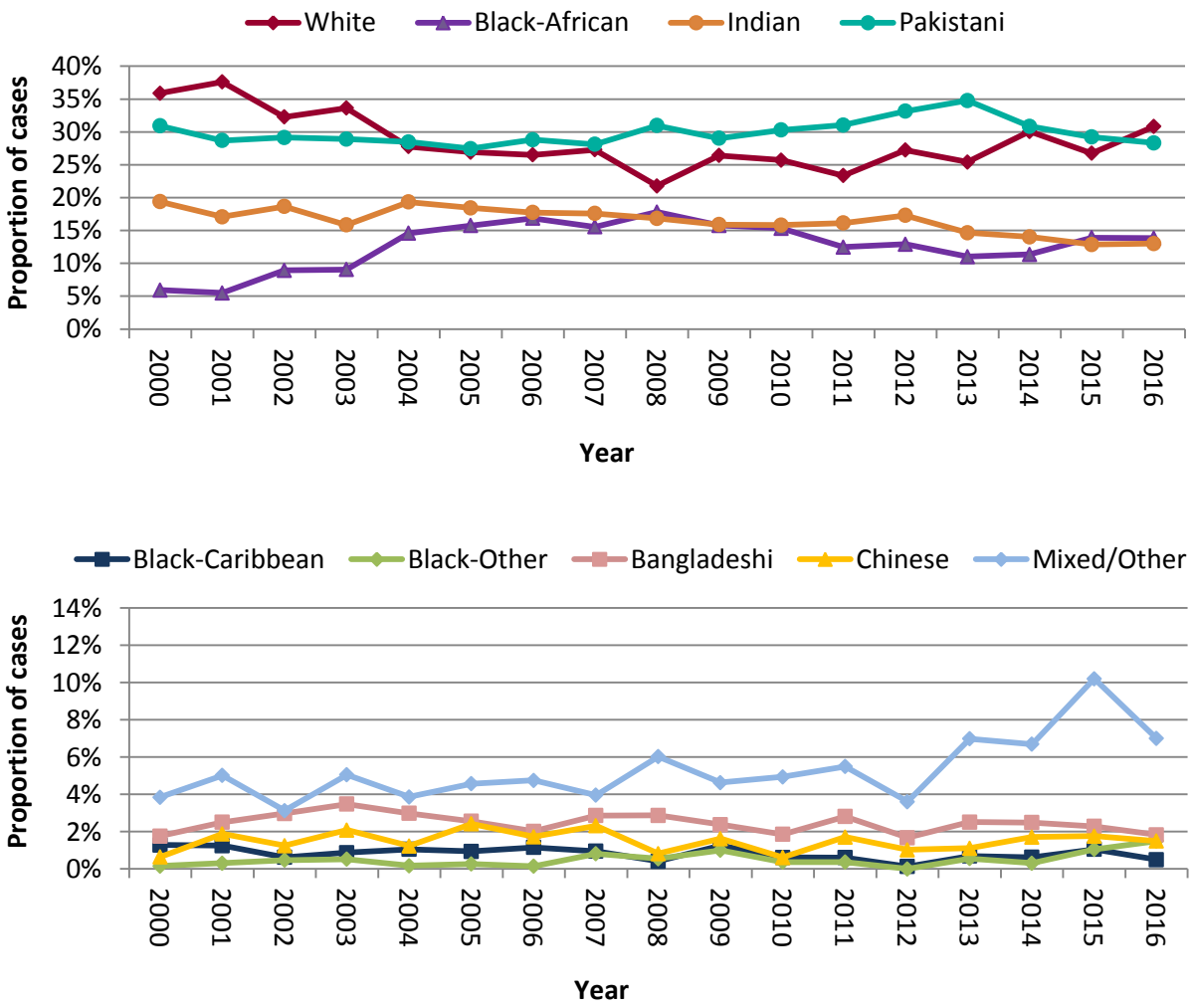
**Interquartile range (time in years)

Of the most common countries of birth for 2016 non-UK born TB cases, 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 were Romania and Eritrea.[1] In the North West, the country with the longest median time between entry to the UK and notification was Pakistan (13 years; IQR 4-29 years).

Ethnic group

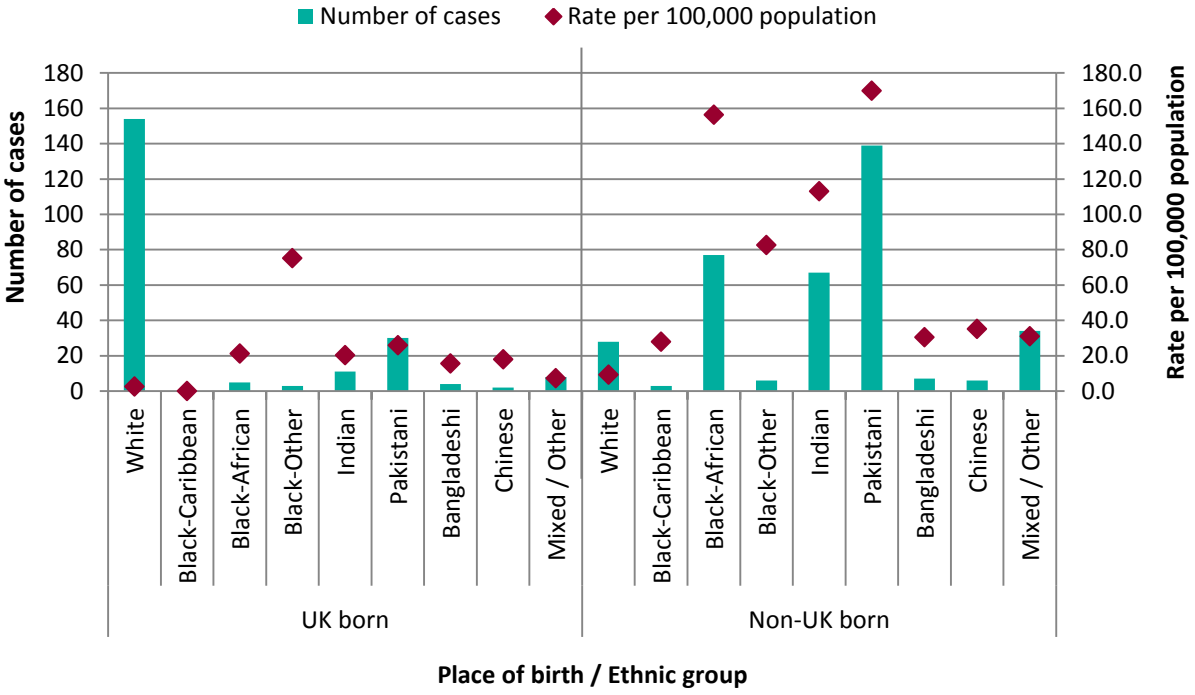
In 2016, ethnicity was known for 98% (590/600) of cases. The most common ethnic groups among all tuberculosis cases in the North West were the White and Pakistani ethnic groups (Figure 7). The proportion of White cases increased slightly from 27% in 2015 to 31% in 2016; whereas there was a small decrease in the proportion of cases with Pakistani and Mixed/Other ethnicity. The proportion of TB cases in other ethnic groups remained similar to 2015.

Figure 7: Proportion of TB cases by ethnic group, North West, 2000 – 2016



Of UK born TB cases in 2016, the greatest proportion (71%, 154/217) were in the White ethnic group (Figure 8). Among the non-UK born, 38% (139/370) were in the Pakistani ethnic group; 21% (77/370) were in the Black-African ethnic group; and 18% (67/370) were in the Indian ethnic group.

