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Tuberculosis in Yorkshire and Humber: Annual review (2016 data)

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The data presented in this report are correct as at 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. In particular we aim to update the Yorkshire and Humber and North East TB Control Board and clinical leadership groups across Yorkshire and Humber.

Aim of report

This report describes the recent epidemiology of TB in Yorkshire and Humber, 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. The data presented is used to inform recommendations on the ongoing implementation of the *Collaborative TB Strategy for England 2015-2020* (1)

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:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/654152/TB_Annual_Report_2017.pdf

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 Statistic for TB, 'Reports of cases of tuberculosis to enhanced tuberculosis surveillance systems: United Kingdom, 2000 to 2015'. This is available at:

<https://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.

https://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 TB strategy indicators is presented in Appendix D.

Data for indicators which are presented at Upper Tier Local Authority and Clinical Commissioning Group can be found at:

<http://fingertips.phe.org.uk/profile/tb-monitoring>

Executive summary

In January 2015, Public Health England and NHS England jointly launched the *Collaborative Tuberculosis Strategy for England 2015-2020* [1]. The strategy aims to achieve a year-on-year decrease in TB incidence, a reduction in health inequalities, and ultimately the elimination of TB as a public health problem in England. To achieve these aims and deliver significant improvements in TB control the strategy set out 10 key areas for action:

1. Improve access and earlier diagnosis
2. Provide universal high-quality diagnostics
3. Improve treatment and care services
4. Ensure comprehensive contact tracing
5. Improve BCG vaccination uptake
6. Reduce drug resistant TB
7. Tackle TB in under-served populations
8. Implement new entrant latent TB (LTBI) screening
9. Strengthen surveillance and monitoring
10. Ensure an appropriate workforce to deliver TB control

Since the launch of the strategy, significant steps have been taken, locally and nationally, to deliver on the 10 areas for action. In light of the 2016 Annual Report on Tuberculosis in Yorkshire and Humber and its recommendations and taking into account available resources and the life of the Collaborative Strategy, the YHNE TB Control Board developed a list of areas for priority action.

In terms of progress against the action plan and recommendations in last year's report the following activities have been completed:

- A gap analysis at CCG level against the national TB service specification with recommendations to commissioners
- A needs assessment of specialist in-patient facilities for patients with multi-drug resistant (MDR) TB with specific recommendations to improve care
- A series of workshops and learning events including sessions on under-served populations, NICE guidance, MDR-TB and paediatric issues
- An in-depth review of paediatric cases in Yorkshire and Humber
- Analysis of factors contributing to diagnostic delay with recommendations to be taken forward in 2018
- Development of a programme to extend LTBI screening to all eligible migrants in addition to the established nationally-funded screening programme which continues to perform well
- Strengthening support to TB nurses through local TB nurse networks.
- Establishment of the new Yorkshire and Humber clinical network
- A deep dive of the results of a national audit of TB diagnostic services, including a "right to reply" and an opportunity for those Trusts that did not participate to update with their information. This work is ongoing
- An evaluation of cohort review with recommendations for improvement which will be taken forward by the new YH-wide clinical network
- Continued improvement in the offer and uptake of HIV testing

There is still work to be done to improve information capture and entry on to ETS, as well as to improve engagement with CCGs.

Key Points for Yorkshire and Humber

There were 425 cases of TB reported in Yorkshire and Humber during 2016, with an incidence rate of 7.8 per 100,000, which is not only a reduction on 2015 (8.1 per 100,000), but the lowest rate in the last 12 years. It is encouraging that TB incidence is still declining both locally and nationally, however the rate of reduction has slowed during 2016. There remains considerable variation in TB rates across Yorkshire and Humber and the gap between the highest burden local authority and other areas is considerable. This is despite significant progress in incidence reduction in the high burden areas.

As in previous years, there were a number of TB incidents across the region, including in educational, health and social care, childcare and workplace settings. A number of these were particularly complex, with issues around mobile student populations, limited English speaking, difficulties in engaging with employers, and some of these incidents required successive screening rounds. Management of TB incidents consumes a significant amount of resource for many agencies, but also demonstrates excellent collaborative working with a range of partners.

The reduction in numbers of TB cases in Yorkshire and Humber in the past year has occurred in both the non-UK born population and the UK born populations. However, the incidence rates of TB were nearly 21 times higher in those born outside the UK compared to the UK born population and 69% of all TB cases notified in the local population in 2016 were born abroad (where country of birth is known). The local non-UK born rate of TB exceeds the national average (49.1 per 100,000 nationally vs 54.2 per 100,000 in Yorkshire and Humber). Incidence in recent migrants is decreasing more quickly than the incidence in established migrants and 57% of non-UK born TB cases in Yorkshire and Humber have lived in the UK for more than six years.

Among UK born cases, the proportion of cases with Indian Sub-continent (ISC) ethnicities (Pakistani, Indian, Bangladeshi), increased from 23% in 2004 to 31% in 2016. While TB in the Black African ethnic groups in the region remains predominately associated with migration; for ISC ethnic groups, particularly in communities of Pakistani origin, acquisition of TB infection in the UK is an increasing concern (Figure 2.11).

The incidence rate of TB in UK born children (15 years of age and under) in Yorkshire and Humber (1.2 cases per 100,000), an indirect indicator of recent transmission, is now below the England average (1.8 cases per 100,000) and has decreased compared to 2015 (2.2 cases per 100,000). The incidence in pre-school children (0-4 years) has also decreased to 1.8 per 100,000 from 3.6 per 100,000 in 2015. Children aged 0 to 14 made up 3.5% (15) of all TB cases diagnosed in the region in 2016. Where country of birth was known, 78% (11/14) of children with TB in 2016 were UK born, highlighting difficulties in prevention.

Despite year on year improvements in the proportion of cases which are microbiologically confirmed, 15.3% of pulmonary cases are not confirmed and 28% of all cases (pulmonary and non-pulmonary) were not confirmed. Only 65% of pulmonary cases had a smear status recorded.

Early diagnosis and treatment is key to preventing further transmission of TB. It is therefore worth noting that in 2016 over half (59.2%) of pulmonary TB cases commenced treatment more than two months after the onset of symptoms (64.2%) for all cases. Delayed diagnosis of potentially infectious patients within healthcare settings has considerable impact, particularly where the diagnosis was not suspected and staff and patients may have been exposed. Investigation and clinical management of these incidents can be complex and resource intensive.

The NHSE-funded latent TB infection (LTBI) testing and treatment programme has now been in place in Yorkshire and Humber since February 2016, covering the four local authority areas identified as having

the highest burden of TB (Sheffield, Leeds, Bradford and Kirklees). Those eligible for screening (aged 16 to 35 years, who have entered the UK from a high incidence country within the last five years) are identified in primary care and subsequently screened by single interferon gamma release assay (IGRA). Between April 2017 and March 2018 250 latent TB infections were diagnosed as a result of the programme.

The proportion of TB cases diagnosed with multi-drug resistant TB decreased in 2016 from 2.7% in 2015 to 1.2% in 2016. Mono-resistance to Isoniazid increased from 6% in 2011 to 7% in 2016. The most frequent countries of birth of cases resistant to Isoniazid alone and MDR-TB were Eastern European countries in contrast to the national picture where the United Kingdom and Indian subcontinent accounted for the country of birth of the majority of cases.

The proportion of TB cases completing treatment within 12 months of diagnosis (where treatment completion is expected to be less than 12 months) in the region (84.3%) is similar to the 2015 cohort of cases which were reported last year (85.0%) and is also consistent with the England average (83.4%). This does represent a considerable improvement on the 62.5% treatment completion for cases diagnosed in 2004. There is however, considerable variation in treatment completion rates across the region with lower treatment completion reported from both low and high burden areas. Encouragingly many of the highest burden areas in Yorkshire and Humber achieved or exceeded this level of treatment completion. The proportion of patients reported as still on treatment or lost to follow up at 12 months is now lower in the Yorkshire and Humber region than the national average. Patients with a previous diagnosis of TB may present greater risk of resistance to treatment in their current infection. Of the 31 cases in 2016 with a previous diagnosis of TB, 38.7% (12/31) were recorded as receiving Directly Observed Therapy (DOT).

The presence of social risk factors is known to affect adherence to treatment. In 2016 10.3% of cases in Yorkshire and Humber had at least one social risk factor recorded (11.1% nationally). TB cases with social risk factors are more likely to have pulmonary disease and drug resistance, and have worse outcomes. Of the 33 cases notified in 2016 with a social risk factor, 39.4% received Directly Observed Therapy (DOT) compared to 52.1% nationally.

Where social risk factor information was known, among those aged 15 or over and resistant to isoniazid (without MDR-TB), 11.5% (3/26) had at least one known social risk factor. These risk factors were current or history of drug misuse (12.5%, 1/8), or imprisonment (18.2%, 2/11), no cases with INH resistance reported alcohol misuse. 20% of MDR-TB identified in Yorkshire and the Humber had an identified social risk factor, but the numbers are small as this reflects just one among 5 cases of MDR-TB. This disparity between those with adherence risk factors and the use of DOT is observed in both low and high burden areas although the underlying reasons may differ.

Conclusions and Recommendations

The continued reduction in the number of new cases of TB in Yorkshire and Humber and the reduction in the proportion of those with multi-drug resistance is encouraging. This is in part testament to the efforts of the TB Control Board and all its partners. However, social risk factors continue to pose a challenge and there is evidence from many areas that both case and incident management is becoming increasingly complex. This Annual Report highlights the demography, risk factors and outcomes of patients with TB in the region in the past year, providing empirical evidence to inform priorities for action. These include:

- implementing the recommended actions from the recent audit of diagnostic delay
- shifting the focus of LTBI screening from those who have recently arrived in the country to include more established migrants
- undertaking appropriate work to understand the factors influencing the acquisition of TB in people from the ISC
- Improving understanding of the factors behind lack of culture confirmation, especially in pulmonary TB which poses the greatest public health risk.

1. TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2016, a total of 425 cases of tuberculosis were reported in Yorkshire and Humber; a rate of 7.8 per 100,000 population (95%CI 7.1 – 8.6) which is a slight reduction from 2015 (437 cases; rate of 8.1/100,000, 95%CI 7.4 – 8.9) (Figures 1.1 and 1.2). This is the lowest incidence in Yorkshire and Humber in the last 12 years. However, the year on year decline in cases has slowed and this is observed both locally and nationally. Across England there was a 1% decline in the number of cases in 2016 compared to the 10% year by year reductions observed between 2012 and 2015. The TB incidence in Yorkshire and Humber is the third highest rate in Public Health England (PHE) Centres outside London (Figure 1.3).

While the Yorkshire and Humber TB incidence rate remains below the England rate in 2016 (10.2 per 100,000 population); four local authorities in the region have higher rates than the national average – Bradford and Airedale (17.0 per 100,000 population), Kirklees (15.1 per 100,000 population), Sheffield (11.3 per 100,000 population) and Leeds (10.6 per 100,000). These high rates persist in these areas but conceal reductions in incidence over time in these higher burden areas, particularly in Bradford and Airedale, Sheffield and Leeds (Figure1.5). Some lower incidence areas have experienced an increase.

Figure 1.1: Tuberculosis case reports and rates Yorkshire and Humber and England, 2004-2016

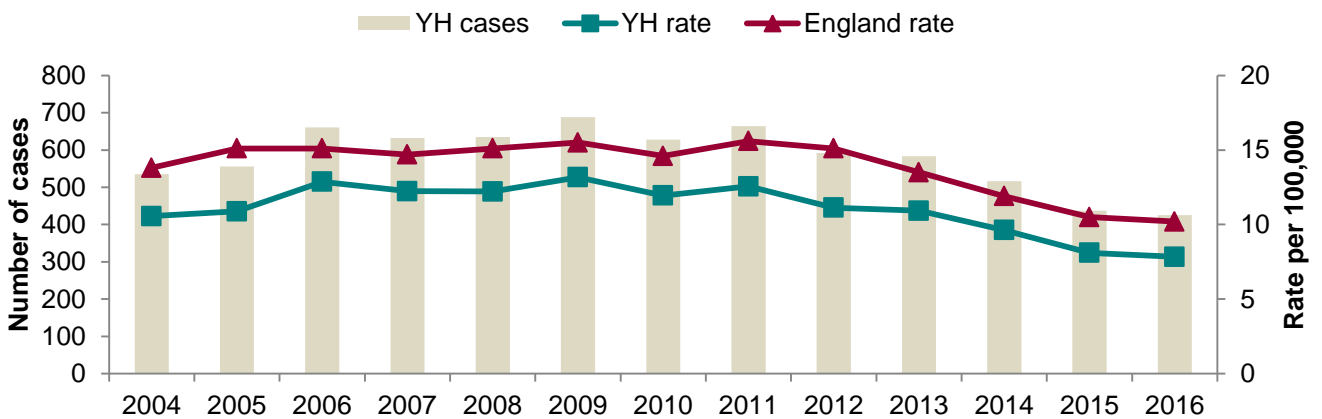


Figure 1.2: Tuberculosis incidence rates in Yorkshire and Humber with 95% confidence intervals, 2004-2016

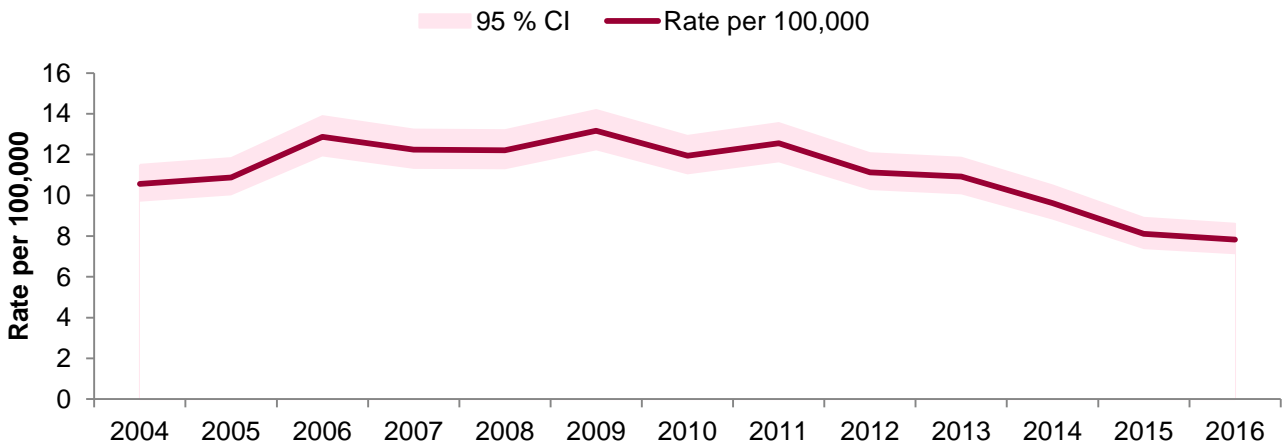


Figure 1.3: Tuberculosis rates by Public Health England Centre and England, 2016

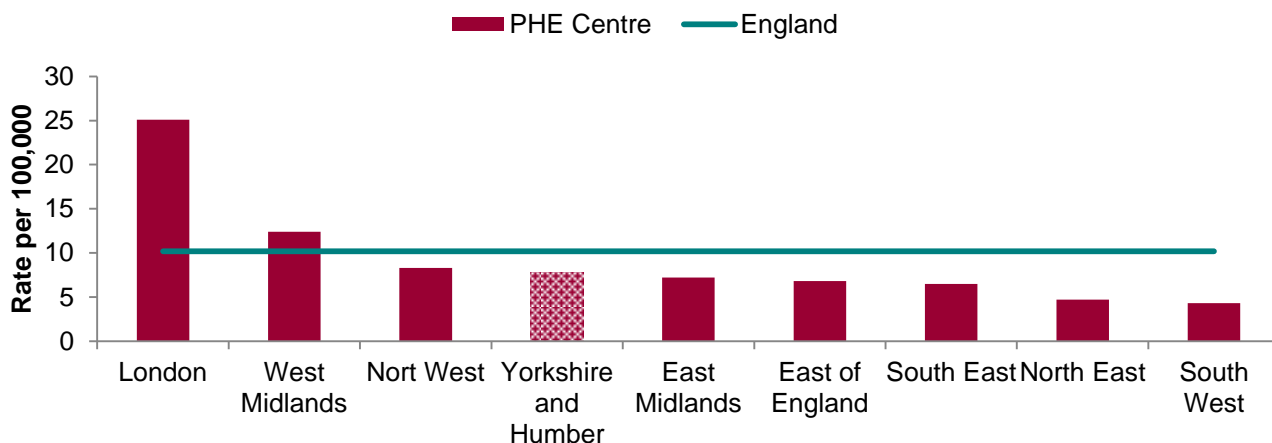


Figure 1.4: Tuberculosis incidence rates with 95% confidence intervals by local authority, Yorkshire and Humber, 2016

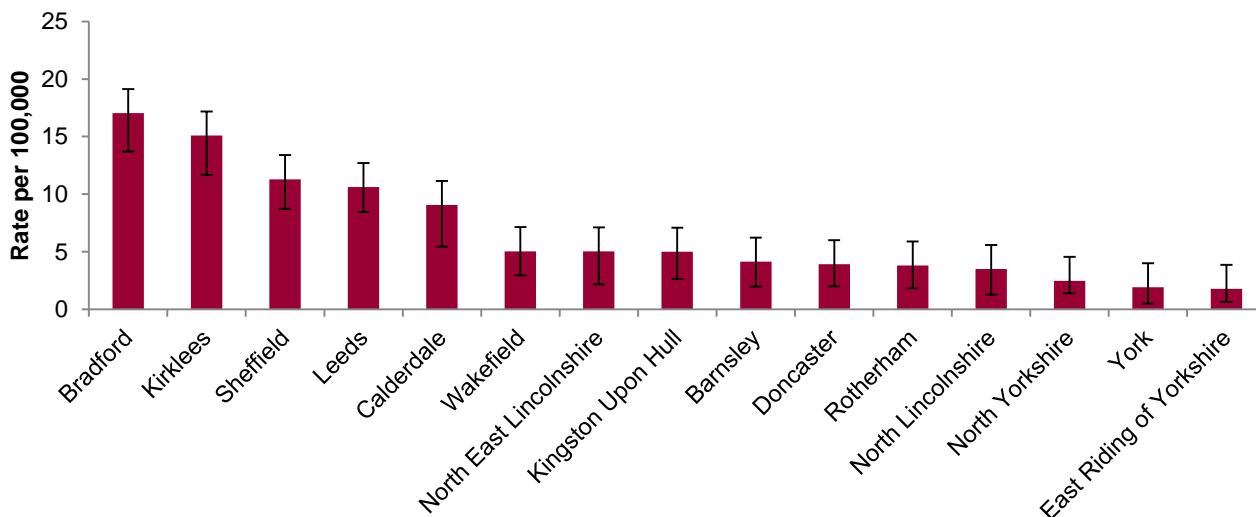


Table 1.1: Number of cases of tuberculosis and regional ranking by local authority, Yorkshire and Humber, 2004-2008, 2012-2016, and 2016

UTLA	Average no. of cases 2004 to 2008	Rank 2004 to 2008	Average no. of cases 2012 to 2016	Rank 2012 to 2016	No. of cases 2016	Rank 2016
Bradford	158.8	1	122.6	1	91	1
Leeds	123.2	2	93	2	83	2
Kirklees	82.2	4	75.4	4	66	3
Sheffield	95	3	80.6	3	65	4
Calderdale	22	5	18.2	6	19	5
Wakefield	20.6	7	18	7	17	6
North Yorkshire	15.6	9	14.6	10	15	7
Kingston upon Hull	13	10	17.8	8	13	8
Doncaster	15.6	8	20	5	12	9
Barnsley	7.4	13	7.4	12	10	10
Rotherham	21.4	6	16.6	9	10	11
North East Lincolnshire	5.5	15	4.6	15	8	12
East Riding of Yorkshire	8.6	12	5.8	13	6	13
North Lincolnshire	6.8	14	11.2	11	6	14
York	9.2	11	4.8	14	4	15

Figure 1.5: Change in incidence rates of tuberculosis between 2004-2008 and 2011-2016, by local authority, Yorkshire and Humber