Figure 8: TB case numbers and incidence by ethnic group and place of birth*, North West, 2016



* Rates calculated using mid-year 2016 Labour Force Survey population estimates[5].

In 2016, 4 of the 9 ethnic groups showed a decrease compared to 2015. Of those experiencing an increase the largest increase was seen in the Mixed/Other ethnic group (50%, from 6 cases in 2015 to 9 cases in 2016), followed by the White ethnic group (22%, from 152 cases in 2015 to 185 cases in 2016).

Occupation

In 2016, information on occupation was known for 91% (420/462) of North West TB cases aged between 18 and 65 years. Of these, 45% (187/420) were not in education or employment; 8% (33/420) were healthcare workers; 10% (41/420) were either studying or working in education; and the remaining cases (38%, 159/420) were working in other occupations.

Over two thirds of cases working in education (71%, 29/41) and healthcare (73%, 24/33) were born outside the UK.

Clinical characteristics

Site of disease

In 2016, site of disease was known for all cases. 57% of TB cases in North West England had pulmonary disease (Table 2), greater than the national average of 53.9%.[1] Of the 344 pulmonary cases, 246 (72%) were culture confirmed (compared with 79% in 2015). The most common extra-pulmonary site was extra-thoracic lymph nodes, accounting for 20% of all cases. The majority of extra-pulmonary cases notified in 2016 were born outside the UK (75%, 191/256).

Table 2: Site of disease of TB cases, North West, 2016

Site of disease*	Number of cases	Proportion of cases
Pulmonary	344	57%
Miliary	14	2%
Laryngeal	3	1%
Extra-pulmonary	256	43%
Lymph nodes (extra-thoracic)	121	20%
IT lymph nodes	97	16%
Extra-pulmonary (unknown)	60	10%
Pleural	41	7%
Extra-pulmonary (other)	36	6%
Gastrointestinal	33	6%
Bone (spine)	18	3%
CNS (other - not meningitis)	12	2%
Bone (other - not spine)	10	2%
Genitourinary	9	2%
CNS meningitis	8	1%
Cryptic	4	1%

* With or without disease at another site.

Previous diagnosis of tuberculosis

Information on previous history of TB was known for 91% (547/600) of North West cases in 2016. Of these, 7% (37/547) 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% (28/37) of cases; of these, 89% (25/28) were previously treated.

BCG vaccination

Information on BCG vaccination was available for 41% (246/600) of North West cases in 2016; lower than national levels (70.6%).[1] The proportion of cases with known BCG vaccination status declined with age: from 81% (29/36) in cases aged 0-14 years to 33% (31/95) of cases aged 65 and over. Of cases with known information, 63% (155/246) had reportedly received BCG vaccination (59%, 17/29, for cases aged 0-14 years).*

* Information was recorded for 72% (36/50) of cases aged 0-17 years; 56% (20/36) of which had received BCG vaccination.

2. Laboratory confirmation of TB

Laboratory tests data collection

Data for all culture confirmed TB isolates from the Mycobacterium Reference Laboratories, including speciation, drug susceptibility testing and Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats (MIRU-VNTR) typing 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 344 pulmonary cases in the North West in 2016, 54% (187/344) had a sputum smear result reported. This is the same as the previous year and lower than national levels (63.1%). 65% (122/187) of known North West sputum smear results were positive. 91% (111/122) of pulmonary, sputum smear positive cases were also culture confirmed.

Culture confirmation and speciation

A total of 63% (377/600) of all cases in 2016, both pulmonary and extra-pulmonary, were confirmed by culture. Of the 344 pulmonary cases, 72% (246/344) were culture confirmed; compared with 76% nationally. 51% (131/256) of extra-pulmonary North West cases were culture confirmed, higher than national levels (48.1%).[1]

Culture confirmation was 19% (7/36) in those aged 0-14 years, lower than in other age groups (63% and over). There was also variation among LAs: approximately half (51%, 18/35) of North West LAs had culture confirmation for at least 60% of cases.

Among all culture confirmed cases, 98% (370/377) were identified with *Mycobacterium tuberculosis* (*M. tuberculosis*) infection; 1.1% (4/377) with *Mycobacterium tuberculosis complex* and 0.8% (3/377) with *Mycobacterium bovis* (*M. bovis*). There were no cases of *Mycobacterium microti (M. microti)* or *Mycobacterium africanum* (*M. africanum*) recorded in 2016.

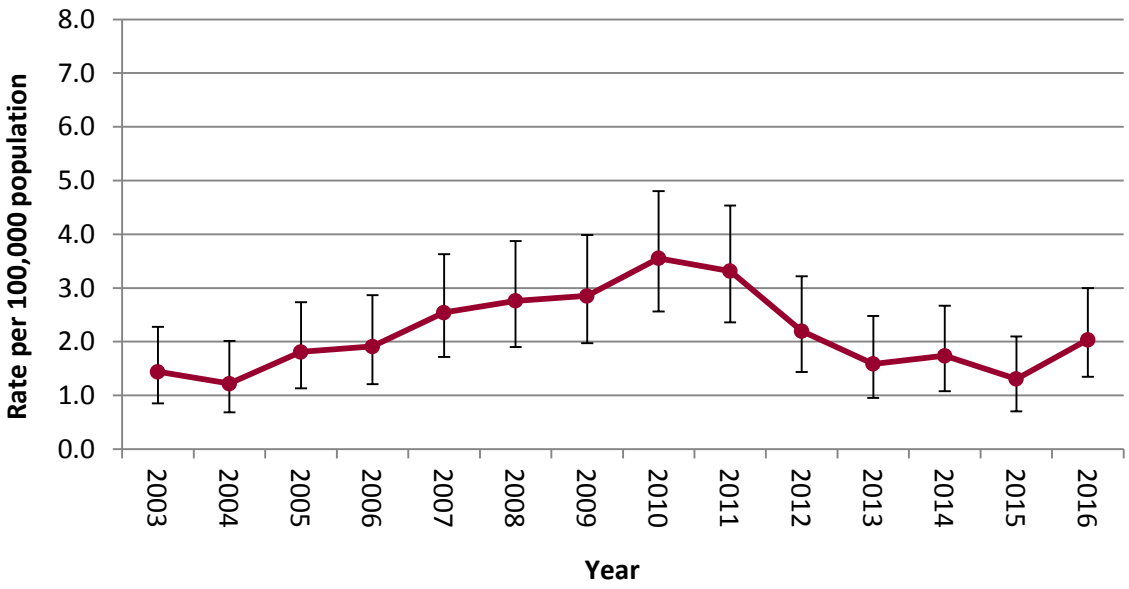
3. TB transmission

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. In the North West, the rate of TB in UK born children under 15 years of age was 2.0 per 100,000 in 2016, higher than in the previous year (1.3 per 100,000 in 2015). This is an overall decrease since the peak of 3.6 per 100,000 in 2010 (Figure 9) but is slightly higher than the national rate of 1.8 per 100,000.[1]

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

Figure 9: Incidence of TB in UK born children*, North West, 2000 – 2016



* Aged 0-14 years. Rates calculated using mid-year 2016 Labour Force Survey population estimates[5]. Error bars represent upper and lower 95% confidence intervals.