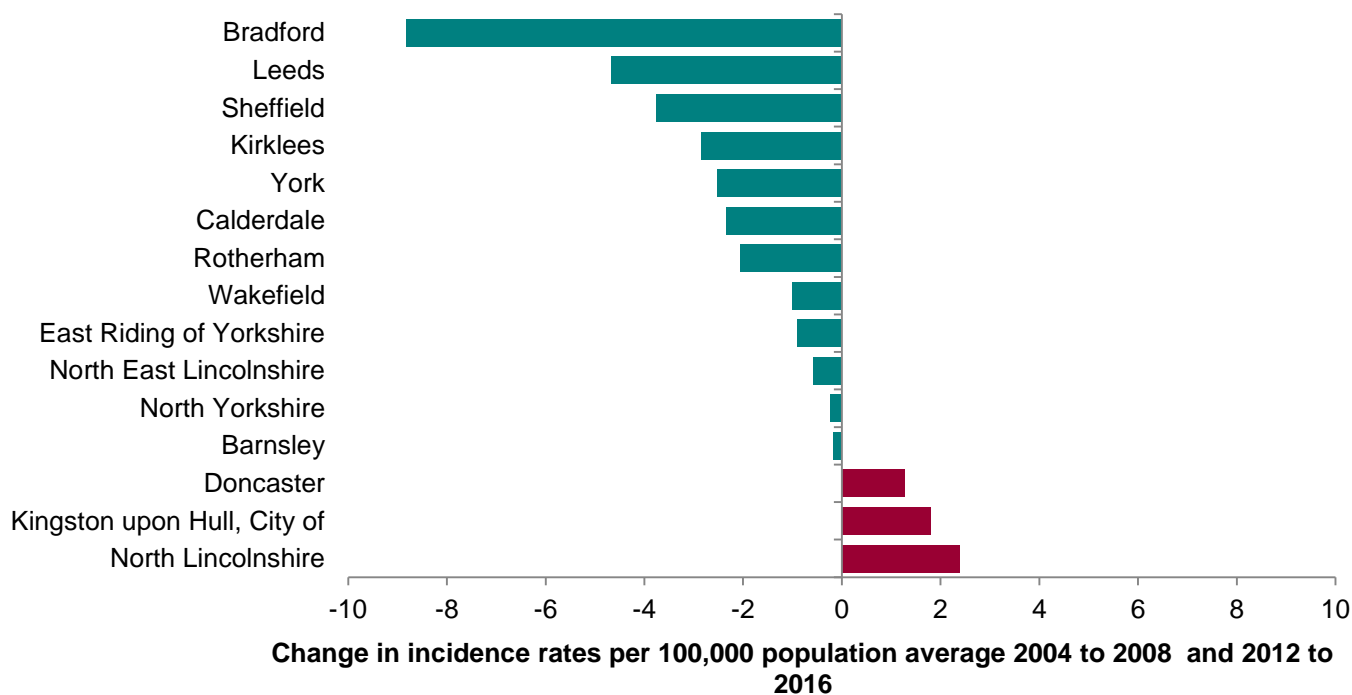
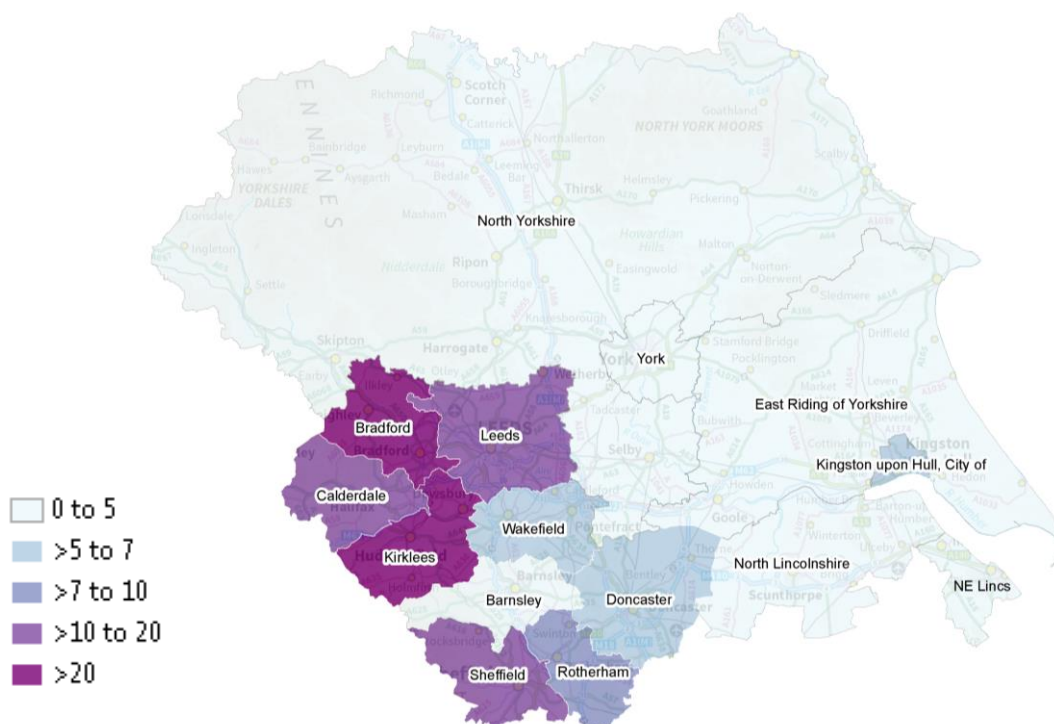
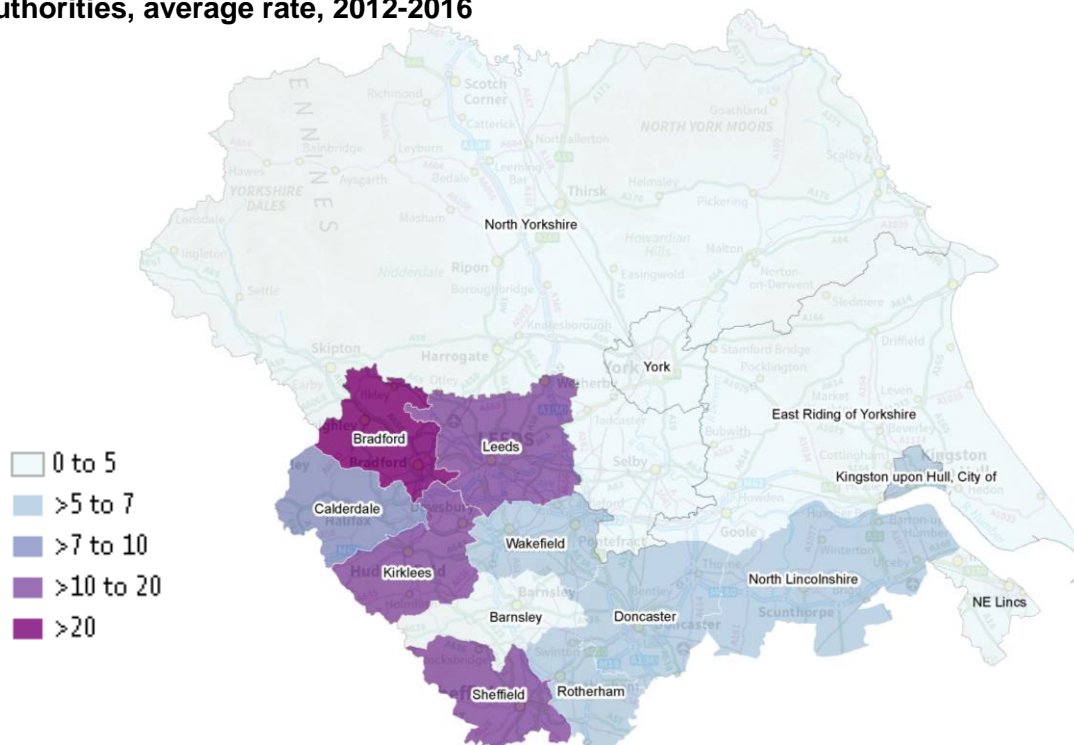


Figure 1.6: Tuberculosis incidence per 100,000 population for Yorkshire and Humber local authorities, average rate, 2004-2008



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Figure 1.7: Tuberculosis incidence per 100,000 population for Yorkshire and Humber local authorities, average rate, 2012-2016



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2. Demographic characteristics

Age and sex

Sixty-two per cent of the TB cases in the region in 2016 were aged between 20 and 49 years. The proportion of cases in the 70 years and over age-group has declined from 15% in 2004 to 13% in 2015 and is now in line with the national figure.

The proportion of TB cases in the region occurring in children aged 1 year and under in 2016 was 0.5% which is a small decrease from 2015 (1.6%) but this only relates to a difference of five cases. Similarly the incidence rate in those one year and under in Yorkshire and Humber decreased from 10.9 per 100,000 (95%CI 4.38-22.47) in 2015 to 3.1 per 100,000 (95%CI 0.4-11.2) in 2016. In 2016 50% (1/2) of cases in children aged one year and under were UK born.

Of the TB cases in all children <15 years old in the region, 79% were UK born, very similar to the 80% in the previous year. There is geographical variation and in Bradford 8.5 % of all TB cases in the last five years has been a child aged 14 years or younger. The epidemiology of TB in children in Yorkshire and Humber, whilst improving, still indicates ongoing TB transmission.

In keeping with the national pattern, TB incidence in the Yorkshire and Humber region remained slightly higher in males than females. In 2016, there were more male TB cases in every age group except the 0-9 year age group, where there were more female cases (Figure 2.3).

Figure 2.1: All persons tuberculosis rates by age group, Yorkshire and Humber, 2004-2016

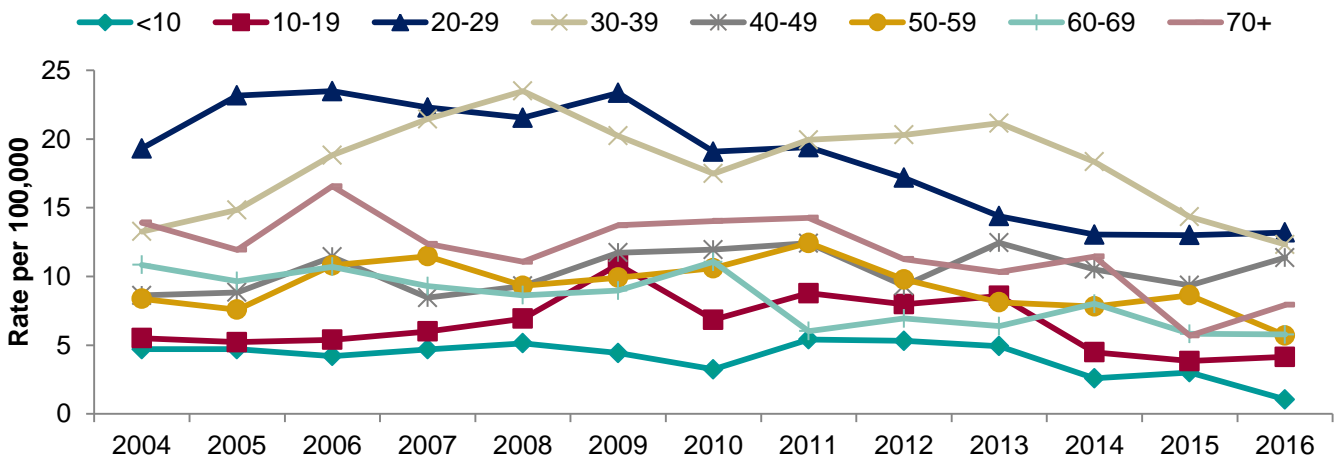


Figure 2.2: Child and adult tuberculosis notifications rates, Yorkshire and Humber, 2004-2016

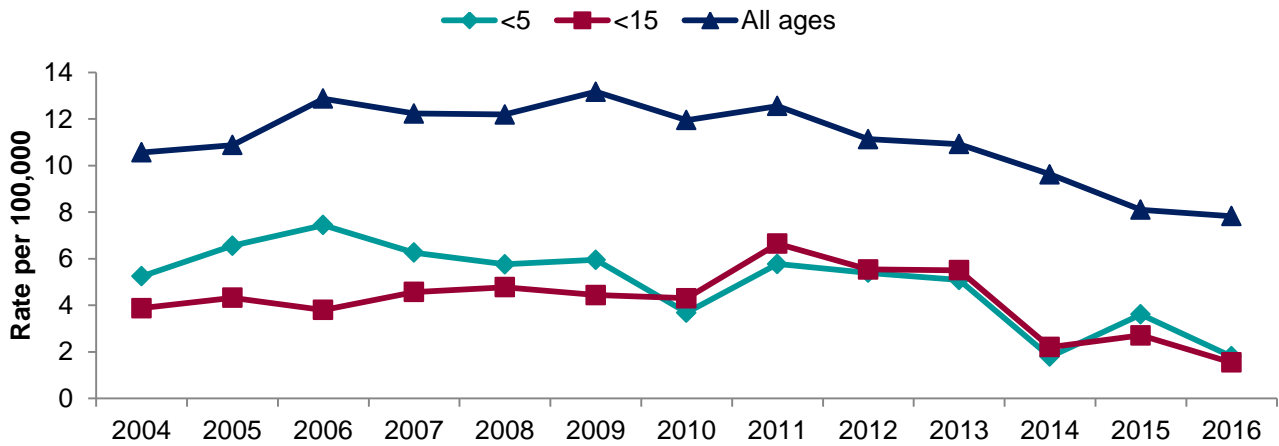
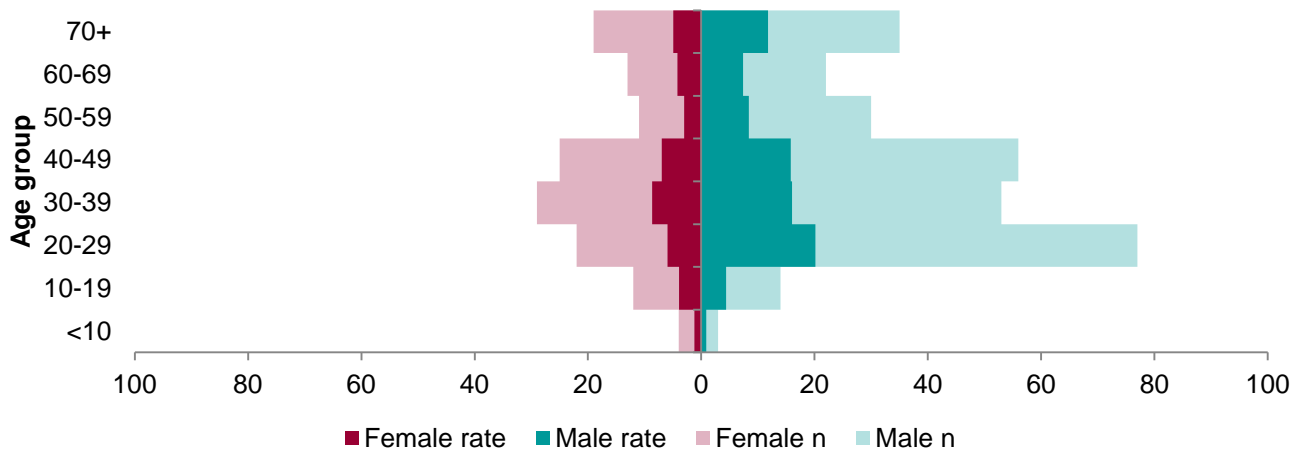


Figure 2.3: Tuberculosis reports & rates by age group and gender, Yorkshire and Humber, 2016



Place of birth and time since entry

Place of birth was recorded for 95.1% (404/425) of cases reported in 2016, similar to 95.8% in 2015.

UK born

Thirty-one per cent (126/404) of TB cases in Yorkshire and Humber in 2016 were UK born. The incidence of TB in the UK born population in the region has improved modestly between 2004 and 2016; with a UK born TB incidence rate of 4.13/100,000 in 2004 declining to 2.6/100,000 in 2016 (Figure 2.4).

Non-UK born

Sixty-nine per cent (278/404) of TB cases in the region in 2016 were born outside the UK. The incidence rate for TB in the non-UK born population in the region has declined year on year from the peak of 112.8 per 100,000 population in 2006, to 54.2 per 100,000 population in 2016 (Figure 2.5)¹. However, the TB

¹ The population estimates used to calculate TB incidence rates by country of birth have been updated. This has resulted in an increase in the denominator population for non-UK born and thus a **decrease** in the TB incidence rate for non-UK born compared to the rates reported in the previous annual report. The incidence rates in the UK born remains mostly unchanged. **Data source:** <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/datasets/populationoftheunitedkingdombycountryofbirthandnationality>

incidence rate in the non-UK born in the region remains higher than the national rate (49.4 per 100,000) and is 21 times higher than the rate for UK born residents of Yorkshire and Humber compared to 15 times higher nationally.

The trend in the last 10 years among non-UK born cases has been for a reduction in the proportion of TB cases among individuals resident in the UK for less than five years, and an increase in the proportion of cases among individuals resident in the UK for greater than 10 years (Figure 2.8).

Place of birth and age

In 2016, the number of TB cases in non-UK-born exceeded that in the UK born TB cases in every age group except the 0-19 and 70+ age groups. Cases in UK born children outnumber cases in children born outside of the UK (Figure 2.6). The high proportion of UK born among TB cases in children under 15 years of age is of concern as it indicates recent TB transmission potentially occurring in the UK.

Figure 2.4: Tuberculosis rate per 100,000 population for UK born cases, with 95% confidence intervals and 2% decline target from 2004, Yorkshire and Humber, 2004-2016



Figure 2.5: Tuberculosis case reports by place of birth, proportion of cases and rate per 100,000 population, Yorkshire and Humber, 2004-2016

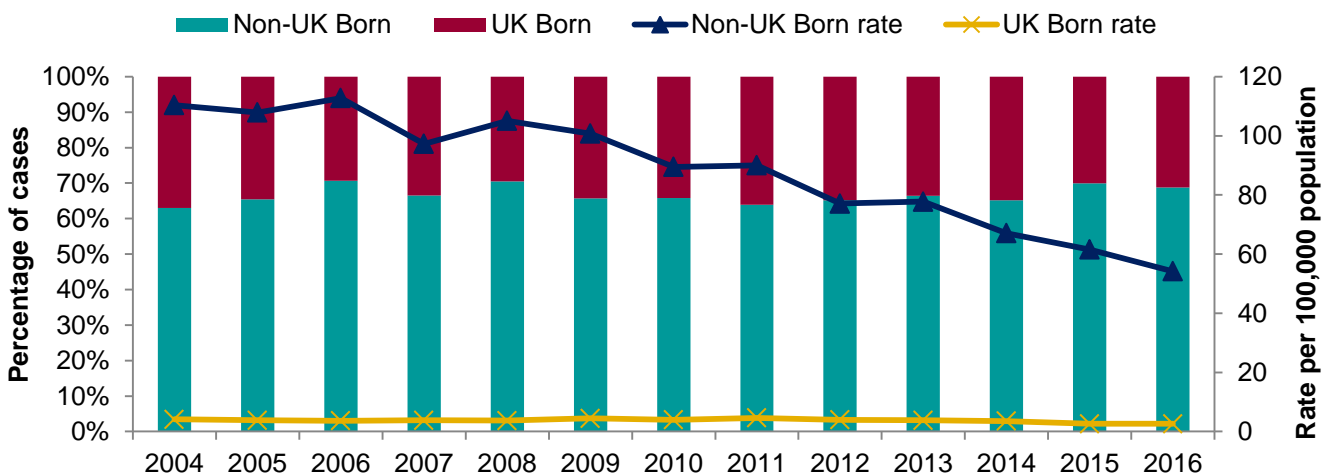


Figure 2.6: Tuberculosis case reports by place of birth and age group, Yorkshire and Humber, 2016

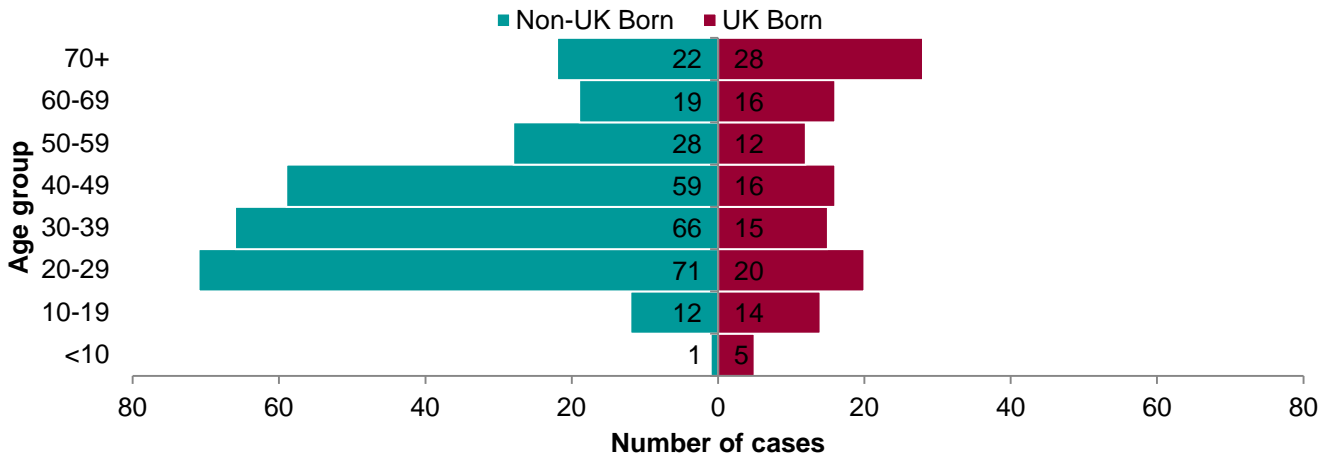


Figure 2.7: Non-UK born tuberculosis cases by time since entry to the UK, Yorkshire and Humber, 2016

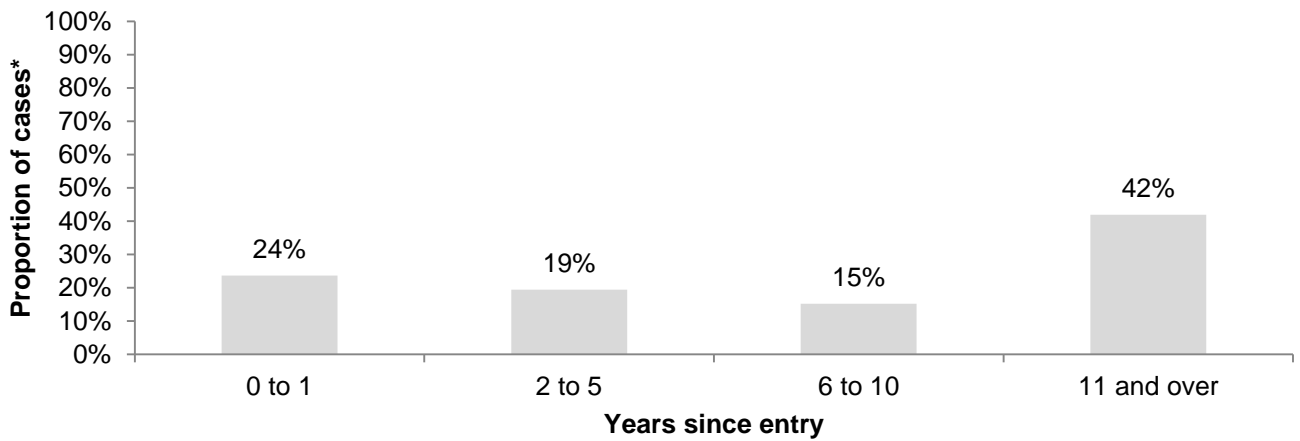
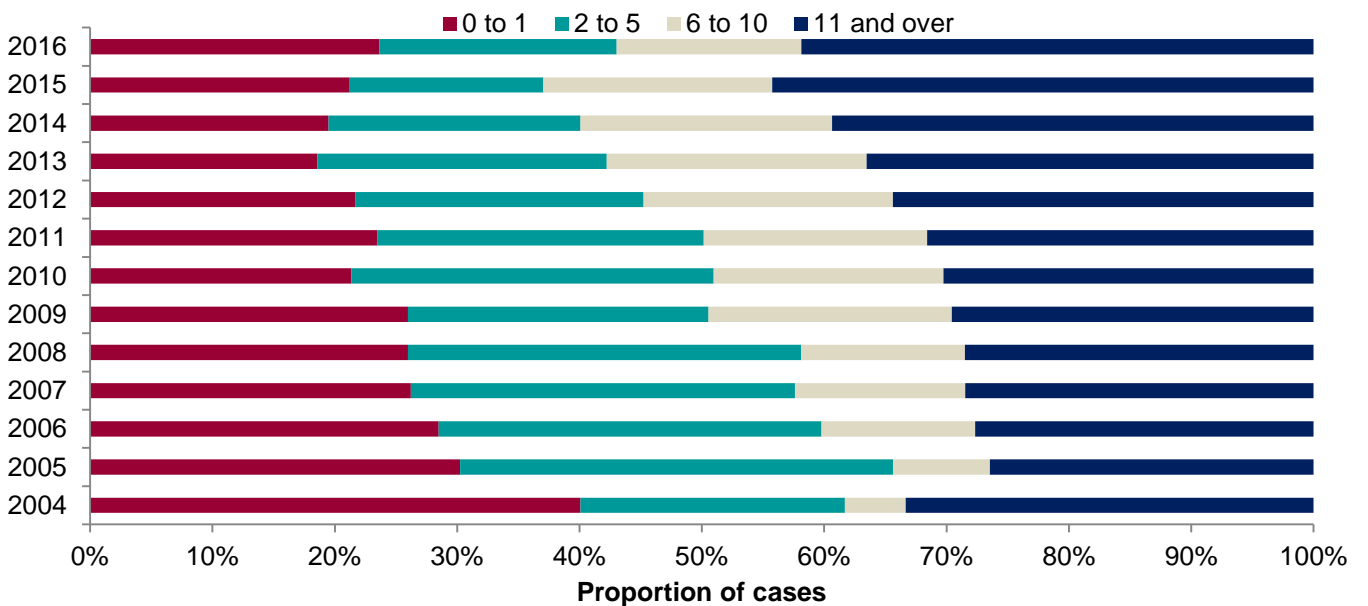


Figure 2.8: Time between entry to the UK and TB notification for non-UK born cases in years, Yorkshire and Humber 2004-2016



Country of birth

Amongst non-UK born TB cases in the region, the most commonly reported country of birth was Pakistan, accounting for 32% of all non-UK born cases in 2016, followed by India (16%). Five sub-Saharan African countries – Eritrea, Somalia, Zimbabwe, Ethiopia and Sudan collectively accounted for 17% of cases in 2015 (Table 2.1). The proportion of TB cases from eastern European countries has decreased slightly with 8% of non-UK born TB cases notified in 2016 coming from Eastern European countries (Romania, Poland, Lithuania, Bulgaria, Slovakia Czech Republic, Hungary, Latvia), in comparison to 11% in 2015.

Table 2.1: Reported country of birth for non-UK born tuberculosis cases, Yorkshire and Humber, 2016

Country of Birth	Number of cases	Percentage of Non UK born cases
Pakistan	90	32
India	45	16
Eritrea	22	8
Sudan	11	4
Zimbabwe	11	4
Somalia	10	4
Romania	7	3
Bangladesh	6	2
Poland	6	2
Afghanistan	5	2
Ethiopia	5	2
Other <= 1% Each	60	22

Ethnicity

Ethnicity was recorded for 95% of TB cases notified in 2015. Thirty-one per cent of TB cases in the region in 2016 were from the Pakistani ethnic group. The next most frequent reported ethnicities were white (25%), Black African (19%) and Indian (13%) (Figure 2.9).

The TB incidence rate in the Pakistani ethnic group has decreased between 2010 and 2016 from 112 to 55 per 100,000 population². A less marked decline was observed for other ethnic groups. The incidence in the Indian ethnic group declined from a peak of 124 in 2011 to 76 per 100,000 population in 2016, and the Bangladeshi group declined from 80 in 2011 to 27 per 100,000 population in 2016 (Figure 2.12).

These rates are markedly higher than the rate for the white ethnic group which remained almost unchanged between 2011 (3.2 per 100,000 population) and 2016 (2.2 per 100,000 population). However the TB incidence rate for Black Africans in the region has increased from 160 per 100,000 population in 2010 to 173 per 100,000 population in 2016 consolidating the observed increase in 2015 (Figure 2.12).

The proportion of TB cases with Indian Sub-continent (ISC) ethnicities (Pakistani, Indian, Bangladeshi), who were UK-born increased from 18% in 2004 to 22% in 2016. For Black ethnic groups (Black African,

² Data source for population data by ethnic group 2011 census data

Black Caribbean, Black Other), the proportion that were UK-born decreased from 8.5% in 2004 to 6.0% in 2016. This suggests that while TB in the Black African ethnic groups in the region remains predominately associated with migration; for ISC ethnic groups, particularly in communities of Pakistani origin, acquisition of TB infection in the UK is an increasing concern (Figure 2.11).

Figure 2.9: Tuberculosis case numbers by ethnic group, Yorkshire and Humber, 2004-2016

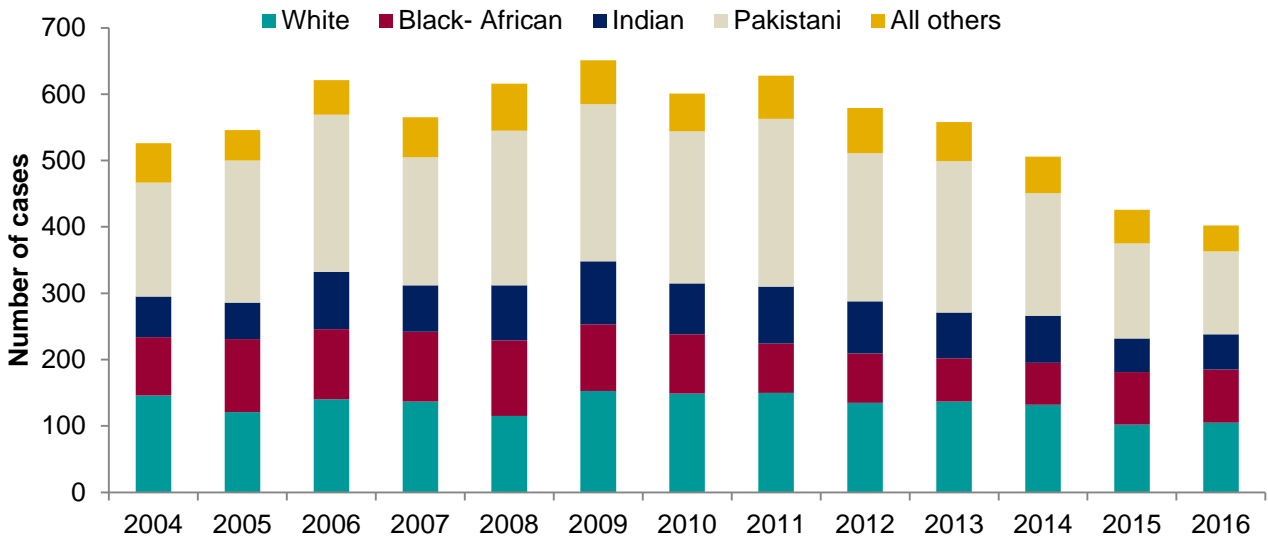


Figure 2.10: Tuberculosis case numbers by ethnic group, Yorkshire and Humber, 2004-2016

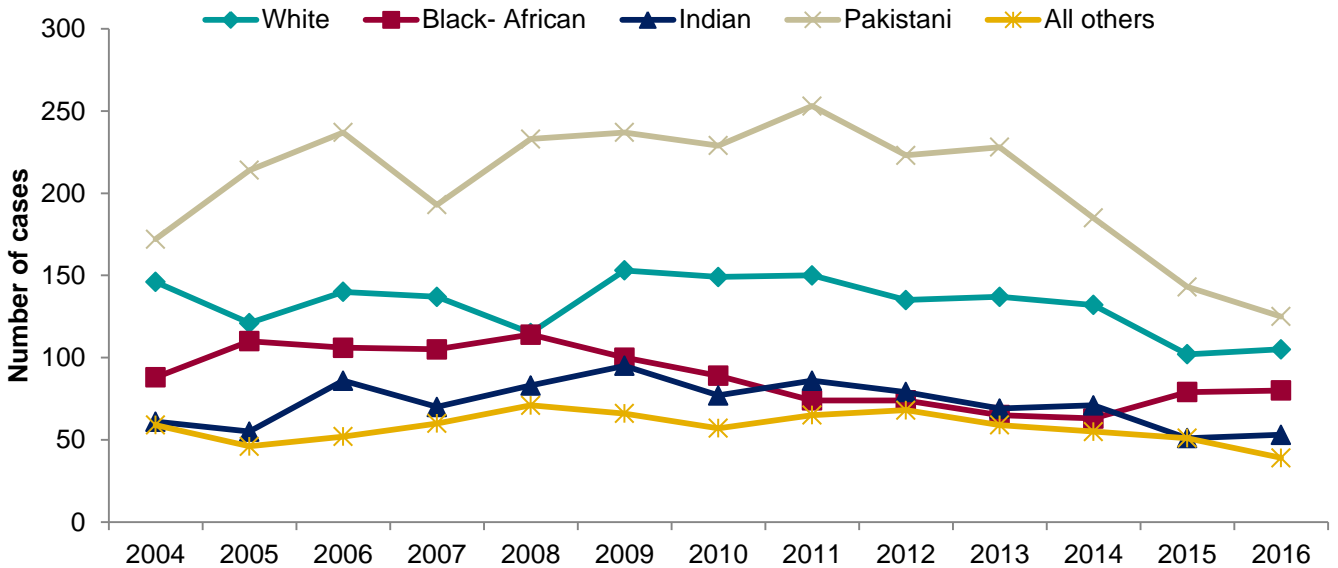


Figure 2.11: Tuberculosis case numbers by ethnic group and place of birth, Yorkshire and Humber, 2016

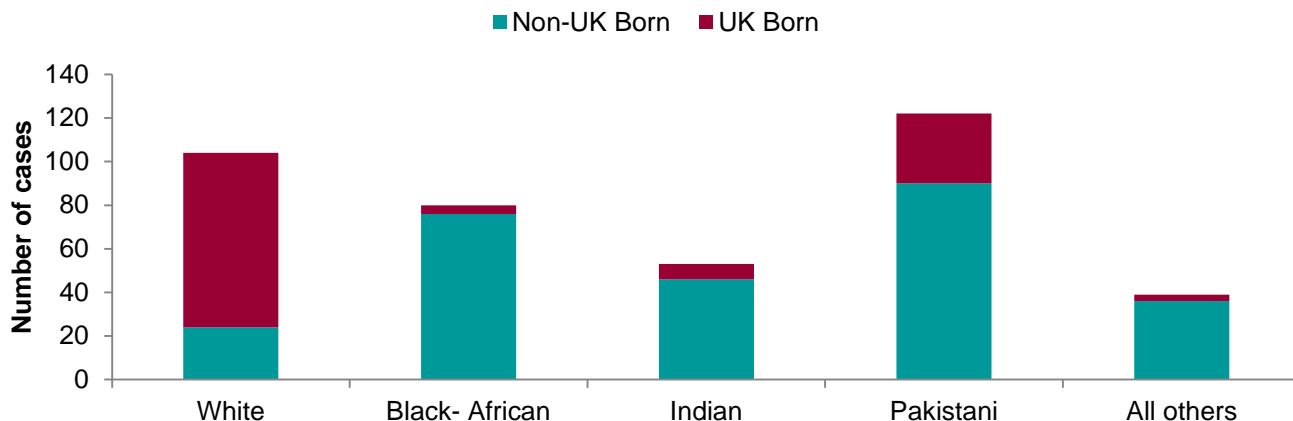
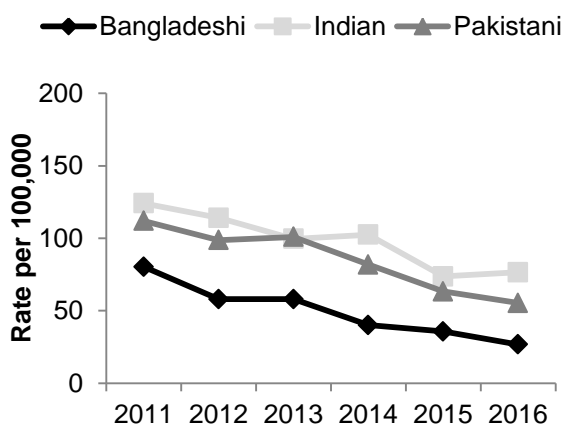
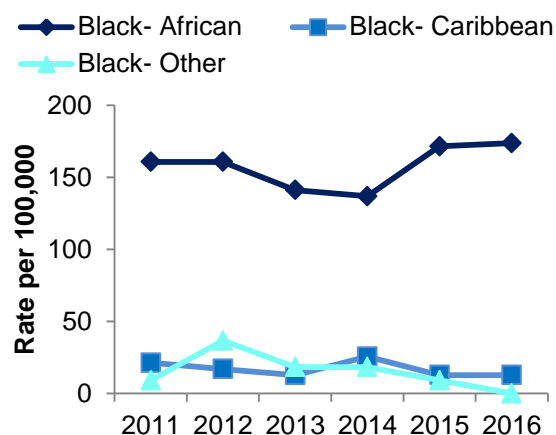


Figure 2.12: Trend in tuberculosis rates per 100,000 population a) Indian sub-continent ethnic groups b) black ethnic groups c) mixed/other ethnic groups and d) white and all ethnic groups

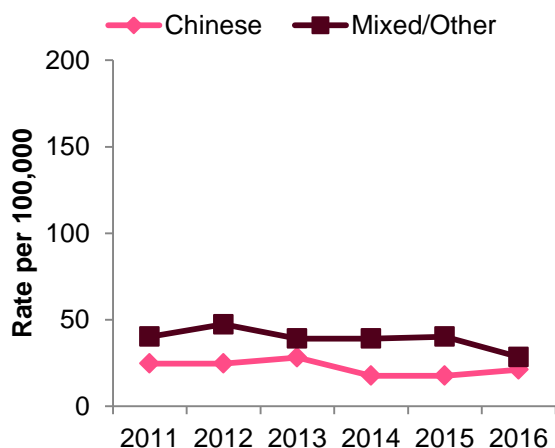
a)



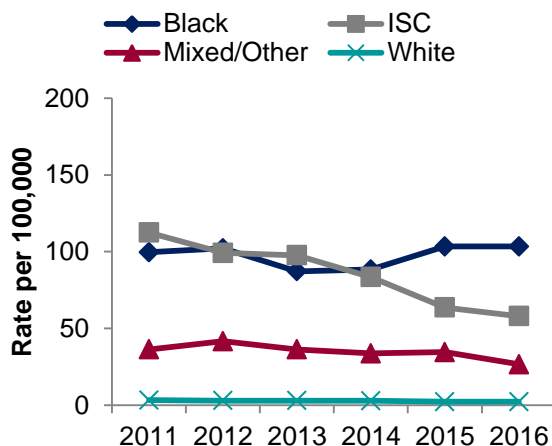
b)



c)



d)



Occupation

Twenty-one TB cases in Yorkshire and Humber in 2016 were known to be health care workers. Twenty-seven cases worked in education. TB cases in these occupations can indicate complexity in case management due to the nature of transmission chains. Thirty-nine per cent of cases between the ages of 18 and 65 were reported as unemployed; a factor which may be associated with some of the life-style risk factors for TB in addition to the correlation between unemployment and deprivation.

Table 2.2: Occupational category of TB patients aged 18 to 65, Yorkshire and Humber, 2016

Occupation Category	n(%)
Education	27(8.7%)
Health care worker	21(6.8%)
Laboratory/pathology	1(0.3%)
None	121 (39.2%)
Other	139(45.0%)

3. Clinical characteristics

Site of disease

Fifty-eight per cent of TB cases reported in the region in 2016 had pulmonary disease, similar to the proportion nationally (53.9%). The ratio of pulmonary to extra-pulmonary TB cases has been relatively stable in the region in the past decade (Figure 3.1). In 2016 as in previous years, extra-pulmonary disease was more common in non-UK born than in UK born TB cases (Figure 3.2).

Figure 3.1: Tuberculosis cases by site of disease, Yorkshire and Humber, 2004-2016

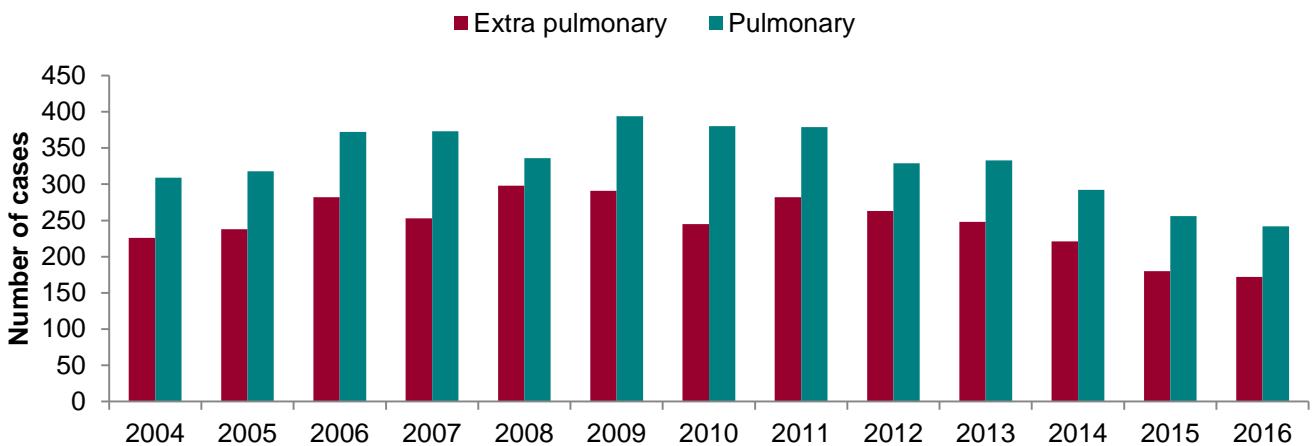
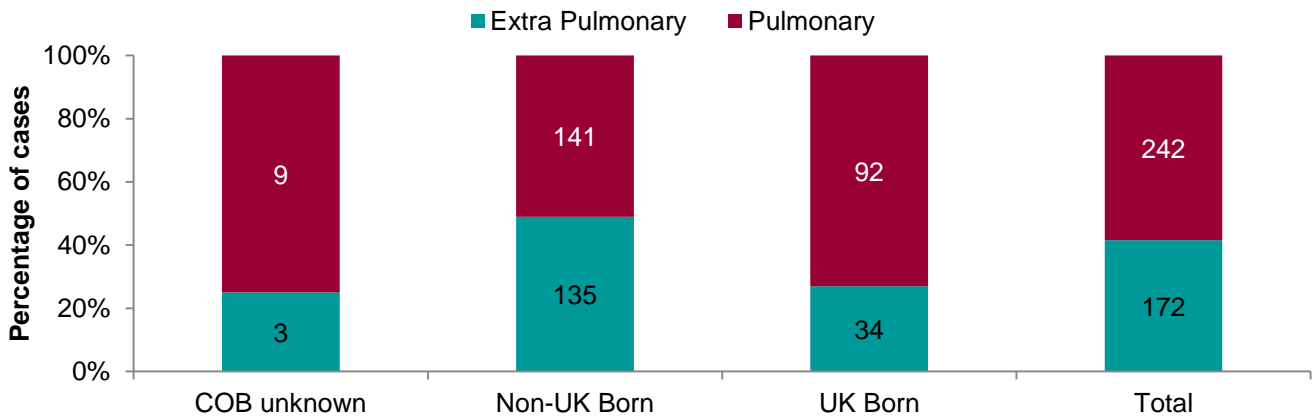


Figure 3.2: Tuberculosis cases by site of disease and place of birth, Yorkshire and Humber, 2016



Previous history of tuberculosis

For Yorkshire and Humber cases notified in 2016, 8% (31/388) of cases (where past history is documented) had a previous diagnosis of TB more than 12 months before their current notification. Among those with a previous diagnosis of TB, 95% (21/22) of cases (95%) where treatment status was documented had previously been treated for TB and 48% (12/25) of cases where DOT status is recorded are known to have received DOT during their current notification of TB. Time since previous diagnosis was known for 80.6% (25/31) of cases with a past history of TB, with a median time since previous diagnosis of seven years (IQR 3-46 years). This is consistent with the national picture. Given the recognised association between previous disease, treatment compliance and antimicrobial

resistance this may be an area where increased assurance on treatment compliance through enhanced case management may be helpful. It is also the case that clinical assessment may appropriately downgrade the risk of non-compliance and the need for DOT. This may contribute to the low numbers of cases with a previous TB history reporting receiving DOT in their current infection.

Table 3.1: Previous TB history among cases diagnosed between 2004 and 2016, Yorkshire and Humber

Year	Previous diagnosis unknown	No previous diagnosis of TB	Previous diagnosis of TB	% of cases with a previous diagnosis of TB (where status recorded)
2004	81	405	49	11%
2005	97	418	41	9%
2006	111	513	37	7%
2007	145	451	36	7%
2008	74	519	42	7%
2009	56	582	50	8%
2010	36	545	47	8%
2011	27	596	41	6%
2012	20	531	41	7%
2013	32	517	34	6%
2014	32	449	35	7%
2015	23	381	33	8%
2016	37	357	31	8%

Smoking status

Information on current smoking status at onset of symptoms, presentation or during care was collected from 2 July 2015. In 2016 information on smoking status was known for 75% (308/410) of notified TB cases in Yorkshire and Humber aged 15 years or older, which is a significant improvement on the 44% in 2015, but lower than national average (83%). Where information was known, 25.3% (78/308) were current smokers, which is higher than the England average of 20.0%. These figures may be subject to a bias towards completing this information in known smokers.

Travel and visitor risk factors

History of travel to and visitors received from a country outside the UK (excluding Western Europe, US, Canada, New Zealand and Australia) in the last two years prior to TB diagnosis has been collected since 13 May 2015. In 2016, in Yorkshire and Humber, information on travel history and visitor history was known for 70.1% and 55.7% of notified TB cases, respectively. Where information was known, 18.8% (56/298) of TB cases had travelled outside the UK and 5.9% (14/237) had received a visitor from outside the UK. Where the country of travel or origin of visitor was known, 90.3% (47/52) of cases travelled to their country of birth and 58.3% of cases had received a visitor from their country of birth. Compared to the England averages Yorkshire and Humber cases were more likely to have travelled outside of UK (17.2%) and less likely to have received a visitor from outside of the UK (7.3%). Data completion in Yorkshire and Humber cases remains lower than the UK average of 77.6% for travel history and 71% for visitor information.

4. 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.

Culture confirmation and speciation

Microbiological confirmation through culture remains the gold standard for TB diagnosis. It enables assessment of drug sensitivities to inform treatment and informs decisions and actions taken to control transmission. It is also essential for genotypic studies of TB in the UK. In 2016, 85% of pulmonary cases in Yorkshire and Humber were microbiologically confirmed, above the national figure (76%) and an improvement on the previous year (71%). Of all notified TB cases 71.7% were culture confirmed; the highest proportion of all PHECs.

Use of PCR confirmation has increased in recent years and has increased the proportion of microbiologically confirmed pulmonary TB cases in the region by about 2-3% each year (Figure 4.2). However, it remains significantly below the European Centre for Disease Prevention and Control target of 80%.

In 2016 the proportion of culture confirmation was lower among TB cases aged 0-14 years 33% (5/15) compared with those aged 15-44 years 74% (177/238), and 45-64 years 65% (68/105) and 65 years and older 82% (55/67).

Sputum smear status

Sputum smear status is an indicator of TB infectivity and therefore, a marker for potential transmission. Sputum smear status was known for 65.3% (158/242) of pulmonary TB cases diagnosed in the region in 2016 (Figure 4.1), compared to 63.1% nationally.

Where sputum smear status was known, 52.5% (83/158) were sputum smear positive in 2016 compared to 45% (101/222) in 2004 (Figure 4.3). Nationally 56.1% of cases with a reported sputum smear result were positive in 2016.