Strain typing and clustering

The PHE National Strain Typing Service was established in January 2010. All TB isolates were typed using 24 loci mycobacterial interspersed repetitive unit-variable number tandem repeats (MIRU-VNTR) at the National Mycobacterium Reference Laboratory (NMRL). Cases with an identical strain pattern are considered clustered.[6] Many clusters occur among household and social contacts; but clustering in strain patterns may identify links between cases that would otherwise appear unrelated. However, it is important to bear in mind that not all clusters identified by strain typing

can be linked epidemiologically. All cluster data shown below are for cases reported between 2010 and 2015. The National Strain Typing Service was terminated in North and Central England in December 2016, replaced by whole genome sequencing (WGS), and will be fully terminated throughout England by the end of 2017.[1]

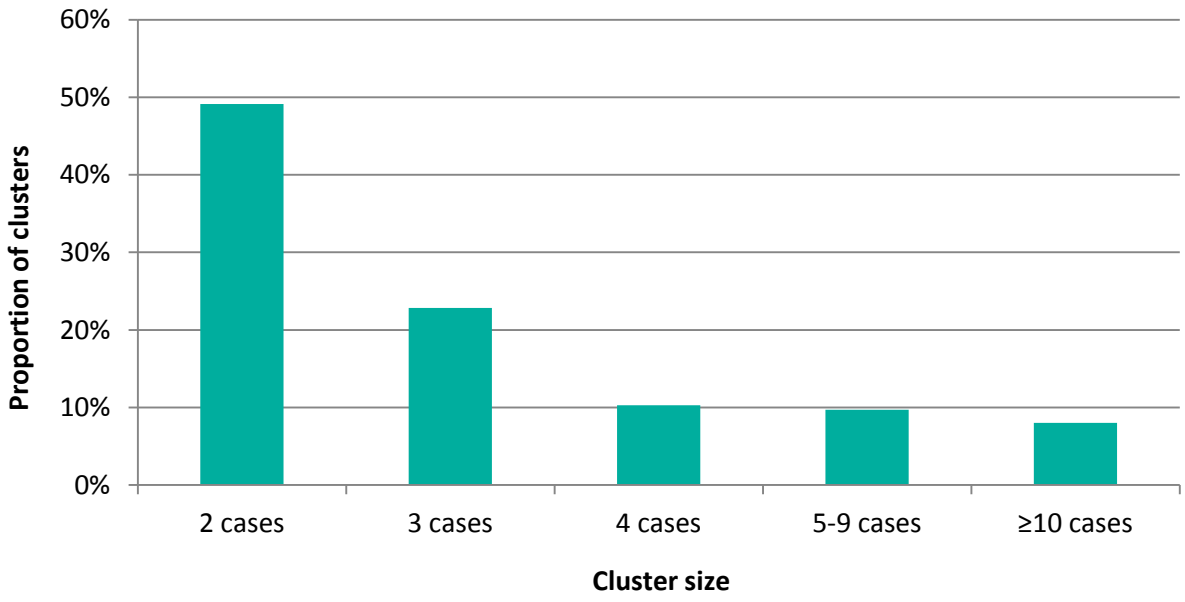
Proportion of cases clustered and geographical distribution

Between 2010 and 2016, 4,928 cases of TB were confirmed by culture in the North West. Of those, 67% (2,034/4,928) had a MIRU-VNTR profile with typing of at least 23 loci. 56% (1,137/2,034) were clustered with at least one other individual at UK level, and were linked to 562 national clusters; 36% (723/2,034) were clustered with other cases within the North West and comprised 175 different regional clusters.

Size of clusters

Of the 175 clusters in the North West during the period 2010 to 2016, 82% (144/175) consisted of fewer than 5 cases; 10% (17/175) had 5 to 9 cases; and 8% (14/175) comprised 10 or more cases (Figure 10). The median cluster size was 3 cases (range 2 to 36 cases).

Figure 10: Proportion of regional TB clusters by size, North West, 2010 – 2016



Cluster lineage

In the period 2010 to 2016, 50% (361/723) of cases in North West clusters had strains of Euro-American lineage; 31% (227/723) were of Central Asian lineage; 5% (35/621) were of Beijing lineage; and 2% (17/723) were of East African Indian lineage. 39% (361/919) of all cases infected with the Euro-American lineage were in North West

clusters, as were a third of all culture confirmed cases in the North West which had at least 23 loci identified (Table 3).

Table 3 Lineage of TB clusters, North West, 2010 – 2016

Lineage	Number of cases*	Number of cases clustered	Proportion of cases clustered
Euro-American	919	361	39%
Central Asian	595	227	38%
East African Indian	160	17	11%
Beijing	81	35	43%
Other**	279	83	30%
Total	2034	723	36%

* Number of culture confirmed cases with at least 23 loci.
** Including *M. bovis* cases, *M. africanum* cases, cases with multiple lineages and cases with no known lineage.

Most cases with East African Indian lineage were born outside the UK (94%, 16/17); as were those of Beijing (89%, 31/35) and Central Asian (68%, 155/227) lineage. 72% (259/361) of those with Euro-American lineage were UK born; as were 86% (6/7) of *M. bovis* cases. 89% (322/361) of cases in North West clusters which had Euro-American lineage had pulmonary disease.

Characteristics of cases in clusters*

Of the 723 clustered North West cases notified between 2010 and 2016, 62% (449/721) were male and 58% (421/723) were aged 15 to 44 years. Children aged under 15 years comprised just 3% (23/723) of clustered cases.

Over half (55%, 383/701) of clustered cases were UK born. Of those which were born outside the UK, 48% (139/292) were notified within 5 years of entering the UK and 33% (95/292) were notified more than 10 years after entry.

The majority of clustered North West cases notified between 2010 and 2016 were in the White ethnic group (44%, 300/689) and over one quarter (28%, 191/689) were in the Pakistani ethnic group.

76% (553/723) of clustered cases had pulmonary TB. Of those, only 37% (204/553) were smear positive. However, this figure is distorted by the fact that sputum smear results were missing for 47% (260/553) of pulmonary cases. 7% (44/653) of clustered cases had received a previous diagnosis of TB.

23% (130/562) of clustered cases had at least one social risk factor (current or previous history of prison, homelessness, alcohol use and/or drug use). However, over three quarters (77%, 432/562) recorded having no social risk factors. Isoniazid resistance was observed in 4% (27/723) of clustered North West cases between 2010 and 2016, and multi-drug resistant (MDR-TB) cases comprised 0.6% (4/723) of clustered cases.

* 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 85% of North West cases notified in 2016. This proportion has improved over the last 5 years, from 68% in 2011. The median number of days between symptom onset and treatment start was 85 (Table 4). This was lower among those with pulmonary disease at 75 days and higher among extra-pulmonary cases at 101 days. Among pulmonary cases, 40% (118/293) were treated within 2 months of symptom onset, and 69% (202/293) 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 4: Time between symptom onset and treatment start*, North West, 2016

	Median days (IQR)	0-2 months		2-4 months		>4 months	
		n	%	n	%	n	%
Extra-pulmonary	101 (55-199)	59	27%	68	31%	89	41%
Pulmonary	75 (38-136)	118	40%	84	29%	91	31%
Pulmonary smear positive	62 (34-129)	52	46%	30	27%	30	27%
All Cases	85 (44-157)	177	35%	152	30%	180	35%

* 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% of males and 34% of females. A greater proportion of cases were in older age groups: 0% in the 0-14 age group compared with 31% for those aged 15-44, 32% for those aged 45-64, and 40% for those aged 65 years and over.

Of the 31 local authorities with notifications of pulmonary TB in 2016, 9 had over half of their cases treated within 2 months of symptom onset. There was also variation among ethnic groups: 26% (17/66) of cases (with known onset and treatment dates) in the Pakistani ethnic group were treated within 2 months of symptom onset, compared with 39% (26/66) with delays of more than 4 months. In the Black-African ethnic group, 59% (26/44) were treated within 2 months of symptom onset, while only 9% (4/44) 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. 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 the following groups:

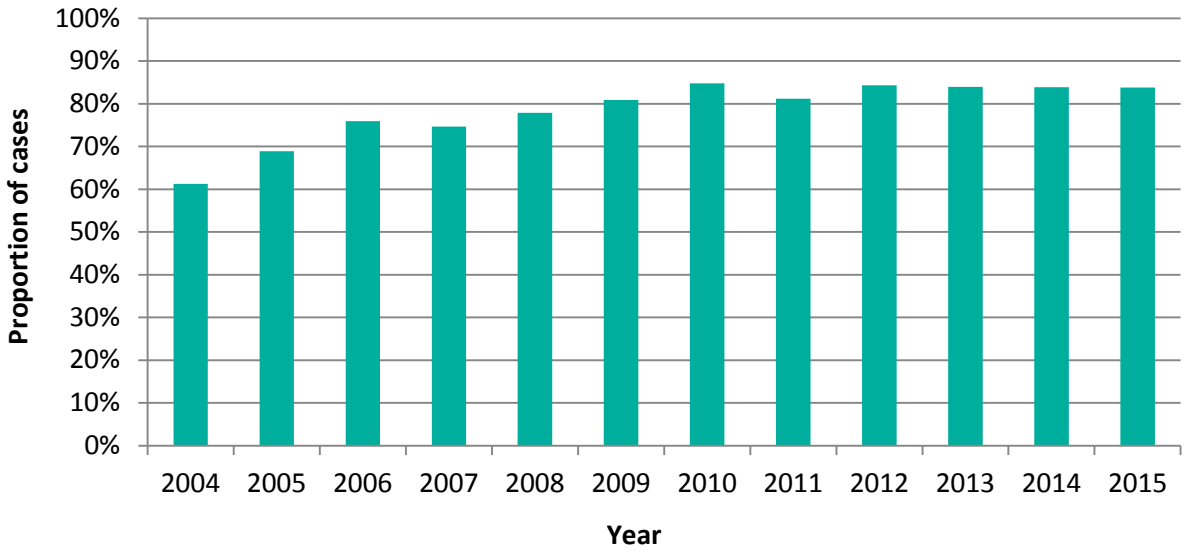
For cases with an expected treatment duration of less than 12 months, TB outcomes at 12 months are reported. This group excludes cases with CNS (central nervous system) disease, who have an expected treatment duration of 12 months. In addition, those with spinal, cryptic disseminated or miliary disease 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

In 2015, 568 TB cases were notified in the North West; 87% (494/568) 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 has remained stable at 84% since 2012 (Figure 11).

Figure 11: Treatment completion at 12 months for drug sensitive cases with expected treatment duration of 12 months, North West, 2004 – 2015*



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

In 2015, 84% (414/494) of cases in this group completed treatment at 12 months (Table 5), compared with 84% (469/559) in 2014. The most common reasons for not completing treatment were death (8%, 38/494) and being lost to follow up (5%, 26/494).

Table 5: TB outcome at 12 months for drug sensitive cases with expected treatment duration of 12 months, North West, cases diagnosed in 2015*

TB outcome	n	%
Treatment completed	414	84%
Died	38	8%
Lost to follow up	26	5%
Still on treatment	14	3%
Treatment stopped	2	0%
Not evaluated**	0	0%
Total	494	100%

* 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 38 deaths, the relationship between TB and death was unknown for 39% (15/38). Among the 23 cases for which information was recorded, TB caused 4 deaths; contributed to 13; and was incidental to 6.

The median age of those who died was 77; 8 cases (21%) were diagnosed at post-mortem. Older cases were less likely to complete treatment: 58% (39/67) of those aged 65 years or older completed treatment within 12 months, compared with over 85% of cases in the other age groups. The 65 years and over age group also had a higher proportion of cases who died (33%, 22/67).

Treatment completion was 85% (259/305) among the non-UK born, and broadly similar in the UK born at 84% (147/176). A greater proportion of UK born cases died before completing treatment (12%, 21/176) than those born abroad (4%, 13/305). The proportion of females completing treatment within 12 months was 86% (162/189), compared with 83% (252/305) 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

82% of cases with no social risk factors recorded completed treatment within 12 months, compared with 80% of cases with known risk factors.

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

Of the 67 cases with CNS, spinal, miliary or cryptic disseminated disease in 2015, 72% (48/67) had completed treatment at the last recorded outcome (Table 6). 43% (29/67) completed treatment within 12 months, while 36% (24/67) remained on treatment. 28% (19/67) completed treatment in more than 12 months.

Table 6: TB outcome at last recorded outcome for drug sensitive cohort with CNS, spinal, miliary or cryptic disseminated disease, North West, cases diagnosed in 2015*

TB outcome	n	%
Treatment completed	48	72%
Died	11	16%
Lost to follow up	3	4%
Still on treatment	5	7%
Treatment stopped	0	0%
Not evaluated**	0	0%
Total	67	100%

* 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.

7% (5/67) were still on treatment at last recorded outcome; 16% (11/67) died; and 4% (3/67) were lost to follow up. Of the 11 deaths, TB caused death in one case and was incidental in 4 cases. In 6 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 2013, ranging from 4% to 7% overall; although in 2014 and 2015, this increased slightly to 9%. Of the 561 drug sensitive cases notified in 2015, 49 cases (9%) died. Of these, the relationship between TB and death was unknown for 43% (21/49). TB was incidental to 20% (10/49) of deaths; contributed to 27% (13/49) of deaths; and caused 10% (5/49) of deaths. 51% (25/49) of deaths were in cases aged 65 years and over.

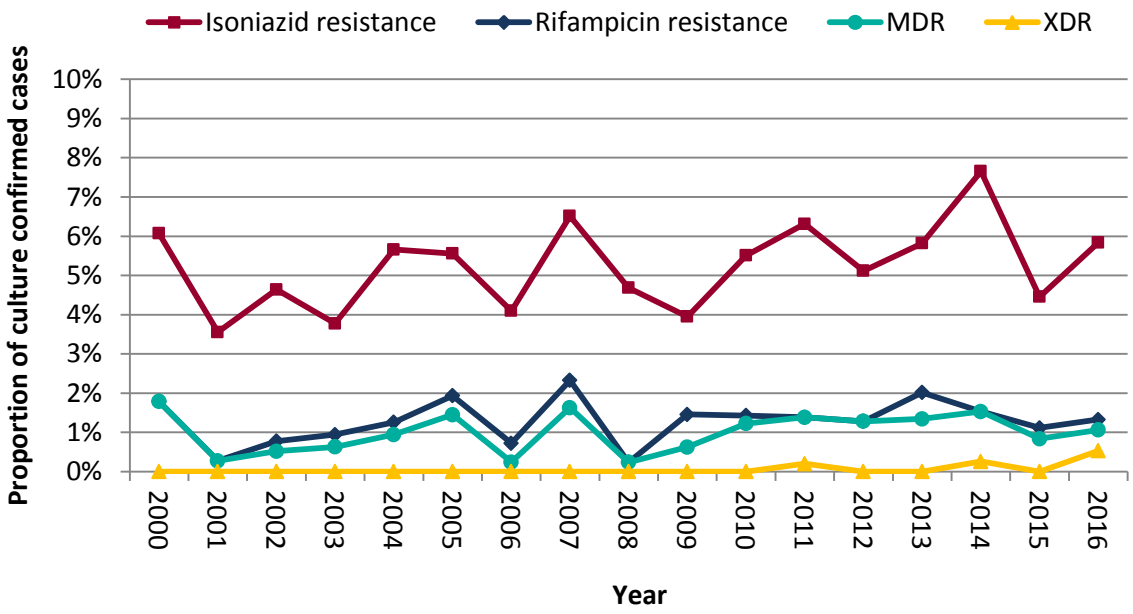
The proportion of drug sensitive cases that were lost to follow up at the last recorded outcome has remained reasonably stable since 2004, ranging from 3% to 5% overall. 5% (29/561) of cases were lost to follow up in 2015. Of these, 90% (26/29) were born outside the UK; and 62% (18/29) had left the UK. Males accounted for 69% (20/29) of cases lost to follow up and 79% (23/29) were in the 15-44 age group.