Figure 4.1: Proportion of pulmonary tuberculosis cases where sputum smear status known Yorkshire and Humber, 2004-2016

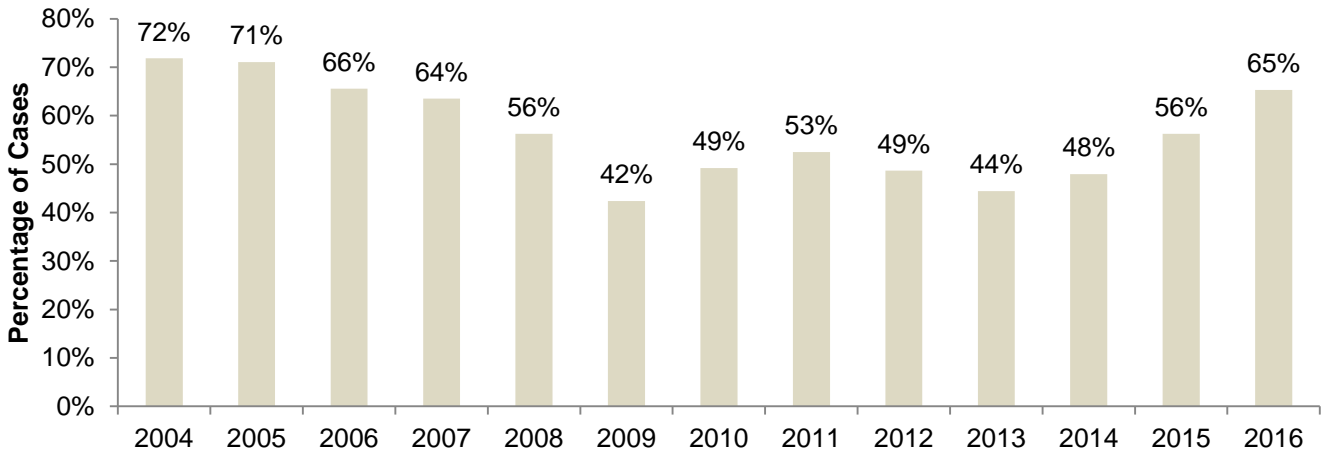
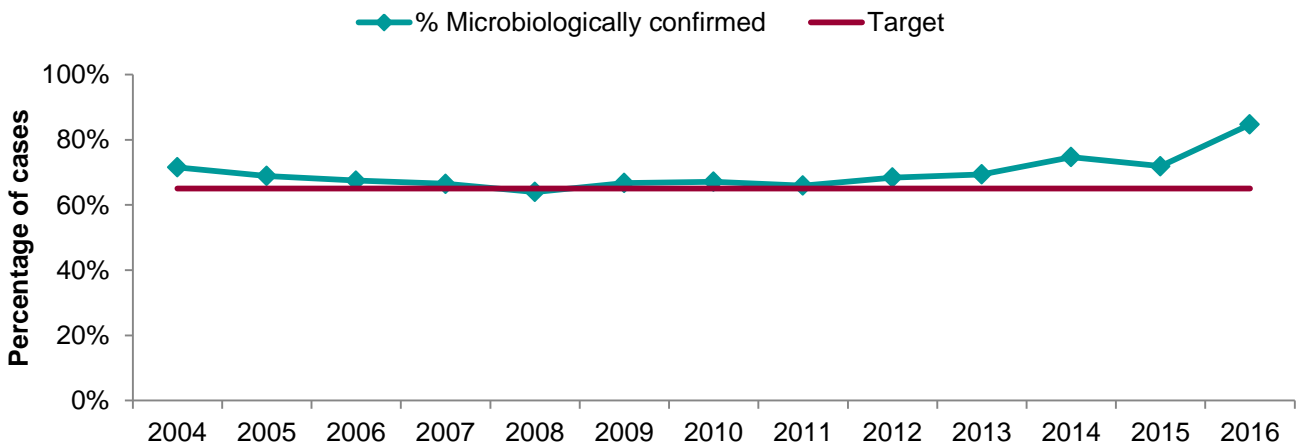
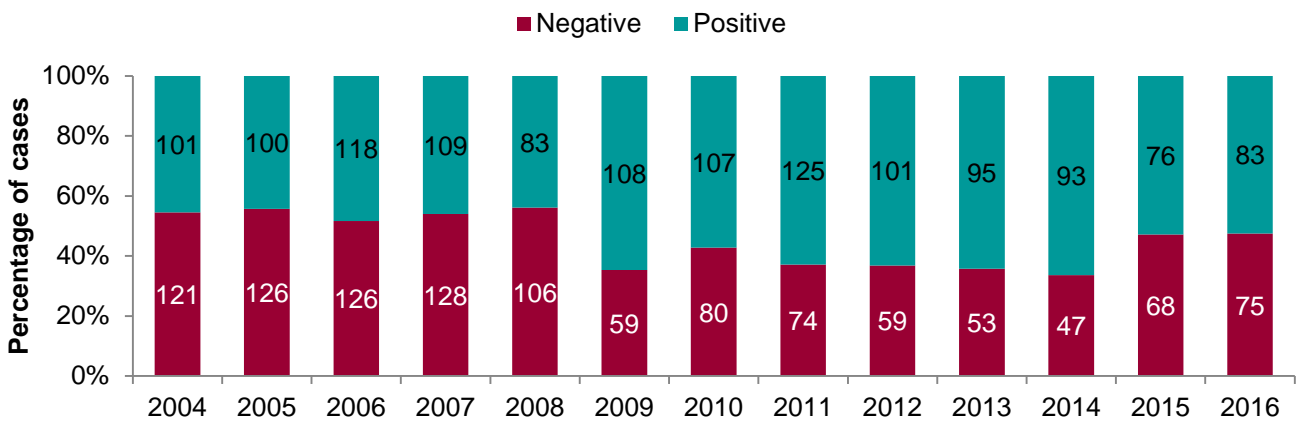


Figure 4.2: Proportion of pulmonary tuberculosis cases microbiologically* confirmed, Yorkshire and Humber, 2004-2016



* Culture or PCR

Figure 4.3: Proportion of sputum positive Tuberculosis cases (where sputum status known), Yorkshire and Humber, 2004-2016



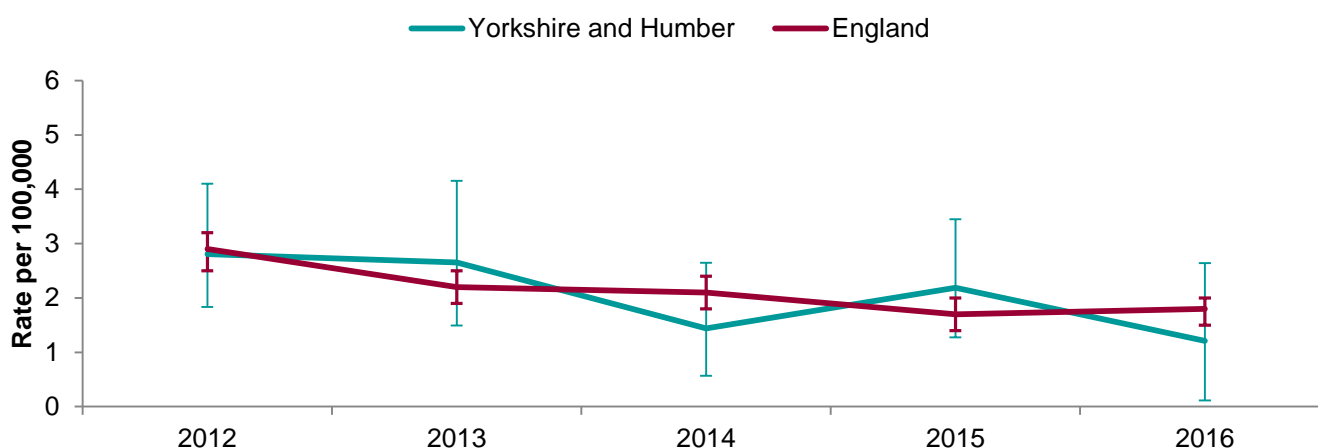
5. TB transmission

The incidence rate of TB in children is widely accepted to be a good indicator of TB transmission in a community. Molecular genotyping of the organisms causing TB in a population can also provide insight into putative transmission chains.

Rate of TB in UK born children

In 2016, the rate of TB in UK born children under 15 years of age within England was 1.8 per 100,000 (95% CI 1.5-2.0) with a reduction over the last three years. In Yorkshire and Humber the rate of TB in UK born children under 15 declined to 1.2 per 100,000 from 2.2 per 100,000 in 2015 although there are wide confidence limits on this.

Figure 5.1: Rate of TB in UK born children (<15), Yorkshire and Humber, 2012-2016



Strain typing and clustering

The PHE National Strain Typing Service was established in January 2010 to prospectively type TB isolates using 24 loci Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats (MIRU-VNTR). In December 2016, the service was terminated for the North and Central England and replaced by whole genome sequencing (WGS).

Clustered cases (with indistinguishable MIRU-VNTR profiles) may reflect cases that are part of the same chain of transmission, but could also reflect common endemic strains circulating either in England or abroad; additional epidemiological information is required to assess whether cases with indistinguishable strain types are likely to reflect recent transmission.

Whole genome sequencing

Whole genome sequencing (WGS) of *Mycobacterium tuberculosis* complex isolates provides information on Single Nucleotide Polymorphisms (SNP) differences between isolates and provides more information than MIRU-VNTR strain typing on how isolates are related to each other. WGS has been carried out retrospectively on some isolates of TB cases epidemiologically and molecularly linked by

MIRU-VNTR to support cluster investigation and to inform public health action going forward. WGS cluster information will be available for 2017 data in next years report.

Within the Field Epidemiology Service, there is a designated TB cluster investigator whose role is to review strain typing and identify clusters within and across PHE Centres. Cluster information is regularly provided including contextual information about strain types, which are routinely reviewed with the health protection team for epidemiological links and for decisions on appropriate monitoring or further investigation of the cluster.

Proportion of cases clustered and geographical distribution

Between 2010 and 2016 there were 2,349 culture confirmed cases of TB in Yorkshire and Humber, of which 1,660 cases (70.7%) had an isolate that was strain typed with at least 23 loci typed. Of these, 695 (41.8%) did not cluster with any other isolates within Yorkshire and Humber. The remaining 965 (58.1%) cases clustered with at least one other case in Yorkshire and Humber since 2010. This is less than the proportion of cases clustering in England (59.7%). Between 2010 and 2015, 147 different strain type clusters were reported in Yorkshire and Humber and 2,878 were reported in England.

Table 5.1: Number and proportion of culture confirmed cases typed and number and proportion of cases in clusters, Yorkshire and Humber, 2010-2016

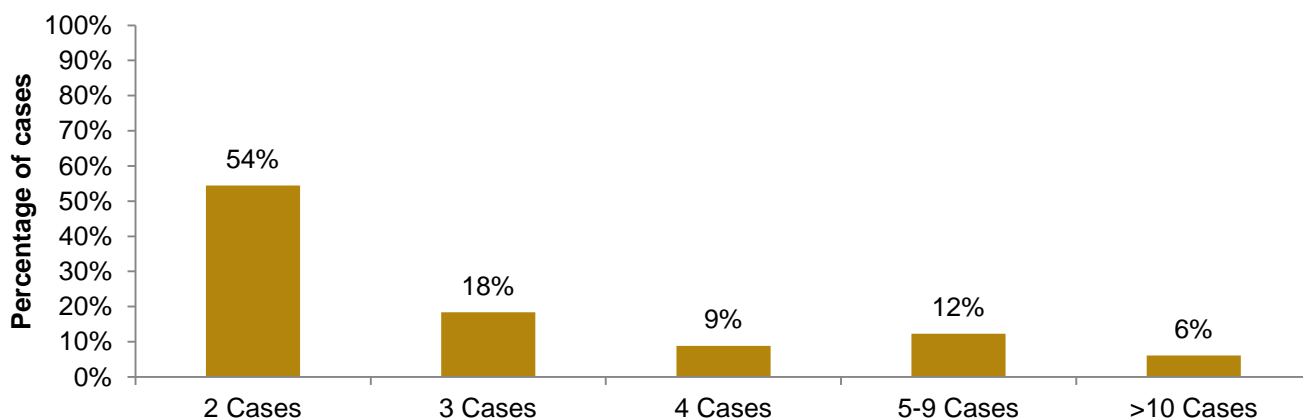
Years	Culture confirmed cases (%)	Strain - typed cases >= 23 loci	Case clustered	Clusters
2010-2016	2349 (61.1%)	1660 (70.7%)	965 (58.1%)	147

Cluster size

Of the 147 clusters in Yorkshire and Humber identified between 2010 and 2016, the majority of clusters were small, with just over half including only two cases and approximately one fifth including five or more cases.

Nationally, over the seven year period 2010 to 2016, there were a total of 2,878 clusters with a median cluster size of three cases (range 2-244). The majority of clusters (74.4%; 2,141/2878) were small in size (<5 cases), with 45.5% (1,310) having only two cases in the cluster.

Figure 5.2: Proportion of clusters by size, Yorkshire and Humber, 2010-2016



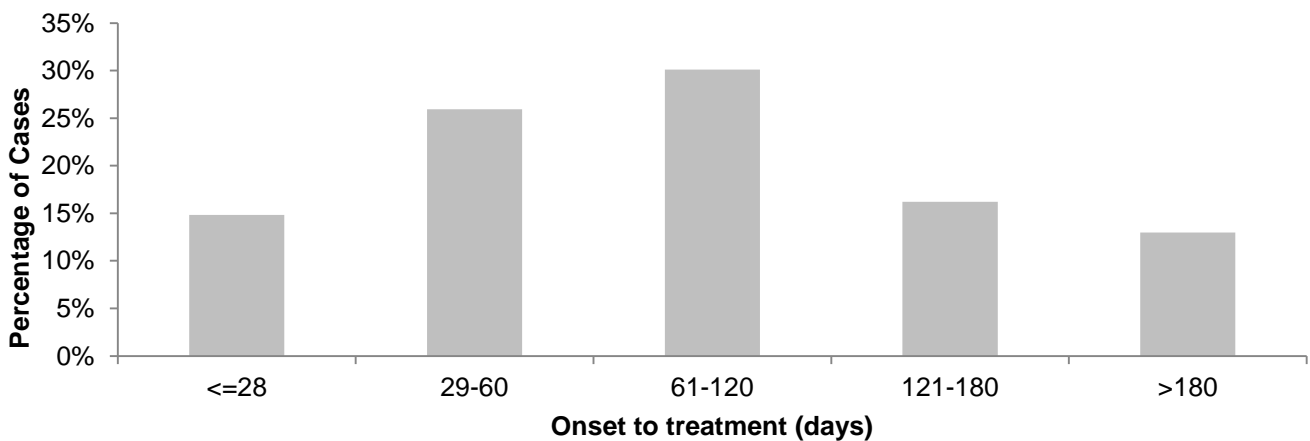
6. Delay from onset of symptoms to start of treatment

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

Dates of symptom onset and treatment start were available for 89.3% (216/242) of pulmonary TB cases diagnosed in 2016, the same as the previous year.

In 2016, among the 216 pulmonary TB patients where the interval between onset and treatment is known 41% started treatment within 60 days (two months) of symptom onset (Figure 6.1). Of concern is the significant proportion of pulmonary cases, 29% (63/216) commencing treatment over 121 days (four months) after onset of symptoms. However, across England 31% of pulmonary cases were reported as commencing treatment over four months after onset of symptoms in cases.

Figure 6.1: Pulmonary tuberculosis case reports by time of onset to treatment start date, Yorkshire and Humber, 2016



*excluding asymptomatic cases, and those with missing onset dates

There was a higher proportion of UK-born pulmonary TB cases with longer delays from symptom onset to treatment start in comparison to non-UK born cases.³ (Figure 6.2). This is consistent with national figures. There was no clear pattern for delays in treatment by ethnic group, (Figure 6.4) The median delay for pulmonary TB cases in Yorkshire and Humber is 67 days, compared to 77 days nationally.

³ Early diagnosis: diagnosis made within 28 days of onset of symptoms. Late diagnosis: diagnosis made more than 120 days after onset of symptoms.

Characteristics of pulmonary TB cases with a delay between onset of symptoms and starting treatment

Table 6.1: Number and proportion of pulmonary TB cases by time from symptom onset to treatment start by age group, Yorkshire and Humber, 2016

Time from symptom onset to treatment start	Age group n(%)					
	<15	15-24	25-34	35-44	45-64	65+
0 to 2 months	7(78%)	18(55%)	15(34%)	13(37%)	18(33%)	17(43%)
between 2 and 4 months	0(0%)	9(27%)	16(36%)	12(34%)	19(35%)	9(23%)
more than 4 months	2(22%)	6(18%)	13(30%)	10(29%)	18(33%)	14(35%)
Total	9(100%)	33(100%)	44(100%)	35(100%)	55(100%)	40(100%)

Figure 6.2: Proportion of pulmonary tuberculosis case reports by time from onset to treatment start date and country of birth, Yorkshire and Humber, 2016

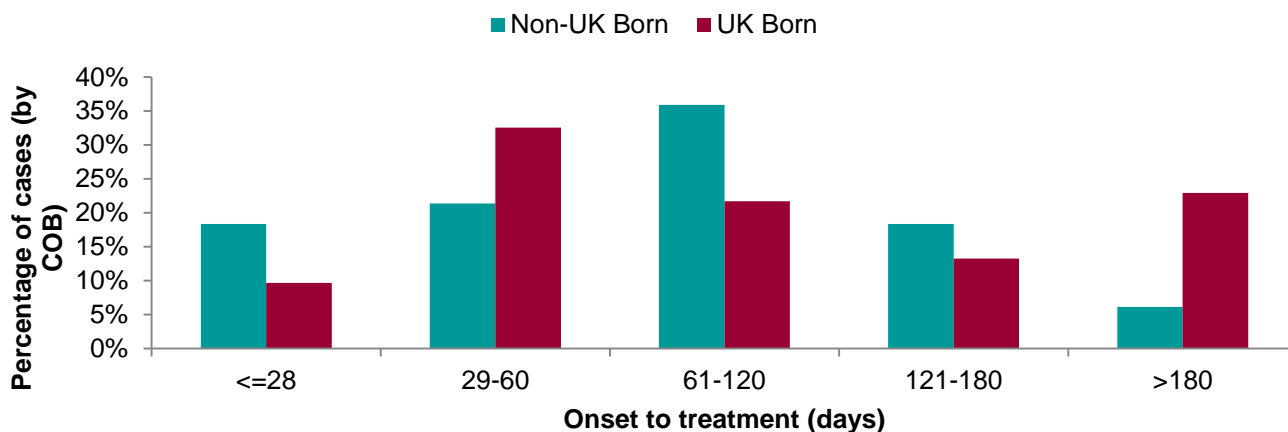


Figure 6.3: Proportion of pulmonary TB cases with a delay from symptom onset to treatment start by place of birth, Yorkshire and Humber 2012-2016

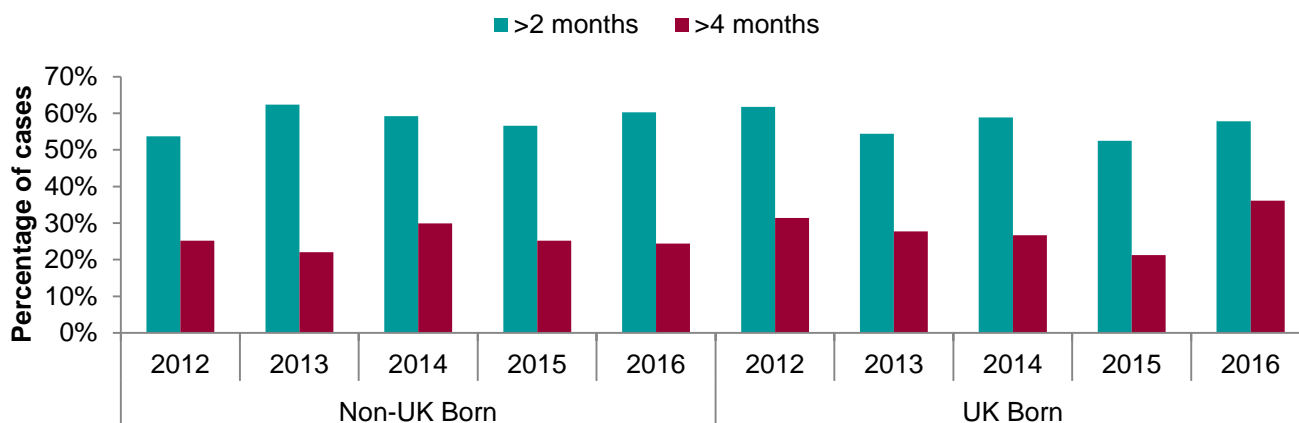


Figure 6.4: Pulmonary tuberculosis case reports by time from onset to treatment start date and ethnic group, Yorkshire and Humber, 2016

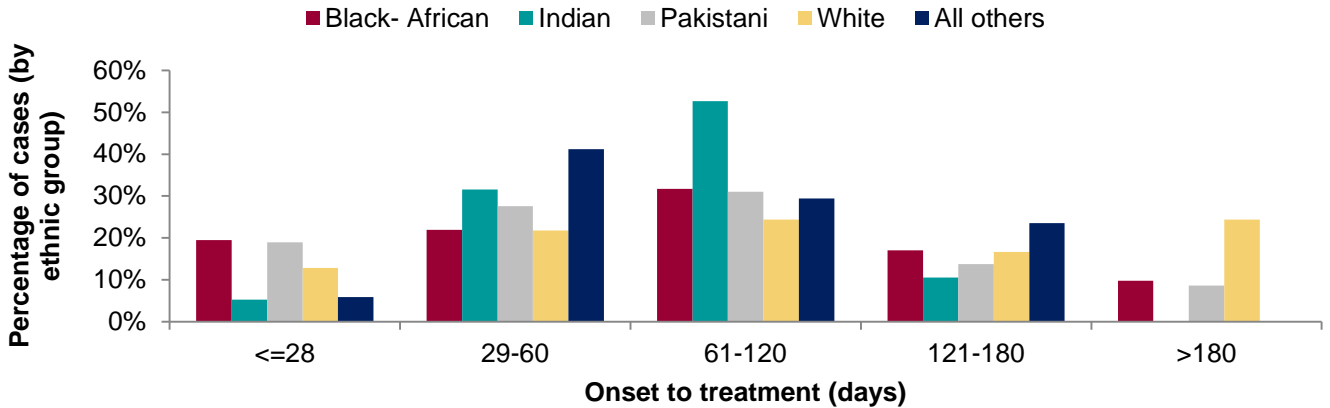
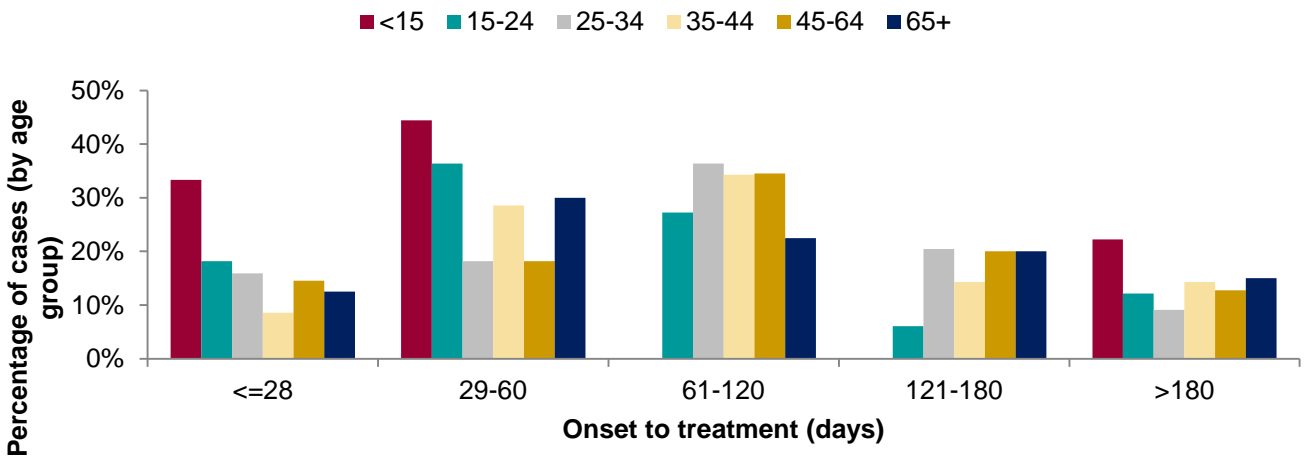
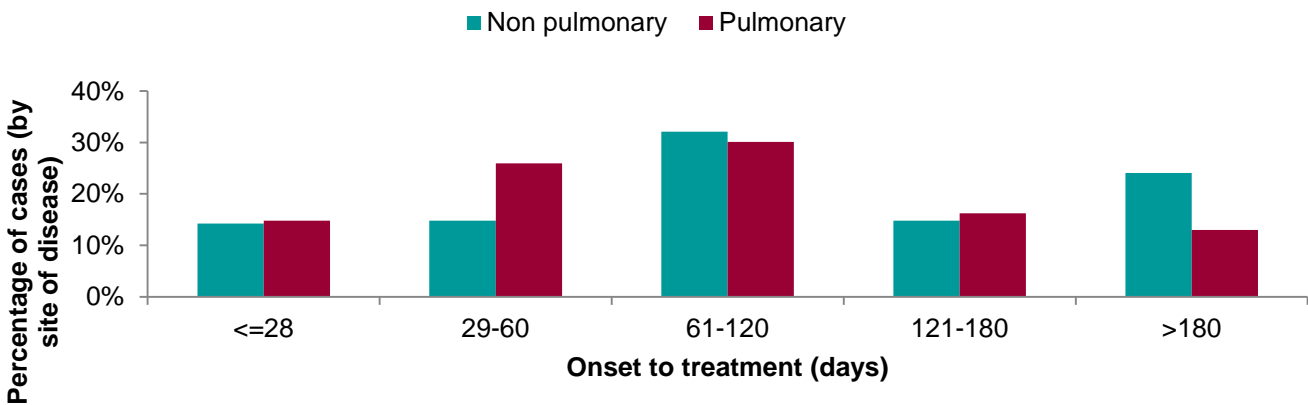