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

Drug resistance

In 2016, 6% (23/377) of culture confirmed TB cases were resistant to one or more first line drugs. 6% (22/377 cases) had isoniazid resistance; an increase from the previous year (4%, 16/359, in 2015). 1% (5/377) were resistant to rifampicin; 1% (4/377) had MDR-TB (resistant to isoniazid and rifampicin); and 0.5% (2/377) had extensively drug resistant (XDR) TB in the North West in 2016 (Figure 12).

Figure 12: Proportion of drug resistant TB cases, North West, 2000 – 2016*



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

Most drug resistant cases were male (57%, 13/23) and most were aged between 15 and 44 years old (52%, 12/23). Over half had pulmonary disease (78%, 18/23); and, of these, 50% (9/18) had a positive sputum smear result. Of the 4 MDR-TB cases, 3 were non-UK born; all 4 had pulmonary disease and were in the 15-44 years age group.

Of drug resistant cases notified in 2015, 43% (3/7) had completed treatment at the last recorded outcome, compared with 78% (7/9) in 2014. The most common reasons for not completing treatment were still being on treatment (75%, 3/4) and being lost to follow up (25%, 1/4).

TB outcome at 24 months for cases with rifampicin resistant disease

In 2014, 6 culture confirmed cases had rifampicin resistant TB and each of these cases also had MDR-TB. 3 MDR cases were male; 4 were in the 15-44 years age group; and 5 were born outside the UK.

At 12 months, none of the 6 rifampicin resistant cases had completed treatment; 4 were still on treatment; and 2 were lost to follow up. Of the 4 cases that were still on treatment at 12 months, all had completed treatment at 24 months (Table 7).

Table 7: TB outcome at 24 months for culture confirmed cases with rifampicin resistant disease, North West, cases diagnosed in 2014

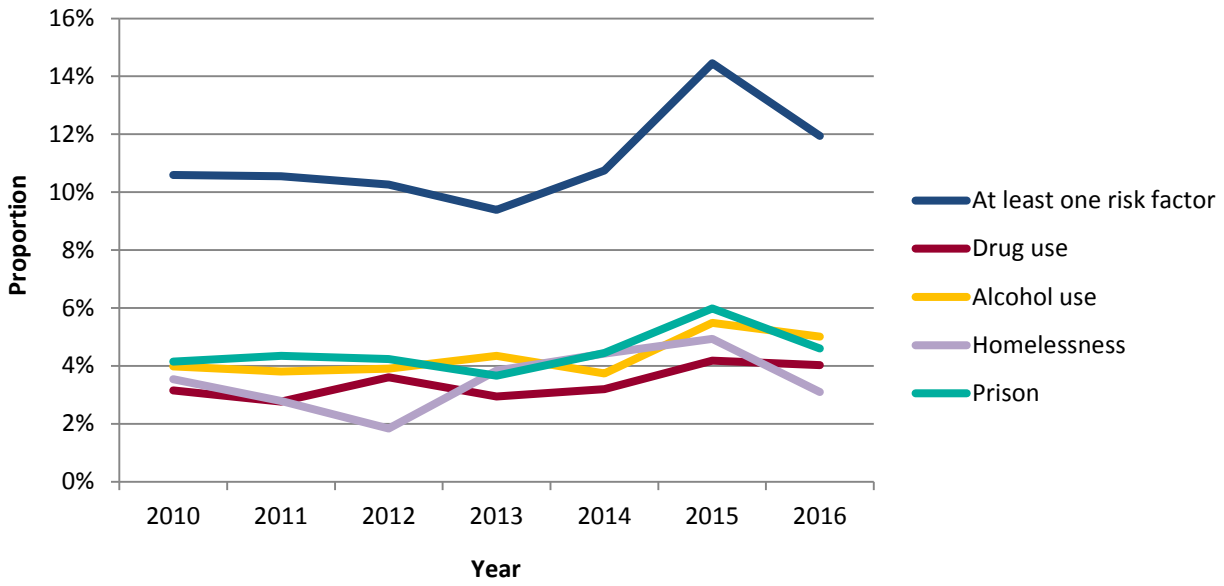
TB outcome	n	%
Treatment completed	4	67%
Died	0	0%
Lost to follow up	2	33%
Still on treatment	0	0%
Treatment stopped	0	0%
Total	6	100%

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 2016, information on social risk factors was recorded for 76% (427/564) of TB cases in the North West aged 15 years and over, and 11.9% (51/427) of these cases had at least one social risk factor (Table 8). Where information on individual risk factors was known, 4.6% (20/435) reported imprisonment, 5.0% (25/499) reported alcohol misuse, 4.0% (20/497) reported drug use and 3.1% (15/485) reported homelessness.

Figure 13: Social risk factors among TB cases*, North West, 2010 – 2016



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

The majority of cases with at least one social risk factor were male (78%, 40/51) and 51% (26/51) were in the 15 to 44 years age group. Almost three quarters of cases (73%, 36/49) with at least one social risk factor were UK born; a similar proportion to previous years (68%, 42/62, in 2015). Among UK born cases, 92% (33/36) 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 (77%, 10/13).

52% (23/44) of cases with at least one social risk factor received directly observed therapy (DOT) in 2016 (for cases where use of DOT was recorded). Of those, 74% (17/23) had current or previous history of alcohol use; 57% (13/23) had current or

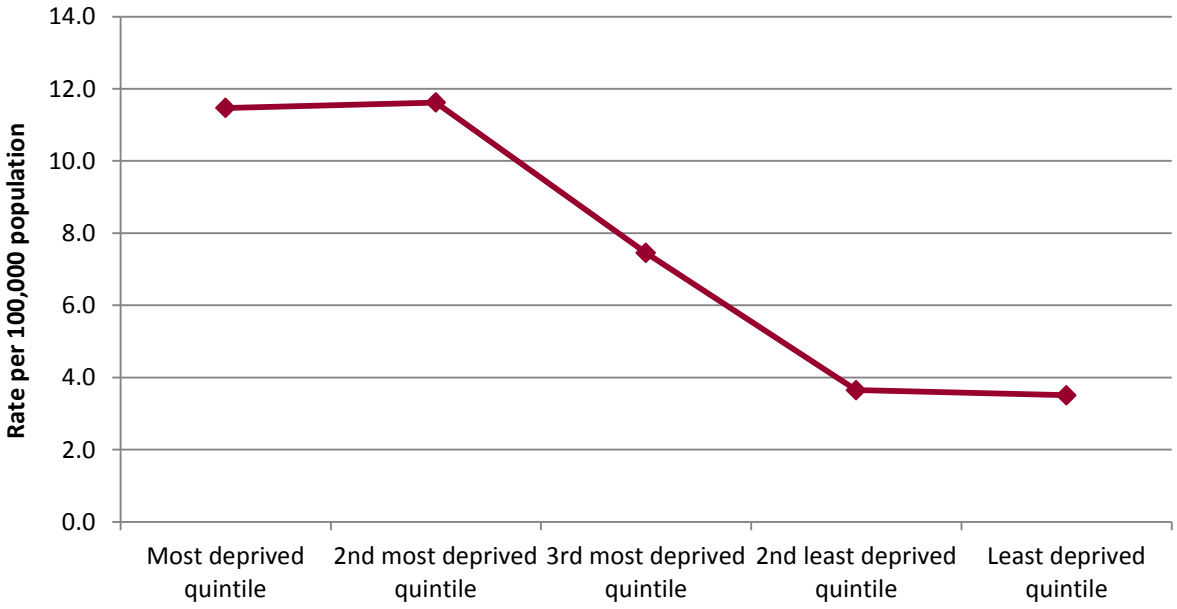
previous drug use; 43% (10/23) had current or previous imprisonment; and 39% (9/23) had current or previous homelessness. 65% (15/23) of cases receiving DOT had more than one social risk factor recorded.

A higher proportion of drug sensitive cases with at least one social risk factor notified in 2015 had died at the last recorded outcome (16%, 10/63) compared to cases with no social risk factors (6%, 22/387).

Socio-economic deprivation

In 2016, 45% (267/600) of TB cases were resident in the most socio-economically deprived areas of the North West, compared to only 7% (39/600) 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 (11.5 and 11.6 per 100,000 population, respectively) compared with the least socio-economically deprived quintile (3.5 per 100,000 population).

Figure 14: Rate of TB by socio-economic deprivation quintile*, North West, 2016



* Denominator data: 2015 Index of Multiple Deprivation (Department for Communities and Local Government) and 2016 Mid-Year 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 96% (547/572) of North West cases reported in 2016 (with previously unknown HIV status and excluding those diagnosed post-mortem). Of these, 93.8% (513/547) were offered and received an HIV test; similar to previous years (96% in 2015 and 93% in 2014). The remaining cases did not receive a test: 4.9% (27/547) were not offered a test; 0.5% (3/547) were offered a test but did not receive it; and 0.7% (4/547) refused testing.

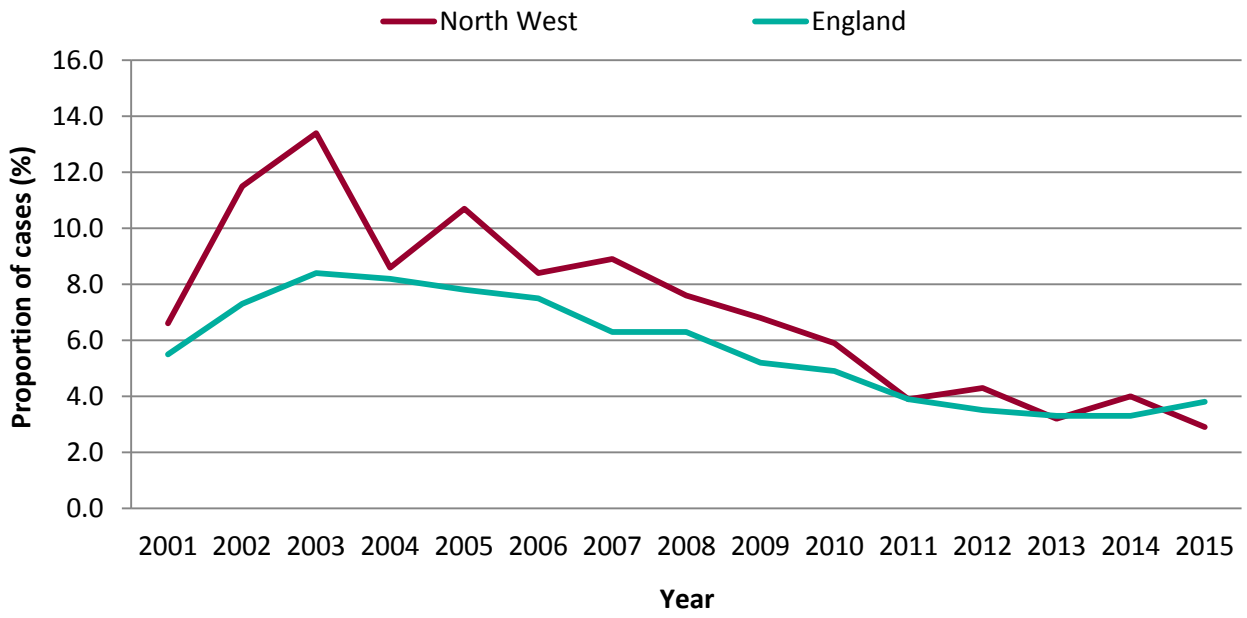
Cases born outside the UK were more likely to be offered a test (97%, 334/343) than UK born cases (92%, 177/193). Cases in certain age groups were also more likely to be offered a test: 93% of cases in the 15-44 and 45-64 years age groups were offered an HIV test, compared with 89% (80/90) of cases aged 65 years and over and 69% (25/36) 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 83% (20/24) in Preston to 100% in Blackburn with Darwen (37/37). In 20 of the 34 local authorities where TB cases were identified in 2016, 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 2003, in line with the national trend (Figure 15).[1] In 2015 (the latest year for which data are available), 2.9% of North West TB cases aged 15 years and over were co-infected with HIV, compared with 3.8% of cases across England.

Figure 15: Proportion of notified and un-notified TB cases matched to an HIV case*, North West and England, 2001 – 2015



* 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. Latent TB infection testing and treatment

A national programme of latent TB infection (LTBI) testing and treatment for new entrants has begun phased implementation in 7 CCGs in the North West: Blackburn with Darwen, Bolton, Central Manchester, East Lancashire, Liverpool, North Manchester and Oldham. Further information on this programme is presented in Public Health England's *Tuberculosis in England: 2017 report*.[1]

Discussion

Numbers and rates of TB in North West England have decreased each year since 2011, with a small increase in 2016; although rates remain below the national level. The regional rate increased by 6% between 2015 and 2016. Nationally, a 'plateau' in the reduction of case numbers has been reported[1], and in the North West the observed rise in the annual rate represents a comparatively small number of cases (n=32).

The reasons for this rise may be multiple and may include random chance and a low incidence year during 2015; but a genuine change in the overall trend direction cannot be ruled out, and reminds us that continued efforts in TB prevention are necessary.

The small rise appears to be largely in the UK born population, with case numbers in this group having risen by 17%. Among these UK born cases, the White ethnic group appears to have experienced the largest rise (from 131 cases in 2015 to 154 in 2016); although this rise was observed in most age groups, and there was no corresponding rise in the number of clustered cases.

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.

In the North West, rates in the non-UK born population have fallen markedly in previous years, but remained stable in 2016.

While most cases were born abroad, the ethnic groups with the highest proportion of total cases were the White and Pakistani ethnic groups. Of cases born abroad who were notified in 2016, 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. Although only making up a small proportion of total cases, there has been a large rise in the number of White, non-UK born cases originating from Romania; suggesting a need to explore interventions within this community. Encouragingly, this group also had the shortest median time between entry to the UK and diagnosis.

Rates across most age groups increased in 2016, with the largest increases seen in the 45-64 and 65+ years age groups. The rate in the 0-14 age group increased overall, reflecting a parallel increase in the rate among UK born children.

Overall, the number of cases with social risk factors has changed little during the past year. However, the general rise since 2010 indicates 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 2016 had a sputum smear result; an improvement on previous years. This is an important indication of infectiousness, and should be obtained for all cases where possible.

From 2010 to 2016, 56% of strain typed cases in the North West were found to cluster genetically with at least one other case at UK level; 36% were clustered with other cases within the North West. Almost half of North West clusters consisted of only 2 people and the largest North West cluster during this period comprised 36 people.