Figure 6.5: Pulmonary tuberculosis case reports by time from onset to treatment start date and age group, Yorkshire and Humber, 2016 (pulmonary TB cases only)



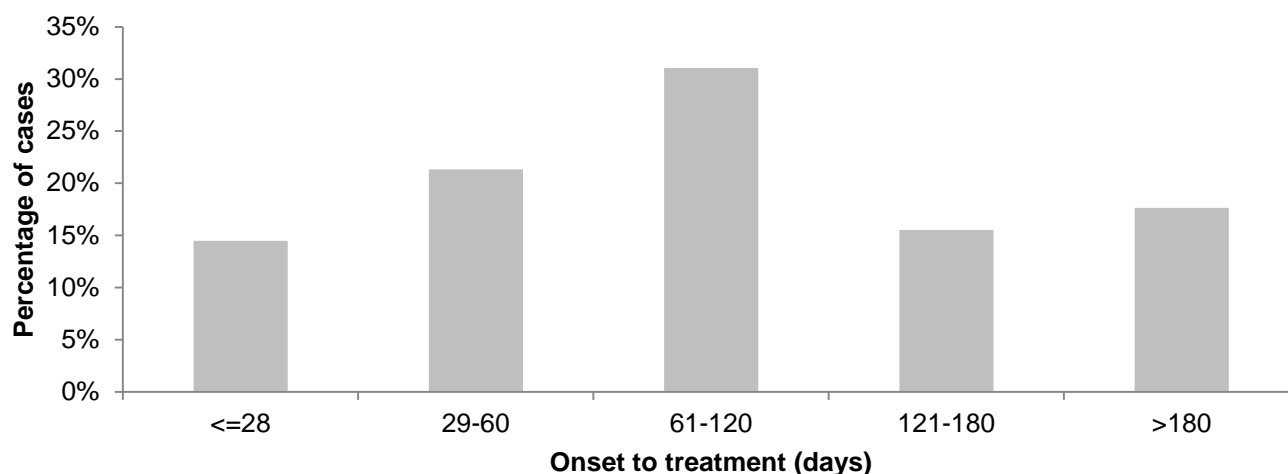
Time from symptom onset to treatment start for patients with pulmonary and non-pulmonary TB

Figure 6.6: Pulmonary and non-pulmonary tuberculosis case reports by time from onset to treatment start date and site of disease, Yorkshire and Humber, 2016



Dates of symptom onset and treatment were available for 89.4% (380/425) of all TB cases diagnosed in 2016, no change from 2015. Thirty-six per cent (136/380) of all TB cases in 2016 started treatment within 60 days (two months) of onset of symptoms (Figure 6.7). As expected, delay in treatment was more common for extra-pulmonary than pulmonary disease – 39% of extra-pulmonary TB cases began treatment more than 120 days after onset of symptoms compared to 29% of pulmonary cases (Figure 6.6).

Figure 6.7: Tuberculosis (pulmonary and non-pulmonary) case reports by time of onset to treatment start date, Yorkshire and Humber, 2016



*excluding asymptomatic cases, and those with missing onset dates

There was no difference in time to treatment start date by country of birth. Proportions of UK-born and non-UK born cases were approximately equal for early and late diagnoses⁴ (Figure 6.9). There was no clear pattern for delays in treatment by ethnic group, (Figure 6.10). Nationally consistently longer delays are experienced by UK born cases. The median delay for all cases in Yorkshire and Humber was 84 days.

Table 6.2: Number and proportion of all TB cases (pulmonary and non-pulmonary) by time from symptom onset to treatment start by age group, Yorkshire and Humber, 2016

Time from symptom onset to treatment start	Age group n(%)					
	<15	15-24	25-34	35-44	45-64	65+
0 to 2 months	9(69%)	25(49%)	26(29%)	20(28%)	35(36%)	21(37%)
between 2 and 4 months	0(0%)	17(33%)	35(39%)	24(34%)	30(31%)	12(21%)
more than 4 months	4(31%)	9(18%)	29(32%)	27(38%)	33(34%)	24(42%)
Total	13(100%)	51(100%)	90(100%)	71(100%)	98(100%)	57(100%)

⁴ Early diagnosis: diagnosis made within 28 days of onset of symptoms. Late diagnosis: diagnosis made more than 120 days after onset of symptoms.

Characteristics of all TB cases (pulmonary and non-pulmonary) with a delay from onset of symptoms to treatment

Figure 6.8: Proportion of all tuberculosis (pulmonary and non-pulmonary) case reports by time from onset to treatment start date and country of birth, Yorkshire and Humber, 2016

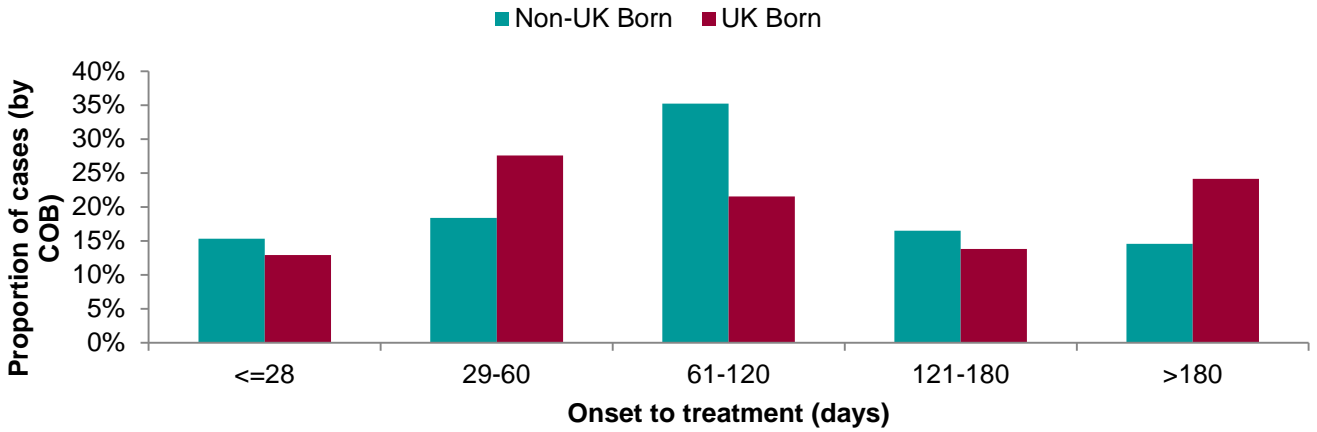


Figure 6.9: Proportion of all TB cases (pulmonary and non-pulmonary) with a delay from symptom onset to treatment start by place of birth, England, 2012-2016

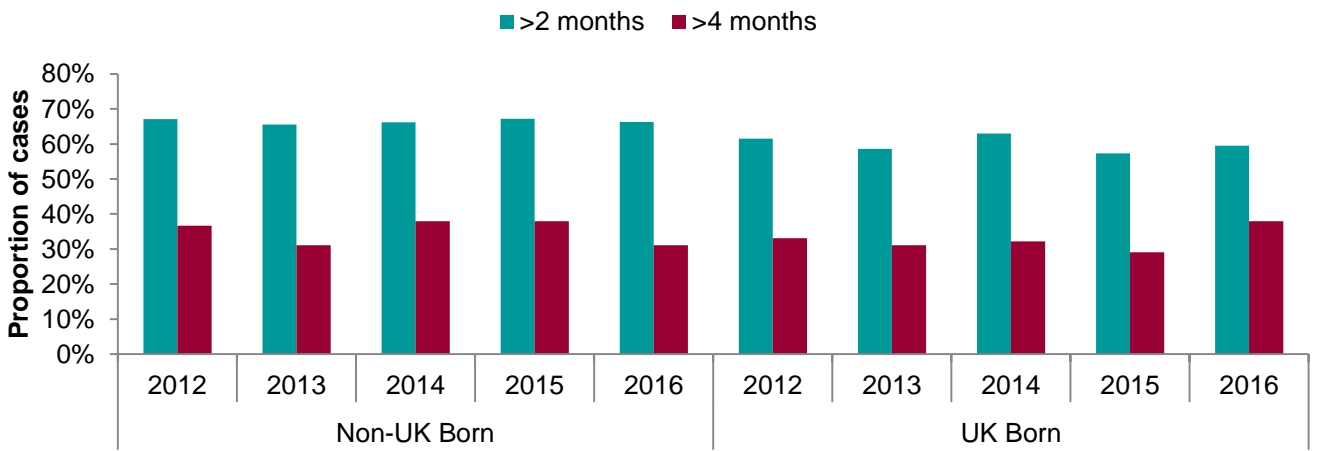


Figure 6.10 Tuberculosis (pulmonary and non-pulmonary) case reports by time from onset to treatment start date and ethnic group, Yorkshire and Humber, 2016

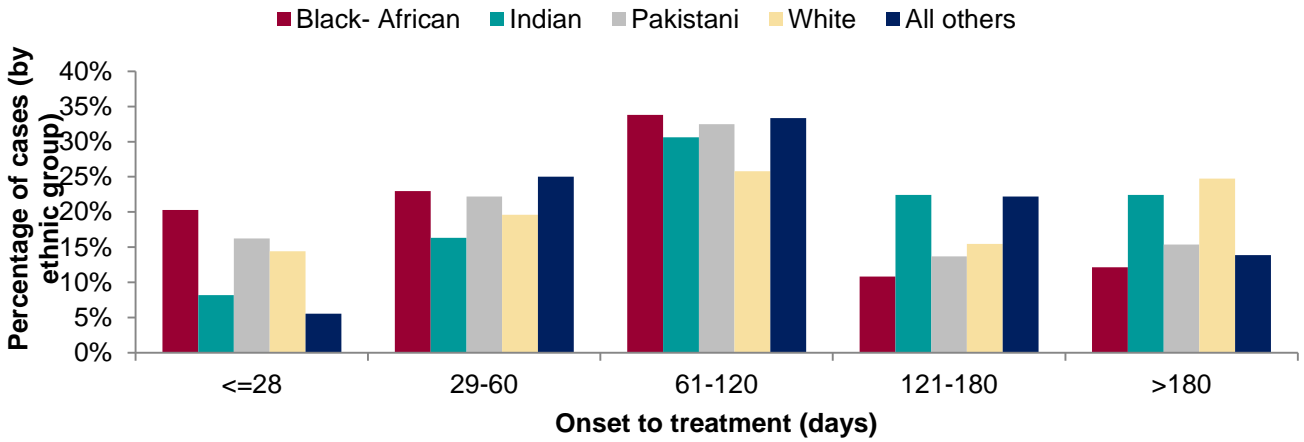
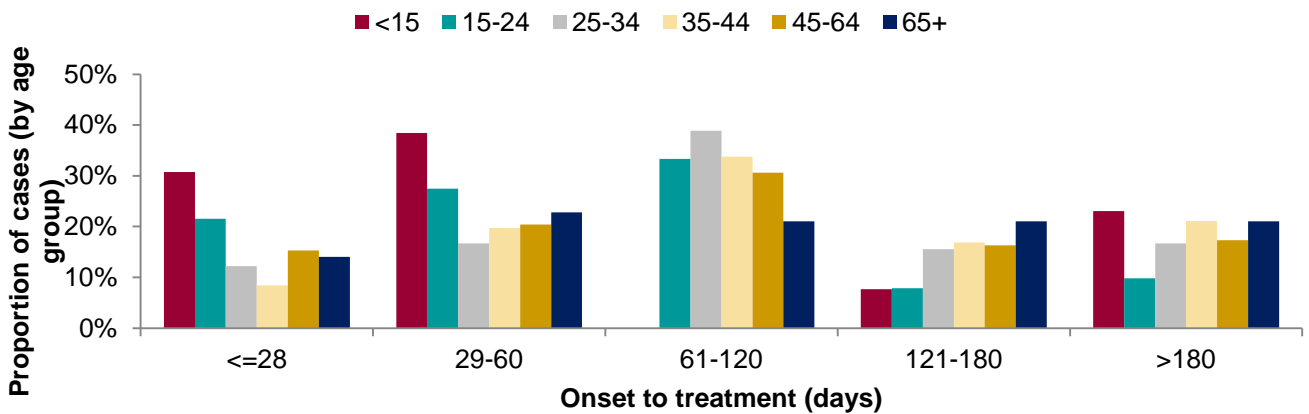


Figure 6.11: All Tuberculosis (pulmonary and non-pulmonary) case reports by time from onset to treatment start date and age group, Yorkshire and Humber, 2016



7. TB outcome in drug sensitive cohort

Drug sensitive cohort

For the purposes of TB outcome reporting the drug sensitive cohort is defined as excluding 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 [5]. 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. Definitions for the various treatment outcomes are contained in Appendix 4. Definitions have been updated in line with the revised 2013 World Health Organization (WHO) TB outcome definitions.

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

- for cases with an expected duration of treatment less than 12 months, TB outcomes at 12 months are reported. This group excludes cases with Central Nervous System (CNS) disease, who have an expected duration of treatment 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.

Treatment outcome reports were received for 98.4% of cases diagnosed in 2015, compared to 76.7% of cases diagnosed in 2004 and 98.9% cases diagnosed in 2014.

The proportion of TB cases completing treatment within 12 months of notification increased in the region from 62.5% for TB cases diagnosed in 2004 to 84.3% for cases diagnosed in 2015 (Figure 7.1). This is just above the national treatment completion rate of 83.4% but lower than the local peak in 2013.

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

Figure 7.1: Proportion of tuberculosis cases that complete treatment by twelve months*, Yorkshire and Humber, 2004-2015

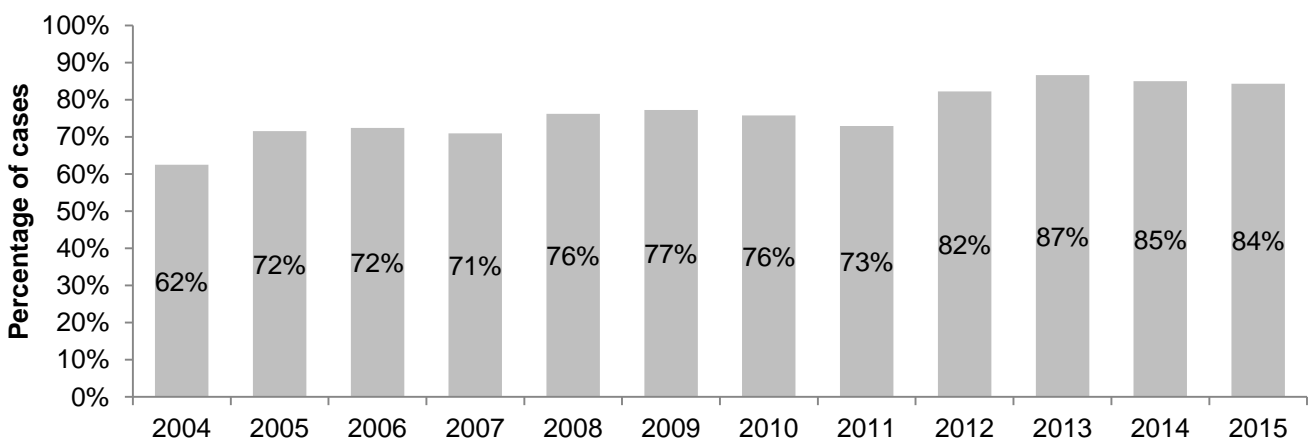
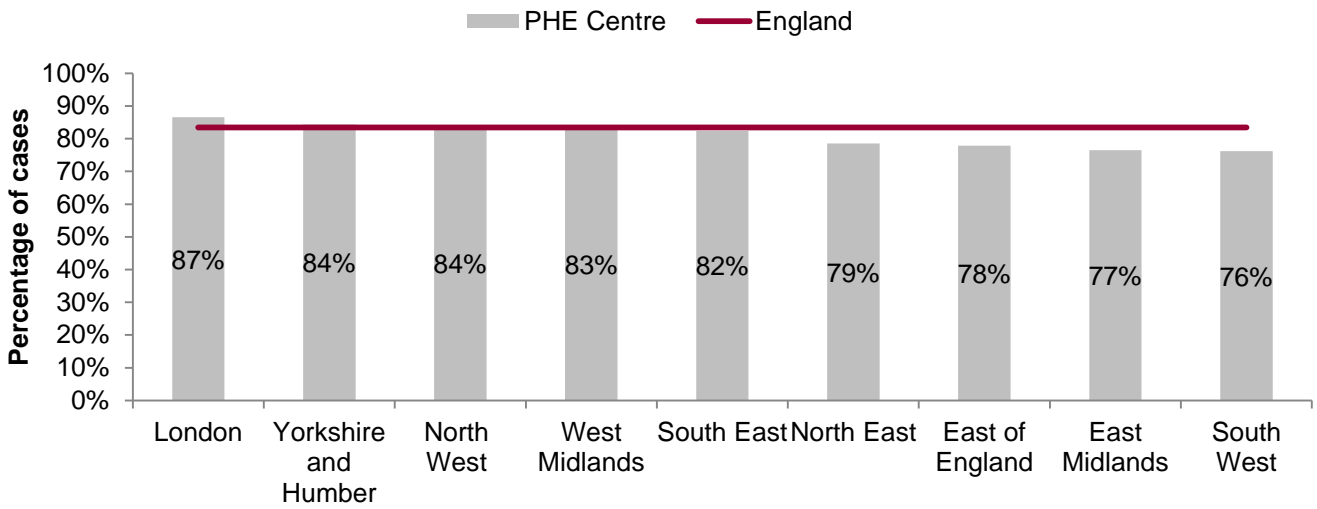


Figure 7.2: Proportion of tuberculosis cases* diagnosed in 2015 that complete treatment in twelve months, by Public Health England Centre, 2015

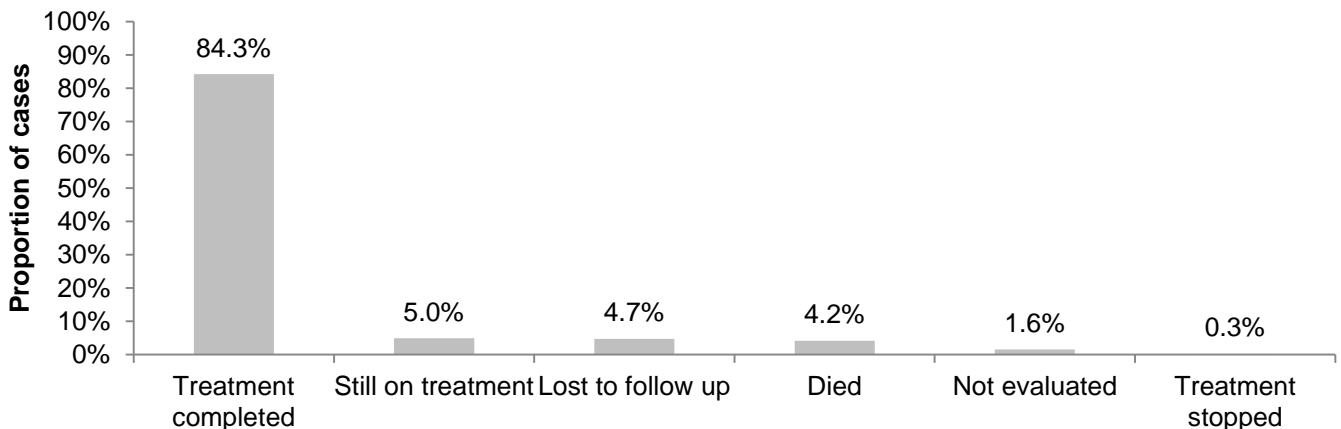


TB treatment outcome

The proportion of patients reported as still on treatment, died or treatment stopped is now lower in the Yorkshire and Humber region than the national average. Of the TB cases diagnosed in 2015, 5.0% were reported as still on treatment compared to the national proportion of 5.3%. Some patients still on treatment at 12 months had experienced interruption of treatment for various reasons leading to an extension of the treatment time. TB treatment was also stopped for a small number of patients due to clinical reasons such as intolerance of the treatment regimen. Those with complex disease and known resistance to anti-tuberculous drugs requiring longer treatment periods are excluded from this analysis.

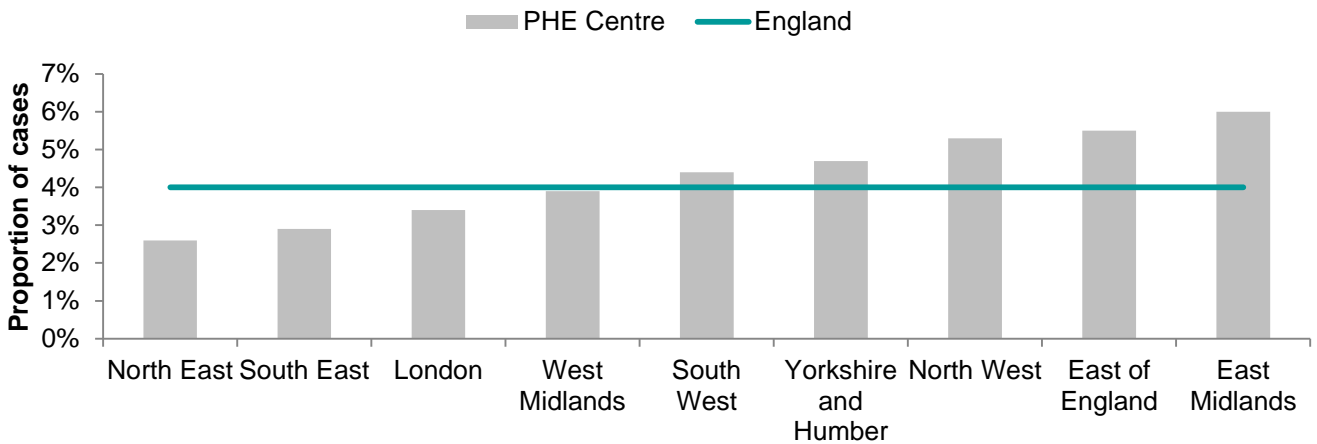
Of TB patients diagnosed in 2015 in the region, 4.7% were reported as lost to follow up 12 months later, an increase from the previous year (2.5%) and above the England proportion of 4.0% (Figure 7.4).

Figure 7.3: Tuberculosis cases by treatment outcome for cases diagnosed in 2015, Yorkshire and Humber



*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

Figure 7.4: Proportion of tuberculosis cases diagnosed in 2015 that reported being lost to follow up as a treatment outcome by twelve months, by PHE Centre



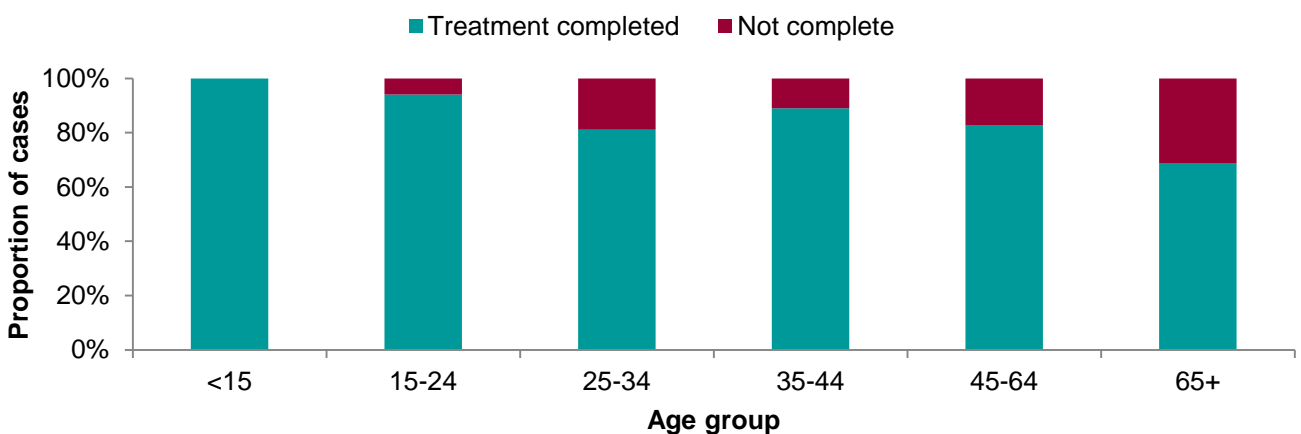
*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

The proportion of patients completing treatment within 12 months was lowest in the 65+ age group (Figure 7.5). Death was the most commonly reported reason for failing to complete treatment in the 65+ age groups while loss to follow up was most commonly reported in the 25-34 age group (Figure 7.).

A similar proportion of UK born than non-UK born TB patients completed treatment within 12 months – 86.1% compared to 84.5% (Table 7.1).

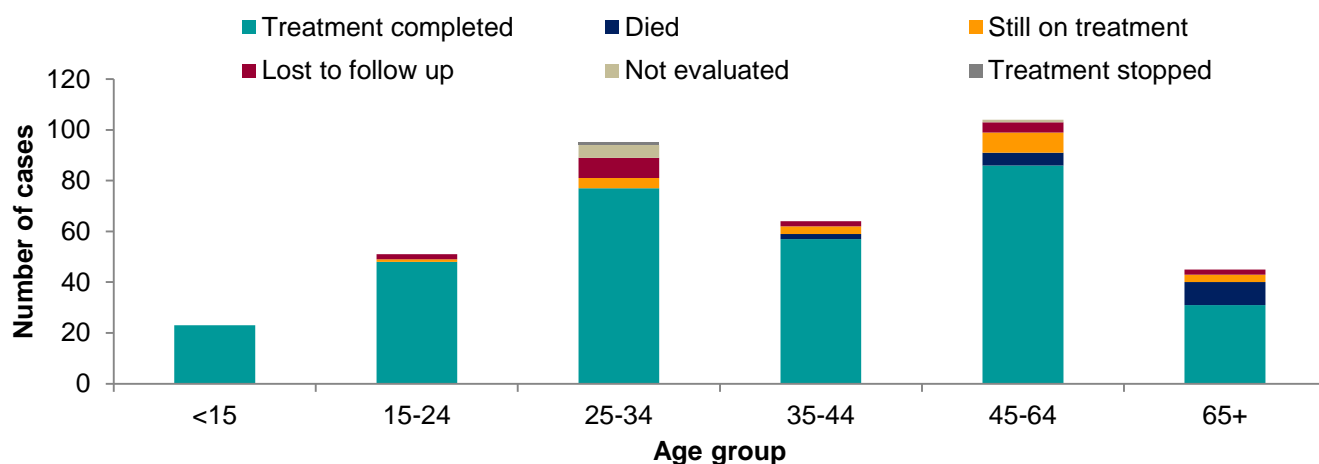
Treatment completion rates varied by ethnicity of the TB patient with the lowest treatment completion rates reported in the white ethnic group – 75.0%, and highest completion rates in the Black-African ethnic group – 89.9% (Figure 7.7). This is partly explained by the age profile of the white TB patients who tend to be older and a higher chance of death from other causes before treatment is completed. This may also be due to the slightly higher proportion of white TB patients with risk factors associated with poor treatment adherence such as substance misuse.

Figure 7.5: Proportion of tuberculosis cases* diagnosed in 2015 by treatment outcome and age group, Yorkshire and Humber



*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

Figure 7.6: Number of tuberculosis cases* diagnosed in 2015 by age group and reason for not completing treatment, Yorkshire and Humber



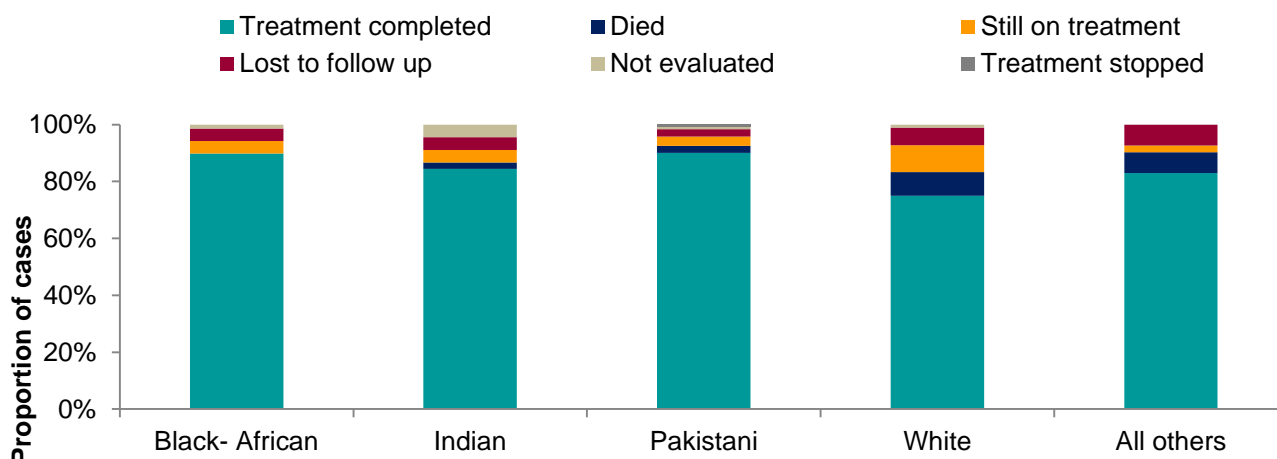
*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

Table 7.1: Proportion of tuberculosis cases diagnosed in 2015 by treatment outcome and country of birth, Yorkshire and Humber

Outcome recorded at 12 months	Non-UK Born	UK Born
	n(%)	n(%)
Treatment completed	213(84.5%)	99(86.1%)
Lost to follow up	17(6.7%)	0(0.0%)
Still on treatment	10(4.0%)	9(7.8%)
Died	6(2.4%)	6(5.2%)
Not evaluated	6(2.4%)	0(0.0%)
Treatment stopped	0(0.0%)	1(0.9%)

*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

Figure 7.7: Proportion of tuberculosis cases* diagnosed in 2015 by treatment outcome and ethnicity, Yorkshire and Humber



*excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

TB treatment outcome – death

Death was the second most commonly reported reason for not completing treatment in the region (Figure 7.3). The median age of TB patients who were notified in 2015 and died before or whilst on treatment was 68 years.

TB was reported as a contributor or primary cause of death in two of nine deaths (22%) where the cause of death is known. This has declined since 2004 when TB was reported as the cause or contributor to death in 69% of TB cases who died within 12 months of diagnosis. However, it should be noted that numbers are small and the proportion of deaths where the role of TB was reported as unknown was very high, 50% in 2015 (Table 7.2).

Table 7.2: Number of deaths per year and proportion of total cases and relationship of death outcome to tuberculosis, Yorkshire and the Humber, 2004-2015 diagnoses

Year	Number of cases	Number of deaths	Proportion of cases	Median age	TB caused death	TB contributed to death	TB incidental to death	Unknown
2004	485	30	6%	79	5	11	7	7
2005	495	34	7%	69	7	9	8	10
2006	580	35	6%	76	4	8	7	16
2007	571	35	6%	69	3	7	8	17
2008	571	29	5%	66	1	8	9	11
2009	606	35	6%	73	3	6	13	13
2010	565	36	6%	74.5	6	4	11	15
2011	591	36	6%	72.5	2	7	9	18
2012	535	27	5%	76	2	9	6	10
2013	529	26	5%	69.5	0	3	7	16
2014	472	29	6%	73	2	4	8	15
2015	382	18	5%	68	0	2	7	9

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

Table 7.3: TB treatment last recorded outcome (August 2016) for the drug sensitive cohort with CNS spinal miliary or cryptic TB notified in 2015 TB, Yorkshire and Humber

Last recorded outcome (August 2017)	n(%)
Treatment completed	35(83%)
Still on treatment	4(10%)
Died	3(7%)
Lost to follow up	0(0%)
Not evaluated	0(0%)
Treatment stopped	0(0%)
Total	42(100%)

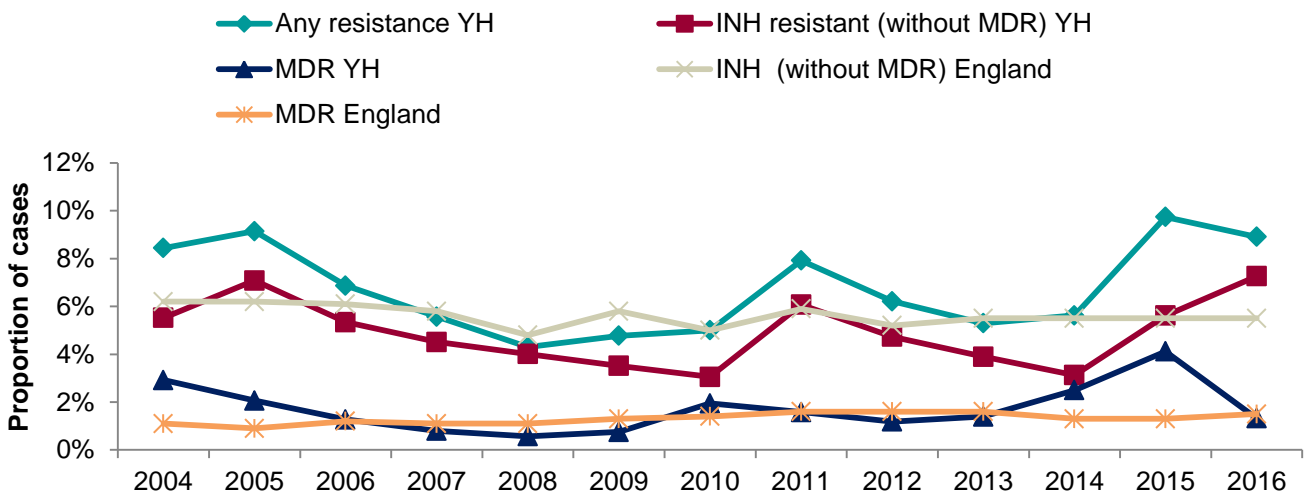
8. Drug resistant TB

Overall initial drug resistance and geographical distribution

The proportion of TB cases with initial resistance to Isoniazid without MDR-TB has remained fairly stable at 7% in 2016, just above the national proportion of 5.5%. The number of cases with MDR-TB detected through a drug sensitivity test (DST) decreased from 3.4% in 2015 to 1.3% in 2016, below the national average (1.5%).

The most frequent countries of birth of cases resistant to Isoniazid alone and MDR-TB were Eastern European countries in contrast to the national picture where the UK and the Indian subcontinent accounted for the country of birth of the majority of cases. Where social risk factor information was known for those 15 years and over, 11.5% (3/26) of cases resistant to isoniazid without MDR-TB had at least one known social risk factor (current or history of drug misuse (12.5%, 1/8), alcohol misuse (0%, 0/12), or imprisonment (18.1%, 2/11). Among the four patients with MDR-TB in Yorkshire and Humber one was known to have a social risk factor.

Figure 8.1: Proportion of culture confirmed tuberculosis cases with drug resistance, Yorkshire and Humber 2004-2016*



*Cases with DST results for at least isoniazid and rifampicin

Figure 8.2: Proportion of tuberculosis cases with drug resistance by world region of birth, Yorkshire and Humber, 2016

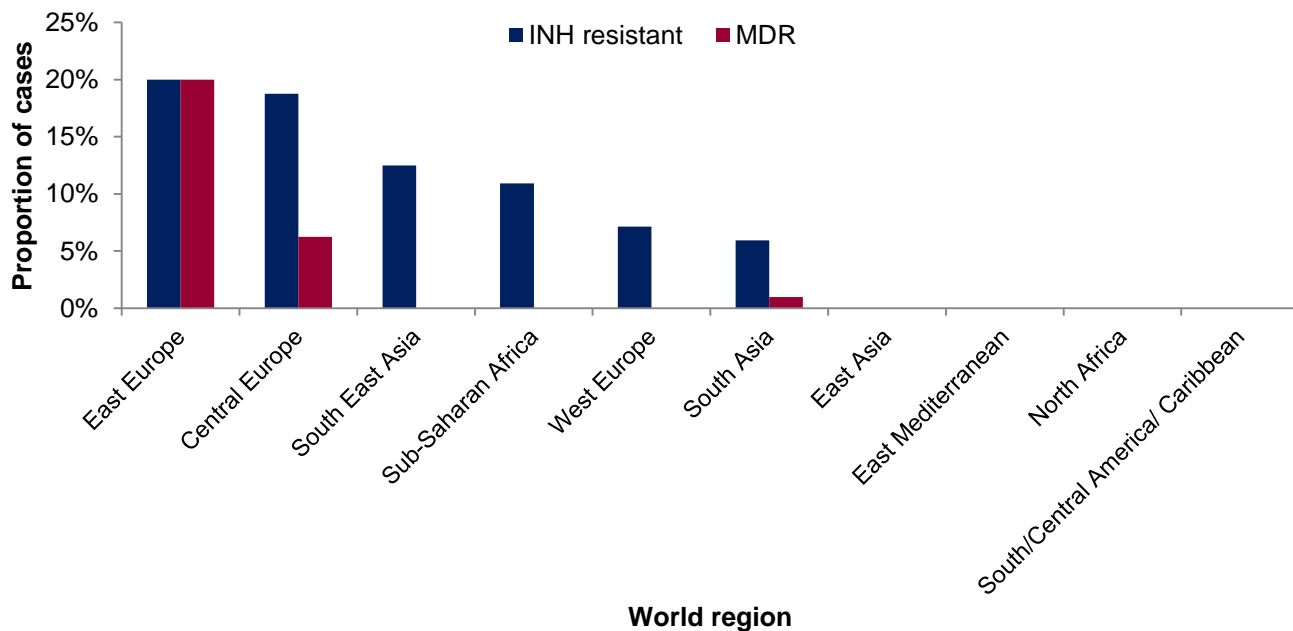
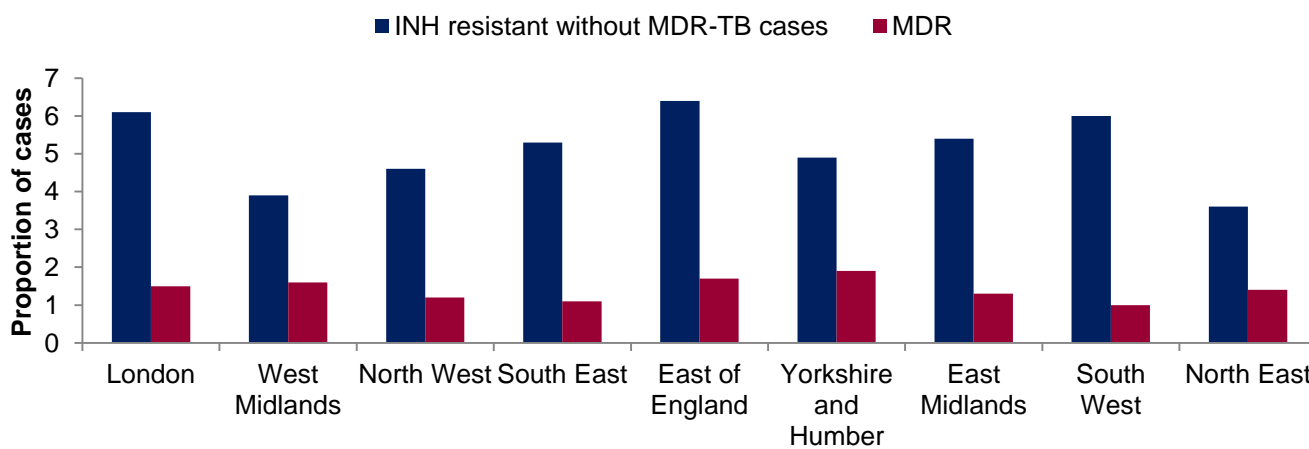


Figure 8.3: Proportion of tuberculosis cases with drug resistance by PHE centre, Yorkshire and Humber, 2012-2016



TB outcome at 24 months for patients with multi-drug resistant disease

Due to the length of time of treatment for cases with MDR-TB, the most current treatment outcome data is reported for cases notified in 2014. There were five cases with MDR-TB in 2014 (2/5) 40% of which had completed treatment at 24 months.

TB outcome at 24 months for patients with isoniazid resistant disease (without MDR-TB)

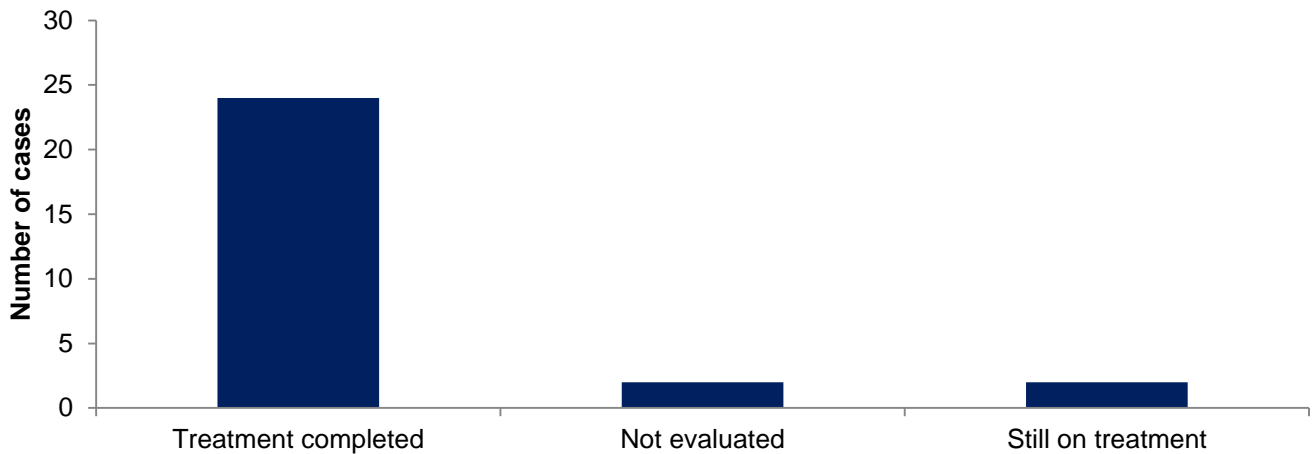
Due to the length of time of treatment for cases with isoniazid resistant TB, the most current treatment outcome data is also reported for cases notified in 2014. In 2014, there were 10 cases of isoniazid

resistant TB (who did not have MDR TB), 100% of which were known to have completed treatment at 24 months, 30% of which were still on treatment at 12 months follow.

TB outcome at 24 months for all patients still on treatment at 12 months

Of the 28 cases notified in 2014 that reported still being on treatment at 12 months (for the drug sensitive and drug resistant cohort), 24 (86%) had completed treatment 24 months after diagnosis. Two (7.1%) were not evaluated and two cases (7.1%) were still receiving treatment.

Figure 8.4: TB outcome at 24 months for all patients still on treatment at 12 months, TB cases diagnosed in 2014



9. TB in under-served populations

Under-served populations

The Collaborative Tuberculosis Strategy for England (2) 2015 to 2020 defines Underserved Populations (USPs) as individuals whose social circumstances, language, culture or lifestyle (or those of their parents or carers) make it difficult to recognise the clinical onset of TB, access diagnostic and treatment services; self-administer treatment (or, in the case of children and young people, have treatment administered by a parent or carer); or attend regular appointments for clinical follow-up.