More than 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 remained stable at 84% since 2012. 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 94% in 2016; 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 96% of cases; and in 20 of the 34 local authorities where TB was notified in 2016, 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: Description of data sources and definitions

Data sources

Data on tuberculosis cases in the North West are derived from the national Enhanced TB Surveillance (ETS) system. Data collected includes notification details, and demographic, clinical and microbiological information, including drug resistance and strain type, provided by the National Mycobacterium Reference Laboratory (NMRL).

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

Treatment outcome

Information on treatment outcomes are reported for all cases reported in the previous year, excluding those with known rifampicin resistant disease (treatment outcomes for these cases are reported at 24 months). Definitions for treatment outcome are based on World Health Organization and European definitions, adapted to the UK context. In this report, all data were obtained from the ETS matched dataset provided in August 2017.

Population denominators

Tuberculosis rates by geographical area, age, sex and place of birth were calculated using ONS mid-year population estimates. Rates of TB in UK born children and rates by ethnic group and origin were calculated using UK Labour Force Survey population estimates[3].

Cluster definitions

Strain typing was performed at the TB reference laboratories using 24 MIRU-VNTR profiling. Analysis was undertaken on strain type clusters defined as 2 or more people with TB caused by indistinguishable strains, with at least 23 complete VNTR loci.

Appendix B: TB among North West residents

Table Bi: TB case numbers by local authority of residence, North West, 2007 – 2016

Local Authority	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Allerdale	3	1	0	1	0	2	2	4	2	3
Barrow-in-Furness	7	1	2	4	4	5	2	1	2	2
Blackburn with Darwen	49	53	62	74	42	56	59	34	35	38
Blackpool	11	16	11	12	31	20	12	19	9	15
Bolton	62	63	75	66	61	47	58	56	43	50
Burnley	9	3	15	10	13	11	9	2	3	6
Bury	11	8	24	14	21	23	16	25	17	11
Carlisle	5	2	0	0	1	12	4	1	3	1
Cheshire East	4	9	6	8	12	9	21	12	18	17
Cheshire West and Chester	10	5	8	10	8	8	11	12	11	7
Chorley	0	1	2	1	3	9	6	4	2	4
Copeland	1	0	0	2	0	2	2	0	1	1
Eden	3	2	0	0	0	1	1	1	0	0
Fylde	2	1	8	2	1	2	2	3	1	0
Halton	3	1	2	2	0	0	2	5	2	0
Hyndburn	22	26	11	6	11	9	14	4	9	6
Knowsley	0	4	4	3	5	2	5	3	2	2
Lancaster	1	0	1	8	8	8	4	5	2	7
Liverpool	44	50	45	61	42	48	41	36	41	34
Manchester	175	171	203	198	220	181	166	135	122	136
Oldham	41	46	36	52	46	50	43	53	54	42
Pendle	28	19	27	19	25	18	19	15	11	14
Preston	36	33	23	33	46	35	28	22	17	24
Ribble Valley	5	3	4	0	1	1	2	1	0	3
Rochdale	43	51	47	41	42	35	23	39	26	31
Rossendale	4	2	2	5	1	2	3	4	4	2
Salford	27	34	29	36	24	24	30	26	32	30
Sefton	6	12	9	10	7	17	6	9	6	8
South Lakeland	4	2	5	4	6	7	3	7	0	2
South Ribble	2	3	4	3	9	2	4	6	4	1
St. Helens	4	4	2	4	5	5	3	5	2	2
Stockport	22	24	14	10	28	15	16	19	14	13
Tameside	21	29	46	35	33	34	22	19	16	23
Trafford	29	19	31	23	27	39	31	26	22	25
Warrington	9	9	12	12	6	9	14	9	8	9
West Lancashire	1	2	1	4	1	1	2	3	2	0
Wigan	11	9	16	15	9	7	14	11	14	15
Wirral	16	10	10	16	10	11	11	6	10	13
Wyre	2	2	2	5	9	8	5	0	1	3
Cheshire and Merseyside	96	104	98	126	95	109	114	97	100	92
Cumbria and Lancashire	195	172	180	193	212	211	183	136	108	132
Greater Manchester	442	454	521	490	511	455	419	409	360	376
NORTH WEST	733	730	799	809	818	775	716	642	568	600

Table Bii: TB rate per 100,000 population by local authority of residence, North West, 2007 – 2016

Local Authority	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Allerdale	3.1	1.0	0.0	1.0	0.0	2.1	2.1	4.1	2.1	3.1
Barrow-in-Furness	10.0	1.4	2.9	5.8	5.8	7.3	2.9	1.5	3.0	3.0
Blackburn with Darwen	34.0	36.6	42.4	50.4	28.4	37.9	40.0	23.2	23.8	25.9
Blackpool	7.7	11.2	7.7	8.4	21.8	14.1	8.5	13.5	6.4	10.7
Bolton	23.1	23.3	27.5	24.0	22.0	16.8	20.7	20.0	15.3	17.8
Burnley	10.3	3.4	17.2	11.5	14.9	12.6	10.4	2.3	3.4	6.9
Bury	6.0	4.4	13.1	7.6	11.3	12.4	8.6	13.3	9.0	5.9
Carlisle	4.7	1.9	0.0	0.0	0.9	11.1	3.7	0.9	2.8	0.9
Cheshire East	1.1	2.5	1.6	2.2	3.2	2.4	5.6	3.2	4.8	4.5
Cheshire West and Chester	3.0	1.5	2.4	3.0	2.4	2.4	3.3	3.6	3.3	2.1
Chorley	0.0	0.9	1.9	0.9	2.8	8.3	5.4	3.6	1.8	3.5
Copeland	1.4	0.0	0.0	2.8	0.0	2.8	2.9	0.0	1.4	1.4
Eden	5.7	3.8	0.0	0.0	0.0	1.9	1.9	1.9	0.0	0.0
Fylde	2.7	1.3	10.6	2.6	1.3	2.6	2.6	3.9	1.3	0.0
Halton	2.5	0.8	1.6	1.6	0.0	0.0	1.6	4.0	1.6	0.0
Hyndburn	27.0	32.0	13.6	7.4	13.7	11.2	17.5	5.0	11.2	7.5
Knowsley	0.0	2.7	2.7	2.0	3.4	1.4	3.4	2.0	1.4	1.4
Lancaster	0.7	0.0	0.7	5.8	5.8	5.7	2.8	3.5	1.4	4.9
Liverpool	9.7	11.0	9.8	13.2	9.0	10.2	8.7	7.6	8.6	7.1
Manchester	37.2	35.8	42.0	40.2	43.7	35.4	32.3	26.0	23.0	25.6
Oldham	18.6	20.7	16.2	23.2	20.4	22.1	18.9	23.2	23.4	18.2
Pendle	31.5	21.3	30.2	21.3	27.9	20.1	21.1	16.7	12.2	15.5
Preston	26.0	23.8	16.7	23.8	32.8	24.9	19.9	15.7	12.0	17.0
Ribble Valley	8.8	5.2	7.0	0.0	1.7	1.7	3.5	1.7	0.0	5.1
Rochdale	20.6	24.3	22.4	19.5	19.8	16.5	10.8	18.3	12.1	14.5
Rossendale	6.0	3.0	3.0	7.4	1.5	2.9	4.4	5.8	5.8	2.9
Salford	12.1	15.0	12.7	15.5	10.2	10.1	12.6	10.7	13.0	12.2
Sefton	2.2	4.4	3.3	3.7	2.6	6.2	2.2	3.3	2.2	2.9
South Lakeland	3.8	1.9	4.8	3.8	5.8	6.8	2.9	6.8	0.0	1.9
South Ribble	1.9	2.8	3.7	2.8	8.2	1.8	3.7	5.5	3.6	0.9
St. Helens	2.3	2.3	1.1	2.3	2.9	2.8	1.7	2.8	1.1	1.1
Stockport	7.8	8.5	5.0	3.5	9.9	5.3	5.6	6.6	4.8	4.5
Tameside	9.8	13.4	21.2	16.0	15.0	15.4	10.0	8.6	7.2	10.4
Trafford	13.2	8.6	13.9	10.2	11.9	17.1	13.5	11.2	9.4	10.7
Warrington	4.6	4.5	6.0	6.0	3.0	4.4	6.8	4.4	3.9	4.3
West Lancashire	0.9	1.8	0.9	3.6	0.9	0.9	1.8	2.7	1.8	0.0
Wigan	3.6	2.9	5.1	4.7	2.8	2.2	4.4	3.4	4.3	4.7
Wirral	5.1	3.2	3.1	5.0	3.1	3.4	3.4	1.9	3.1	4.1
Wyre	1.8	1.8	1.9	4.6	8.4	7.4	4.6	0.0	0.9	2.7
Cheshire and Merseyside	4.0	4.4	4.1	5.2	3.9	4.5	4.7	4.0	4.1	3.8
Cumbria and Lancashire	10.0	8.8	9.2	9.9	10.8	10.7	9.3	6.9	5.5	6.7
Greater Manchester	17.0	17.3	19.7	18.4	19.0	16.8	15.4	15.0	13.1	13.6
NORTH WEST	10.6	10.5	11.4	11.5	11.6	10.9	10.1	9.0	7.9	8.4