Social risk factors

Information on factors associated with increased risk of TB is collected for all TB cases. The risk factors collected include:

- Substance misuse – alcohol or drug misuse
- Current or recent history (5years) of homelessness
- Current or recent history (5 years) of imprisonment

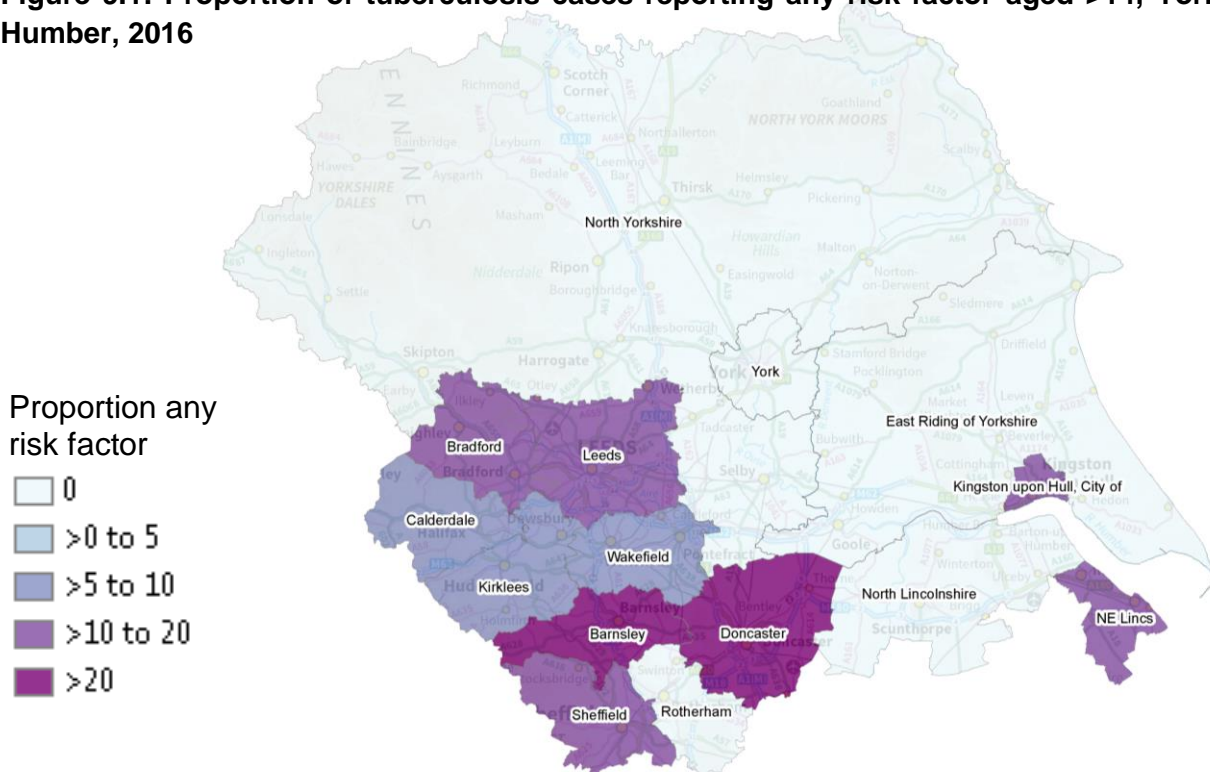
Reporting of risk factors associated with TB has improved since their addition to ETS in 2008. A response for “any risk factor” was recorded for 78.3% (321/410) of TB cases reported in the region in 2016. 13/363 (3.6%) reported alcohol misuse, 10/358 (2.8%) reported drug misuse; 13/356 (3.7%) reported homelessness; and 13/338 (3.8%) reported imprisonment.

In total, 33/321 (10.3%) of TB cases notified in Yorkshire and Humber in 2016 were reported as having at least one social risk factor for TB, consistent with the national epidemiology (11.1%). Cases reporting social risk factors are distributed across the region (Figure 9.1) which indicates that even in areas with low incidence, TB cases may still present a management challenge as they are still likely to have factors that increase the complexity of case management.

Previous diagnosis of TB

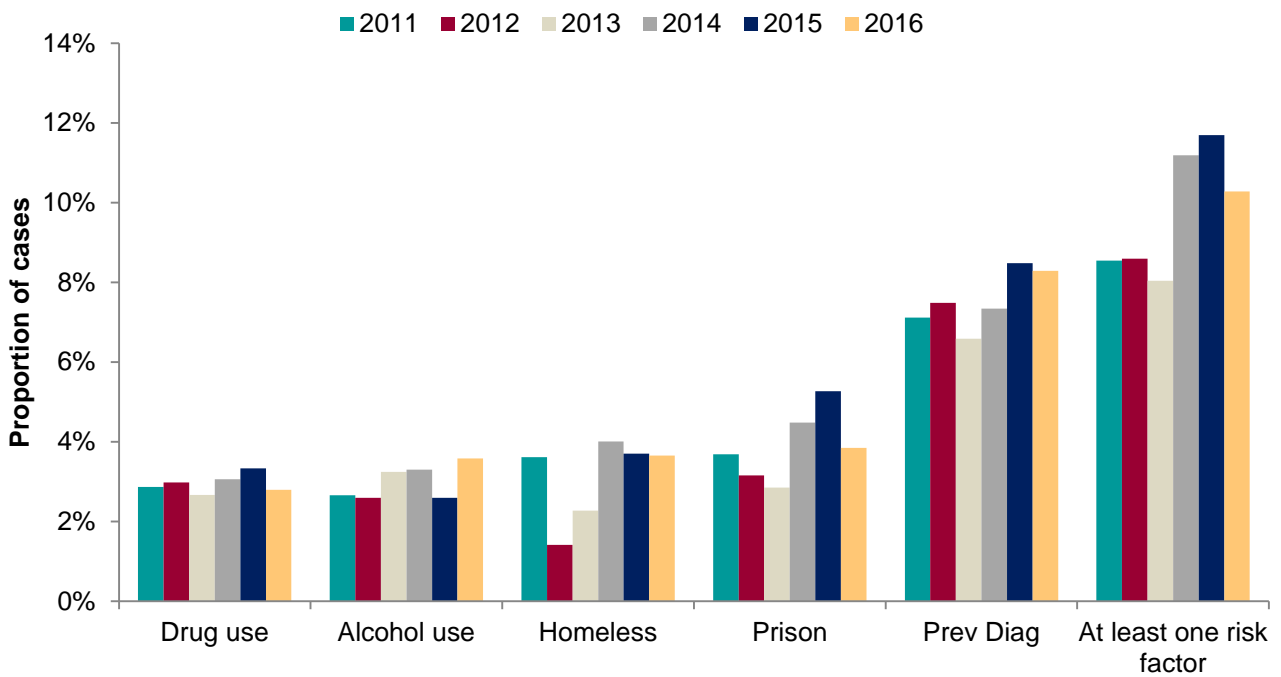
Information on previous diagnosis of TB was available for 91.2% (374/410) of cases notified in 2016 who were 14 years of age. A previous diagnosis of TB in cases over 14 years of age was reported in 31/374 (8.3%) of cases in 2016.

Figure 9.1: Proportion of tuberculosis cases reporting any risk factor aged >14, Yorkshire and Humber, 2016



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Figure 9.2: Proportion of TB cases with at least one social risk factor*, Yorkshire and Humber. 2011-2016



* Includes those aged 15 years and older

Treatment adherence risk factors: Use of Directly Observed Therapy (DOT)

After drug-sensitivity, the most important factor affecting TB treatment outcome is treatment adherence. Non-adherence to TB treatment results in onward transmission, increased morbidity and mortality and the emergence of drug resistant strains. Directly Observed Therapy (DOT) is a well-recognised option for improving treatment adherence and is recommended by the World Health Organisation and NICE.

DOT should be considered for TB patients with active disease who have a past history of poor adherence to treatment, a past history of active TB, a history of homelessness or substance misuse, major psychiatric, memory or cognitive disorders, or have multi-drug resistant TB.

DOT is resource intensive and figures below suggest that DOT is not being applied in many situations where national guidance recommends it should be used. Among TB cases in Yorkshire and Humber with a previous diagnosis of TB, 38.7% (12/31) were recorded as receiving DOT. Only 39.4% (13/33) of TB patients across the region in 2016 with any social risk factors indicating the need for DOT received this treatment (Table 9.1), a decline on the previous year (43%). Whilst these risk factors for poor adherence may be more nuanced and require local clinical assessment the use of DOT remains low across the region. This disparity between those with adherence risk factors and the use of DOT is observed in both low and high burden areas although the underlying reasons may differ. Nationally 52% of cases with a social risk factor received DOT but this was highest among those with current alcohol or drug misuse.

Table 9.1: Tuberculosis cases reporting at least one social risk factor or previous TB diagnosis and DOT Status, by local authority, Yorkshire and Humber, 2016

Local authority	Cases with at least one social risk factor	DOT status reported (for cases with a social risk factor)	Cases with a social risk factor on DOT	Cases with a previous TB diagnosis	DOT status reported (for cases with a previous diagnosis)	Cases with a previous TB diagnosis on DOT
Barnsley	3	3	1	1	1	1
Bradford	9	9	5	7	7	1
Calderdale	1	1	1	1	1	1
Doncaster	2	1	0	2	0	0
East Riding of Yorkshire	0	0	0	0	0	0
Kingston upon Hull, City of	2	1	0	1	1	1
Kirklees	3	3	2	4	4	2
Leeds	7	6	3	5	5	3
North East Lincolnshire	1	1	1	3	2	2
North Lincolnshire	0	0	0	0	0	0
North Yorkshire	0	0	0	2	1	0
Rotherham	0	0	0	0	0	0
Sheffield	4	1	0	4	2	0
Wakefield	1	1	0	1	1	1
York	0	0	0	0	0	0

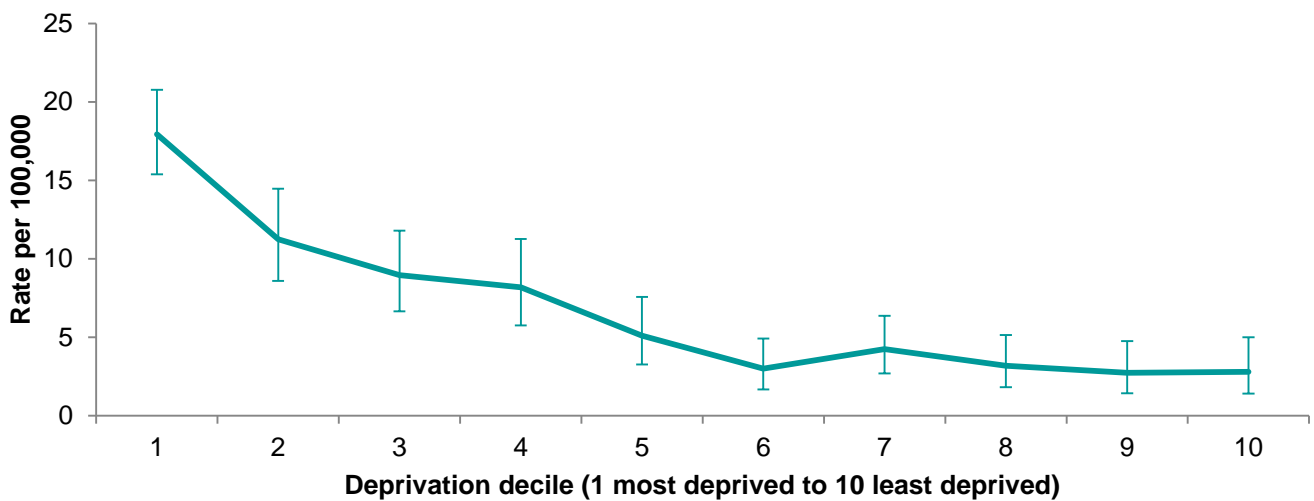
Deprivation

The association between TB and deprivation is well established. Using the Index of Multiple Deprivation (IMD), Figure 9.5 and Table 9.2 shows the association between TB incidence rates in 2015 and IMD scores in 2015.

The IMD provides a summary measure of relative deprivation at Lower-layer Super Output Area (LSOA) level in England and aims to provide a nationally consistent measure of how deprived an area is, by identifying the degree to which people are disadvantaged based on factors such as low income, unemployment, lack of education, poor health, and crime. Each of the 32,844 LSOAs in England is assigned a score and rank. 602/3317 (18.1%) of the LSOAs in our region were categorised amongst the most deprived 10% of LSOAs in England in 2015⁵.

Of the region's population, 18.2% live in these most deprived areas. Much of the region's significant deprivation is concentrated within towns and cities but also around the former coalfields of the region.

Figure 9.5: TB case rate by deprivation, 2016



⁵ Indices of Deprivation 2015. <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>
Accessed 08/01/2015

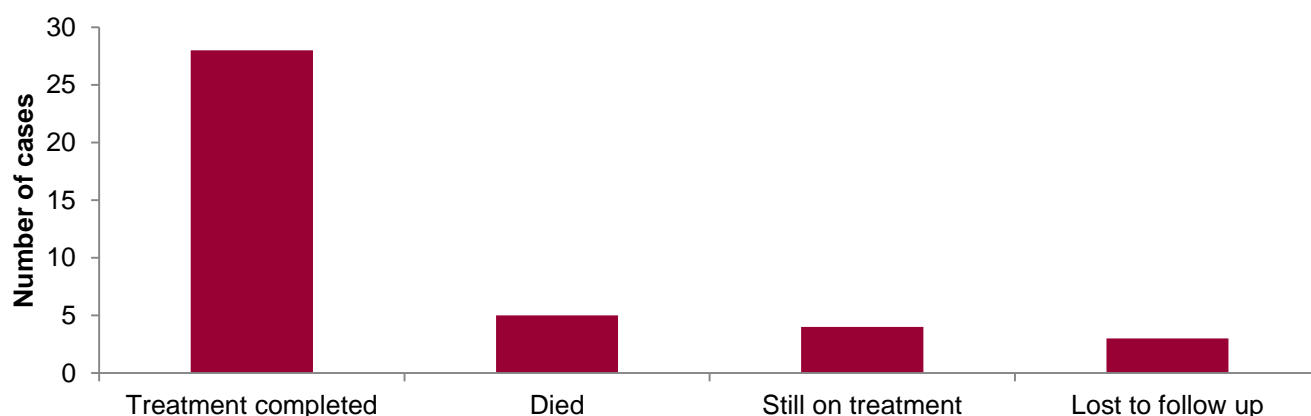
Table 9.2 utilises UTLA IMD average rank score (population weighted)

Table 9.2: Tuberculosis rates by local authority and corresponding local authority deprivation ranking, Yorkshire and Humber, 2016

Upper tier local authority	Rate per 100,000 - 2016	Deprivation Rank in Y&H
Bradford	17.0	2
Kirklees	15.1	11
Sheffield	11.3	8
Leeds	10.6	10
Calderdale	9.1	9
Wakefield	5.0	7
North East Lincolnshire	5.0	6
Kingston Upon Hull	5.0	1
Barnsley	4.1	3
Doncaster	3.9	4
Rotherham	3.8	5
North Lincolnshire	3.5	12
North Yorkshire	2.5	14
York	1.9	15
East Riding of Yorkshire	1.8	13

Social risk factors: Outcome

Of the 39 TB cases with one or more risk factors reported in 2015 who were expected to complete treatment within 12 months, an outcome was known for 100%. Treatment completion within 12 months of diagnosis was lower among cases with a social risk factor, 71.8% (28/39) compared to the overall treatment completion rate of 84.3%. The most common reasons for not completing treatment in this group were death, 10.3% (4/39) and being still on treatment 10.3% (4/39), followed by patient being lost to follow up 7.7% (3/39) (Figure 9.6).

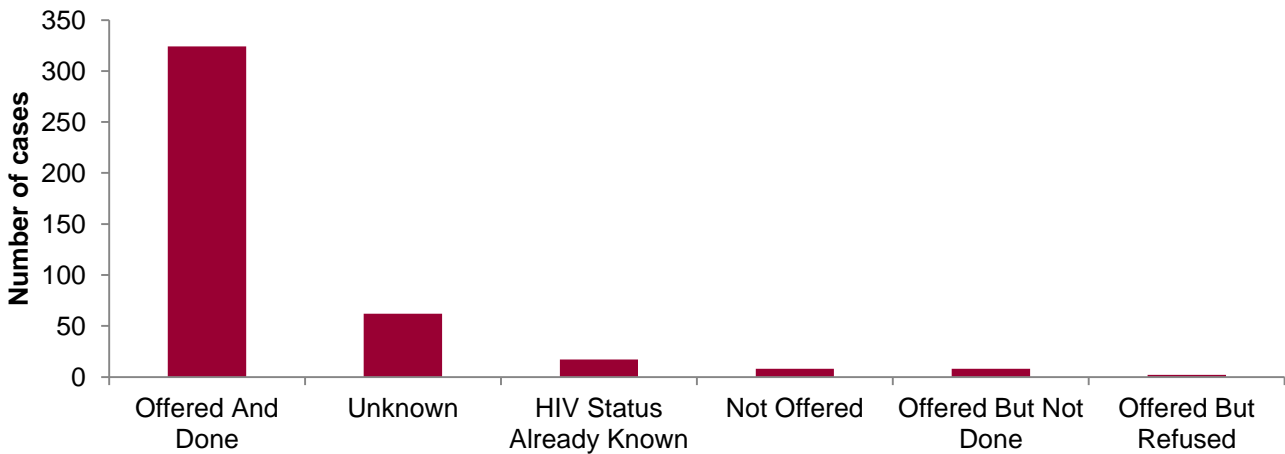
Figure 9.6: Treatment outcome at 12 months for tuberculosis cases diagnosed in 2015 with at least one social risk factor, Yorkshire and Humber

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

HIV testing

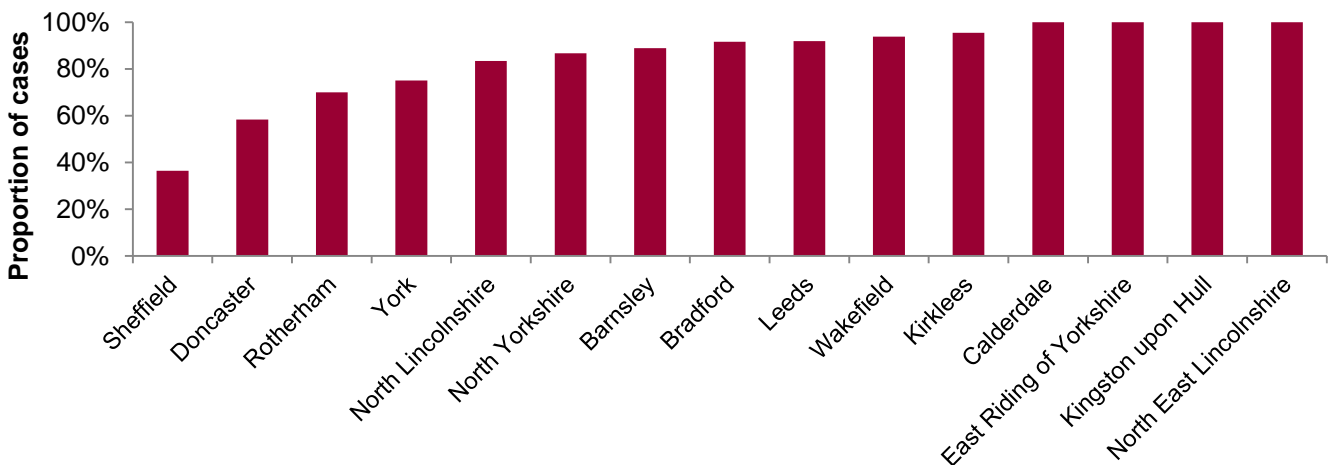
The majority of TB patients in 2016 (82.6%) were being offered and having an HIV test (excluding those diagnosed post-mortem and where HIV status was already known). There appears to be some geographical variation in the offer of HIV testing among TB patients but this may partly reflect the variation in the documentation of the offer. Eight patients were reported as not having been offered an HIV test although some of these will have been children under 6 years of age. Refusal of the offer is uncommon, although some patients accept the offer but the test does not get done which may be caused by a combination of factors. The proportion of cases where an HIV test has been offered and done has increased year on year.

Figure 10.1: HIV testing status of notified TB cases*, Yorkshire and Humber, 2016



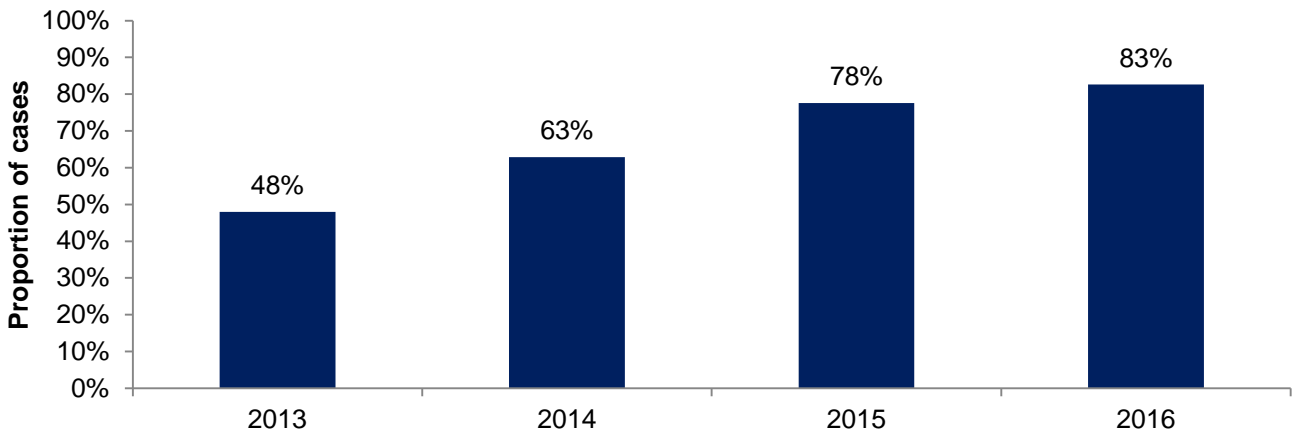
*Excludes cases diagnosed post-mortem

Figure 10.2: Proportion of notified TB cases offered an HIV test by Local Authority, Yorkshire and Humber, 2016*



*Excludes cases where HIV status is known. Where HIV test offer is not recorded, these have been counted as not offered.

Figure 10.3: Proportion of notified TB cases where a HIV test was offered and done HIV test by year, Yorkshire and Humber, 2016*

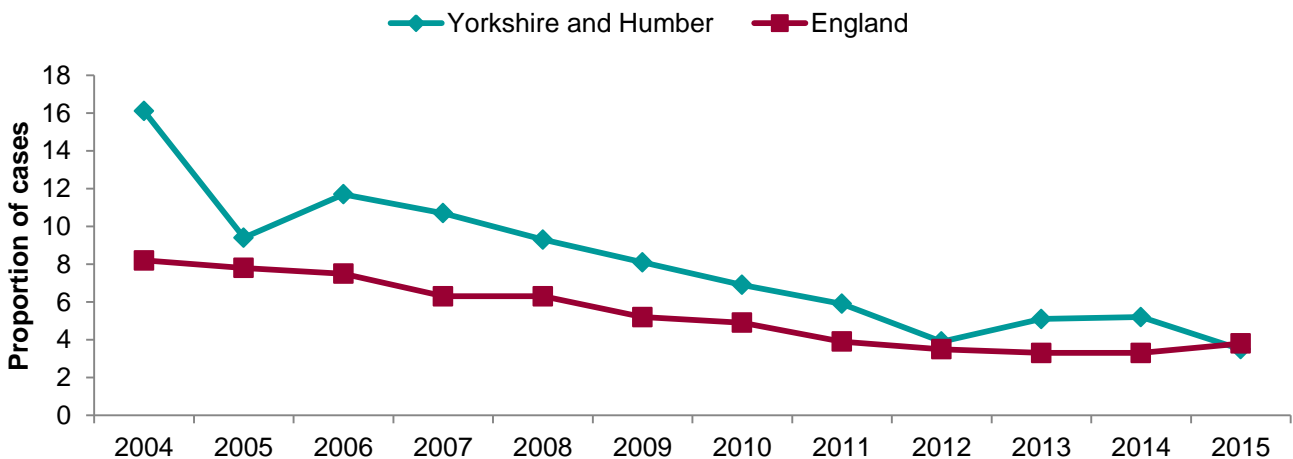


*Excludes cases where HIV status is known. Where HIV test offer is not recorded, these have been counted as not offered.