Table Biii: TB case numbers and rates by age and sex, North West, 2016

	Female		Male	
Age Group	Number	Rate	Number	Rate
0-14	23	3.7	13	2.0
15-44	134	9.8	169	12.3
45-64	58	6.1	108	11.7
65+	47	6.6	48	8.1

Table Biv: Drug resistance among TB cases with culture confirmed disease, North West, 2007 – 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Culture confirmed	430	427	481	490	507	469	447	392	359	377
Drug resistant*	31	21	23	28	32	24	29	30	17	23
% Drug resistant	7%	5%	5%	6%	6%	5%	6%	8%	5%	6%

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

Appendix C: Baseline data for TB strategy monitoring indicators, North West and England, 2000-2016

	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	569	8.3	6,929	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	8,083	15.1
2013	716	10.1	7,263	13.5
2014	642	9.0	6,472	11.9
2015	568	7.9	5,727	10.5
2016	600	8.4	5,664	10.2

	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	3.1	357	101.7	1,791	4.0	4,570	95.1
2005	244	3.8	468	121.2	1,804	4.0	5,186	100.7
2006	229	3.6	426	99.3	1,729	3.9	5,175	92.9
2007	253	4.0	458	99.6	1,799	4.0	5,135	85.5
2008	231	3.6	474	93.5	1,867	4.2	5,417	86.0
2009	255	4.0	494	95.7	1,907	4.2	5,662	86.8
2010	270	4.2	491	91.9	1,814	4.0	5,515	83.1
2011	259	4.0	521	93.4	1,958	4.3	6,021	85.9
2012	262	4.1	494	90.5	2,003	4.4	5,840	81.4
2013	255	4.0	447	78.6	1,842	4.0	5,256	70.6
2014	226	3.5	405	66.4	1,756	3.8	4,611	60.2
2015	185	2.9	368	55.4	1,529	3.3	4,096	51.3
2016	217	3.4	370	55.7	1,469	3.2	4,096	49.4

	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	1.5	209	2.3
2001	20	1.6	229	2.5
2002	19	1.5	228	2.6
2003	18	1.4	179	2.0
2004	15	1.2	264	3.0
2005	22	1.8	247	2.8
2006	23	1.9	209	2.4
2007	30	2.5	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	2.1	162	1.8

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	98	36.4	-	-
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	44.5	1318	45.0
2012	125	43.4	1371	44.1
2013	95	38.2	1224	41.2
2014	120	39.3	1158	39.5
2015	108	40.1	1184	42.4
2016	118	40.3	1079	39.4

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	196	72.9	-	-
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	72.2	2173	74.2
2012	204	70.8	2294	73.8
2013	161	64.7	2124	71.5
2014	219	71.8	2046	69.8
2015	190	70.6	2015	72.2
2016	202	68.9	1898	69.3

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	194	52.4	1,862	52.1
2001	253	66.1	2,037	56.4
2002	265	69.2	2,622	64.9
2003	216	63.5	2,585	66.0
2004	213	67.6	2,740	68.4
2005	271	66.1	2,989	69.1
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	70.4
2011	298	72.3	3,076	71.7
2012	286	73.3	2,950	70.4
2013	265	74.9	2,712	72.9
2014	255	72.6	2,488	73.2
2015	238	78.5	2,244	74.1
2016	246	71.5	2,310	76.0

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	262	93.6	2,779	99.4
2001	353	96.4	3,123	99.2
2002	369	95.1	3,793	98.6
2003	303	95.3	3,799	99.2
2004	296	93.1	4,020	98.6
2005	387	93.5	4,532	98.9
2006	393	94.7	4,607	98.7
2007	394	91.6	4,366	98.2
2008	401	93.9	4,429	97.6
2009	454	94.4	4,519	96.8
2010	460	93.9	4,517	98.0
2011	471	92.9	4,896	97.3
2012	441	94.0	4,786	97.8
2013	420	94.0	4,287	97.6
2014	363	92.6	3,833	97.7
2015	340	94.7	3,426	98.1
2016	347	92.0	3,404	95.4

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	284	44.6	3,631	63.7
2002	472	74.4	4,111	67.4
2003	412	72.3	4,191	69.6
2004	334	59.2	4,426	70.1
2005	497	67.7	4,877	70.3
2006	515	74.5	5,214	75.5
2007	529	73.2	5,290	78.2
2008	552	75.7	5,602	80.3
2009	625	79.0	5,917	81.9
2010	650	81.0	5,650	82.9
2011	632	77.9	6,025	82.1
2012	624	81.3	6,016	83.8
2013	578	82.0	5,502	85.6
2014	512	80.9	4,847	84.8
2015	443	79.0	4,168	83.4
2016	-	-	-	-

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	363	4.5
2013	26	3.7	298	4.2
2014	21	3.3	273	4.3
2015	29	5.2	239	4.2
2016	-	-	-	-

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	47	5.8	393	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	343	6.1
2016	-	-	-	-

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	39	48.8
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	57	60.6
2013	4	44.4	49	57.6
2014	4	66.7	34	49.3
2015	-	-	-	-
2016	-	-	-	-

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	11	11.7
2013	1	11.1	14	16.5
2014	2	33.3	12	17.4
2015	-	-	-	-
2016	-	-	-	-

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	-	-	-	-
2016	-	-	-	-

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	5,786	93.6
2014	547	94.6	5,401	95.4
2015	477	97.0	4,946	96.4
2016	520	95.1	4,887	96.6

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	31	57.4	371	73.5
2011	36	66.7	370	71.4
2012	38	67.9	393	74.7
2013	39	76.5	402	77.3
2014	34	66.7	361	74.7
2015	49	77.8	385	74.6
2016	-	-	-	-

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	309	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	306	6.8
2009	23	4.8	371	8.1
2010	28	5.8	322	7.1
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	262	7.5

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