HIV co-infection rates

The most recent year for which TB-HIV co-infection data is currently available for the region and nationally is 2015. Information on TB and HIV co-infection is obtained by matching TB case reports for ages 15 and above, to HIV case reports from the national surveillance system SOPHID (Survey of Prevalent HIV Infections Diagnosed), combined with reports of new AIDS diagnoses where TB was reported as the AIDS defining illness.

Figure 10.4: Proportion of tuberculosis cases aged 15 and over co-infected with HIV, Yorkshire and Humber, 2004-2015



11.BCG vaccination

The BCG vaccination programme in Yorkshire and Humber is a risk based programme. The vaccine is recommended for individuals deemed to be at higher risk of exposure to TB, particularly to protect against serious forms of disease in infants. In areas with an incidence greater than 40 per 100,000 universal vaccination of infants is recommended. Across Yorkshire and Humber BCG is offered to neonates as a risk based selective programme.

It is not possible to calculate vaccine coverage for areas with a selective programme as the denominator is not defined within Child Health Information Systems.

Information on BCG vaccination history is collected for TB cases and this information is available for 53.2% of cases in Yorkshire and Humber in 2016, compared to 70.6% nationally. Among those cases where vaccination was recorded 70% were vaccinated consistent with 69.6% nationally. Among the seven cases in children under 10 years of age, vaccination history was not available for one case with 83% (5/6) of the remaining children having received BCG vaccine.

BCG vaccination status of cases

Table 11.1: Vaccination status of TB cases in Yorkshire and Humber in 2016 and UK born/non-UK born status

Country of Birth	Unknown vaccination status	Not vaccinated	Yes vaccinated	Total known vaccination status	Proportion vaccinated (where known)
Unknown UK Born	19	0	2	2	100%
Non-UK Born	128	50	100	150	67%
UK Born	52	18	56	74	76%
Total	199	68	158	226	70%

Table 11.2: Number and proportion of TB patients with BCG vaccination, Yorkshire and Humber, 2009-2016

Year	Unknown vaccination status	Not vaccinated	Yes vaccinated	Total known vaccination status	Proportion vaccinated (where known)
2009	286	157	245	402	61%
2010	254	154	220	374	59%
2011	229	179	256	435	59%
2012	209	148	235	383	61%
2013	219	163	201	364	55%
2014	213	107	196	303	65%
2015	194	85	158	243	65%
2016	199	68	158	226	70%

Table 11.3 Vaccination status of TB cases in Yorkshire and Humber in 2016 by age group

Age group	Unknown vaccination status	Not vaccinated	Yes vaccinated	Total known vaccination status	Proportion vaccinated (where known)
0-9	1	1	5	6	83%
10-19	5	5	16	21	76%
20-29	44	22	33	55	60%
30-39	33	15	34	49	69%
40-49	36	6	39	45	87%
50-59	25	3	13	16	81%
60-69	19	6	10	16	63%
70+	36	10	8	18	44%

12. New migrant latent TB infection testing

Key messages

- In Yorkshire and Humber six CCGs covering four local authorities were identified as eligible for funding and have established programmes
- In Yorkshire and Humber in 2017/18, 4248 individuals were invited to screening with acceptance rates varying between 47% and 79%.
- Across all the Yorkshire and Humber programmes test positivity is consistently 13%, representing 250 LTBI cases diagnosed in 2017/ 18
- There is some variation in treatment acceptance but this is consistently higher than 50%. However the proportion of those who commenced treatment who went on to complete treatment is lower with 24-47% not completing treatment.

Implementing new migrant LTBI testing and treatment in Yorkshire and Humber and England

In 2015, of the 209 CCGs, in England, 59 with the highest incidence and burden of TB were prioritised for the new migrant LTBI systematic testing and treatment programme. The national LTBI programme is now in its third year of operation. Eligibility for inclusion in the programme is for persons aged 16-35 years who entered the country from a high incidence country ($\geq 150/100,000$ or sub-Saharan Africa) within the last five years and have previously been living in that country for six months or longer. The national LTBI programme is now in its third year of operation.

Delivery of the funded programme is monitored through the following indicators:

1. LTBI testing and treatment programme coverage
2. LTBI testing acceptance
3. IGRA test performance and LTBI positivity
4. LTBI treatment uptake
5. LTBI treatment completion
6. Adverse events from LTBI treatment

National data on the performance of this programme is detailed in the PHE National Report on Tuberculosis in England 2016 (4)

LTBI screening invitations

Table 12.1: LTBI screening invitations by CCG in Yorkshire and Humber , July 2016 – June 2017

CCG	Number of invitations 2016/17	Number of invitations 2017/18
Sheffield	609	1207
Bradford: City & Districts	629 (*11 /12 months)	824
Greater Huddersfield	651	640
Leeds South and east	-	1267 (*7/12 months)
North Kirklees	318	310
Yorkshire and Humber total	2207	4248

• Source local reporting data

*Number of months data covers if less than 12 months

Information on LTBI acceptance was available for four CCG areas NHS Bradford City CCG, NHS Bradford Districts CCG, NHS Greater Huddersfield, NHS Leeds South and East CCG and NHS North Kirklees. For 2017, acceptance was calculated based on number of individuals invited to test between January and June and this ranged from 47.0% to 78.9%.

Table 12.2: LTBI testing acceptance by CCG in Yorkshire and Humber, July 2016 – June 2017

CCG	2016	2017
NHS Bradford City CCG & NHS Bradford Districts	NR*	69.6
NHS Greater Huddersfield	86.7	47.0
NHS Leeds South and East	20.2	75.7
NHS North Kirklees	-	78.9

*Data not included as denominator provided exceeded number of tests submitted through laboratories
NR- Not reported. Source National TB report

LTBI testing

The NHSE funded programme uses an interferon gamma release assay (IGRA) alone to test for LTBI. Five out of six local programmes test using T-Spot.TB® (Oxford Immunotec) from the nationally procured laboratory provider. The remaining CCG uses a Quantiferon test provided by the local lab. As per national programme clinical guidelines, persons with a positive IGRA test result are referred to secondary care to rule out active TB disease and to initiate treatment for LTBI.

Number of tests and positivity

Data from the Yorkshire and Humber screening sites for the 12 month period between April 2017 and March 2018 indicate that just under 2,000 tests for LTBI were done as part of the screening programme with a positivity rate of 13% which is consistent across the four reporting CCGs. What is less consistent is the proportion of tests reported as borderline or indeterminate (which includes a very small number of samples not tested for technical reasons). In the previous year, of all those tested, 14% were positive for LTBI and approximately 2% of local test results were recorded as indeterminate¹.

Table 12.3: LTBI test results April 2017 to March December 2018²

CCG*	Total tests n	Positive n (%)	Negative n (%)	Borderline/Indeterminate n (%)**
Bradford Districts and City	810	105 (13)	656 (81)	47 (6)
Greater Huddersfield	469	61 (13)	386 (82)	22 (5)
North Kirklees	163	21 (13)	141(86)	1(<1)
Sheffield ³	496	63 (13)	403 (81)	30 (6)
Total	1938	250 (13)	1586(82)	100 (5)

1. An indeterminate result indicates an uncertain likelihood of M. tuberculosis infection.

2. Leeds South and East CCG data not included

Treatment for LTBI

The proportion of LTBI positive patients accepting treatment varied by CCG ranging from 50.7% (38/75) in Sheffield CCG and 76.4 (120/157) in Bradford City and Bradford Districts CCGs. Treatment completion also varied with 53.2% of those starting treatment completing treatment in Greater Huddersfield CCG and 76.3% in Sheffield CCG. However, these figures could be low due to under

ascertainment (because of data quality) and because treatment uptake and completion can be subject to pathway delays.

Table 12.4: LTBI Treatment acceptance and completion for individuals who tested positive for LTBI by CCG, July 2016 – June 2017

CCG	Total number tested positive for LTBI	Started treatment (acceptance)	Completed treatment
		n(%)	n(%)
NHS Bradford City CCG & NHS Bradford Districts CCG	157	120(76.4)	82(68.3)
NHS Greater Huddersfield	71	47(66.2)	25(53.2)
NHS North Kirklees	17	11(64.7)	8(72.7)
NHS Sheffield	75	38(50.7)	29(76.3)

Source National TB report

13. Standards for tuberculosis surveillance

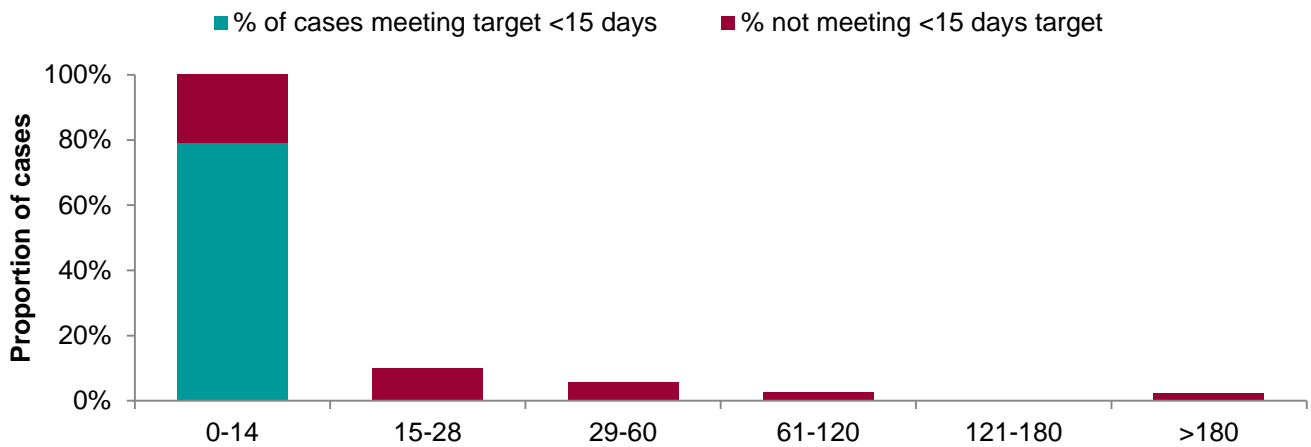
Time from diagnosis to notification

Standards for TB surveillances are set out in Department of Health guidance for England⁶. The guidance identifies key surveillance variables and reporting times and includes the following surveillance standards:

- At least 95% of cases should be reported within two weeks of diagnosis or decision to treat with a full course of anti-TB drugs.
- At least 95% of reported cases should include complete data for the key variables. The key variables are: name, date of birth, sex, ethnic group, born/not born in the UK, postcode, date of notification, previous TB treatment, site of disease (pulmonary/extra-pulmonary); and for pulmonary cases, sputum smear status.

The time from diagnosis to notification could be calculated for 406/425 (95.3%) of TB cases notified in 2016. Seventy-nine per cent of the cases in 2016 were reported within two weeks of diagnosis, below the target of 95% but showing a continuing improvement on previous years. There were very long delays in reporting in a few cases with 2.2% of cases reported more than six months after diagnosis.

Figure 13.1: Days from tuberculosis diagnosis to notification, Yorkshire and Humber, 2016



Completeness of ETS data

Across the region, completeness of reporting of the key variables listed below was not quite as good as in previous years. Many variables failed to reach the 95% completeness target (Table 13.1).

The reporting of postcode and country of birth achieved the target. The region also achieved a 98.4% return for the treatment outcome forms, with 84.3% of cases reported as completing their treatment. Overall data completion is consistent with last year although the reporting of the presence or absence of a prison history has reduced. Reporting of BCG status and culture confirmation status could be better.

⁶ Department of Health. Tuberculosis prevention and treatment: a toolkit for planning, commissioning and delivering high-quality services in England. 2007. London, Department of Health.

Table 13.1: Completeness of key information in TB Notifications, Yorkshire and Humber 2015 and 2016

Variable	2016 Essential Data	2016 % Complete	2015 % Complete
Total Cases	425	N/A	437
Postcode	423	99.5%	99.8%
Ethnic group	402	94.6%	97.5%
UK or Non UK Born	404	95.1%	95.9%
*COB where Non UK Born	278	100.0%	100.0%
*Year of Entry where Non UK Born	258	93.1%	94.8%
BCG Yes/No	226	53.2%	55.6%
Previously Diagnosis yes/no	388	91.3%	94.7%
Alcohol Yes/No	378	88.9%	93.4%
Drug Yes/No	373	87.8%	95.0%
Homelessness Yes/No	371	87.3%	92.2%
Prison Yes/No	352	82.8%	88.3%
DOT	350	82.4%	81.9%
Travel outside UK	298	70.1%	45.5%
Visitor outside UK	237	55.8%	30.7%
HIV Test	362	85.2%	84.7%
** Diagnosis to Notification	406	95.5%	96.6%
***Pulmonary Cases Culture result	242	100.0%	100.0%
***Smear test result	158	65.3%	56.3%
****TOM Submitted	431	98.4%	98.9%
****Treatment Complete	322	84.3%	85.0%

*278 Non-UK Born Cases 2016 and 293 2015

** where date of onset and case report date known

***of 242 Pulmonary cases culture 2016 and 256 2015

**** of 382 2015 cases, 472 cases 2014 (drug sensitive cohort)

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Appendix A: Description of data sources and definitions

Data sources

Data on TB cases in 2016 comes 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 Reference Laboratory.

Definitions

Treatment outcome

Information on outcomes were reported for all cases reported in the previous year, excluding those with known rifampicin resistant disease: outcomes for these cases were reported at 24 months. Definitions for outcome are based on World Health Organization (WHO) and European definitions, but adapted to the UK context. In this report, all data was obtained from the ETS matched dataset provided in August 2016.

Proportions

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

Confidence intervals

A 95% confidence interval for incidence was obtained assuming a Poisson distribution.

Population denominator

Tuberculosis rates by geographical area (Centre, local authority, MSOA and LSOA), age, sex and place of birth were calculated using ONS mid-year population estimates, 2014 mid-year population estimates were also used for 2015 data. Tuberculosis rates by ethnicity were calculated using 2011 census data [\[link to online source\]](#)

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 two or more people with TB caused by indistinguishable strains, with at least 23 complete VNTR loci. Analysis of clustering in Yorkshire and Humber was carried out on cases that were notified between 2010 and 2015.

Appendix B: TB among Yorkshire and Humber Local Authority residents

Table B1: Tuberculosis numbers and rates per 100,000 by local authority of residence, Yorkshire and Humber, 2004-2016

Local authority	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2004 - 2016
Barnsley	10 4.5	4 1.8	11 4.9	6 2.7	6 2.6	3 1.3	8 3.5	12 5.2	3 1.3	5 2.1	11 4.6	8 3.3	10 4.1	
Bradford	110 22.7	158 32.2	185 37.3	170 33.9	171 33.7	205 40.0	172 33.2	173 33.1	170 32.4	155 29.4	95 18.0	102 19.2	91 17.0	
Calderdale	18 9.2	24 12.2	23 11.6	23 11.5	22 10.9	30 14.8	25 12.3	20 9.8	20 9.7	22 10.7	19 9.2	11 5.3	19 9.1	
Doncaster	18 6.2	15 5.1	16 5.4	20 6.8	9 3.0	11 3.7	22 7.3	22 7.3	21 6.9	19 6.3	30 9.9	18 5.9	12 3.9	
East Riding of Yorkshire	10 3.1	5 1.5	13 4.0	5 1.5	10 3.0	7 2.1	2 0.6	15 4.5	6 1.8	4 1.2	10 3.0	3 0.9	6 1.8	
Kingston upon Hull, City of	14 5.5	7 2.7	17 6.7	15 5.9	12 4.7	9 3.5	19 7.4	24 9.4	25 9.7	16 6.2	18 7.0	17 6.6	13 5.0	
Kirklees	69 17.4	80 20.0	76 18.8	85 20.8	101 24.5	104 25.1	103 24.6	123 29.1	87 20.4	74 17.3	85 19.7	65 15.0	66 15.1	
Leeds	113 15.6	104 14.1	147 20.0	101 13.7	151 20.4	125 16.8	117 15.7	113 15.1	84 11.1	114 15.0	93 12.1	91 11.8	83 10.6	
North East Lincolnshire	0 0.0	3 1.9	4 2.5	8 5.0	7 4.4	3 1.9	7 4.4	7 4.4	1 0.6	2 1.3	5 3.1	7 4.4	8 5.0	
North Lincolnshire	3 1.9	1 0.6	7 4.3	6 3.7	17 10.3	35 21.1	7 4.2	13 7.8	19 11.3	15 8.9	6 3.5	10 5.9	6 3.5	
North Yorkshire	20 3.4	13 2.2	18 3.1	17 2.9	10 1.7	20 3.4	18 3.0	13 2.2	13 2.2	17 2.8	13 2.2	15 2.5	15 2.5	
Rotherham	28 11.1	26 10.3	18 7.1	21 8.3	14 5.5	26 10.1	20 7.8	19 7.4	30 11.6	13 5.0	21 8.1	9 3.5	10 3.8	
Sheffield	90 17.3	85 16.2	97 18.4	129 24.3	74 13.9	77 14.3	84 15.4	89 16.1	91 16.3	94 16.8	83 14.7	70 12.3	65 11.3	
Wakefield	27 8.5	23 7.2	20 6.2	15 4.7	18 5.6	23 7.1	20 6.1	15 4.6	17 5.2	22 6.7	25 7.5	9 2.7	17 5.0	
York	5 2.7	8 4.3	9 4.8	11 5.8	13 6.8	10 5.2	4 2.1	6 3.0	5 2.5	11 5.4	2 1.0	2 1.0	4 1.9	

Table B2: Tuberculosis cases by age group, gender, ethnic group and site of disease Yorkshire and Humber, 2004-2016

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Age group													
0-14	28	28	25	28	31	27	20	34	34	32	17	20	7
15-19	37	35	36	40	46	72	45	57	51	54	28	24	26
20-29	124	155	161	157	155	168	138	142	127	107	97	97	99
30-39	97	107	133	148	159	135	116	131	132	137	119	94	82
40-49	61	64	84	63	70	89	91	95	71	94	78	68	81
50-59	54	49	70	73	59	63	68	81	65	55	54	61	41
60-69	53	48	54	49	47	50	63	35	41	38	48	35	35
70+	81	70	98	74	67	84	87	89	71	66	75	38	54
Sex													
Female	232	262	301	282	305	314	278	303	265	235	222	180	135
Male	302	292	356	348	330	364	341	355	327	348	294	257	290
Ethnic group													
Pakistani	172	214	237	193	233	237	229	253	223	228	185	143	125
Black-African	88	110	106	105	114	100	89	74	74	65	63	79	80
Indian	61	55	86	70	83	95	77	86	79	69	71	51	53
White	146	121	140	137	115	153	149	150	135	137	132	102	105
All others	59	46	52	60	71	66	57	65	68	59	55	51	39
Site													
Not pulmonary	226	238	282	253	298	291	245	282	263	248	221	180	172
Pulmonary	309	318	372	373	336	394	380	379	329	333	292	256	242

***Table B3: Tuberculosis cases by detailed site of disease, Yorkshire and Humber, 2004-2016**

Site	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Pulmonary	309	318	372	373	336	394	380	379	329	333	292	256	242
Bone/Spine	13	22	30	24	22	31	19	33	27	23	18	19	15
Bone/Other	4	14	17	19	15	17	13	18	13	13	7	10	11
CNS Meningitis	5	12	11	13	12	14	10	10	4	7	6	9	6
CNS Other	7	9	10	9	7	20	9	13	10	15	7	7	12
Cryptic	9	5	9	3	3	1	3	4	1	2	2	1	1
Gastrointestinal	31	33	44	39	35	35	36	44	37	34	30	23	21
Genitourinary	21	14	8	19	24	16	21	14	16	11	9	11	10
Intra-Thoracic Lymph Nodes	68	56	68	66	95	109	101	105	110	89	66	85	62
Lymph Node	99	116	136	118	156	151	135	143	128	136	103	102	88
Laryngeal	1	1	2	1	4	2	0	0	2	2	0	0	1
Miliary	15	12	27	16	21	24	21	16	19	11	11	15	13
Pleural	52	43	60	57	56	46	36	57	49	42	51	34	40
Extra pulmonary other	44	45	53	48	48	49	39	47	43	32	44	32	27
Extra Pulmonary Unknown	49	65	44	76	87	95	60	72	67	52	45	41	37
Unknown	0	0	9	15	2	4	3	6	0	9	8	3	14

Table B4: Outcomes returned by local authority, Yorkshire and Humber, cases diagnosed in 2004 and 2015

Local authority	Total cases 2004*	Outcomes returned	%Outcomes returned	Total cases 2015*	Outcomes returned	%Outcomes returned
Barnsley	10	10	100%	8	8	100%
Bradford	101	99	98%	91	89	98%
Calderdale	15	15	100%	9	9	100%
Doncaster	18	18	100%	15	15	100%
East Riding of Yorkshire	10	9	90%	3	3	100%
Kingston upon Hull, City of	14	13	93%	13	11	85%
Kirklees	64	43	67%	55	55	100%
Leeds	95	90	95%	78	77	99%
North East Lincolnshire	0	0	0%	7	7	100%
North Lincolnshire	3	2	67%	9	9	100%
North Yorkshire	19	19	100%	14	13	93%
Rotherham	27	22	81%	9	9	100%
Sheffield	81	21	26%	61	61	100%
Wakefield	23	2	9%	8	8	100%
York	5	4	80%	2	2	100%

Target met >95%
90 to 95%
<90%

Table B5: Treatment completion by local authority, Yorkshire and Humber, cases diagnosed in 2004 and 2015

Local authority	Total cases 2004*	Treatment completed	% Complete	Total cases 2015*	Treatment completed	% Complete
Barnsley	10	8	80%	8	6	75%
Bradford	101	85	84%	91	73	80%
Calderdale	15	13	87%	9	6	67%
Doncaster	18	14	78%	15	14	93%
East Riding of Yorkshire	10	5	50%	3	3	100%
Kingston upon Hull, City of	14	10	71%	13	7	54%
Kirklees	64	36	56%	55	51	93%
Leeds	95	78	82%	78	69	88%
North East Lincolnshire	0	0	0%	7	6	86%
North Lincolnshire	3	2	67%	9	6	67%
North Yorkshire	19	12	63%	14	10	71%
Rotherham	27	15	56%	9	8	89%
Sheffield	81	20	25%	61	55	90%
Wakefield	23	1	4%	8	7	88%
York	5	4	80%	2	1	50%

Target met >85%
80 to 85%
<90%

Table B6: Treatment outcomes by local authority, Yorkshire and Humber, cases diagnosed in 2015

Local authority	Total Cases 2015	% Complete	Died	Lost to follow up	Not evaluated	Still on treatment	Treatment completed	Treatment stopped
Barnsley	8	75%	1	0	0	1	6	0
Bradford	91	80%	6	6	2	4	73	0
Calderdale	9	67%	1	1	0	1	6	0
Doncaster	15	93%	0	0	0	1	14	0
East Riding of Yorkshire	3	100%	0	0	0	0	3	0
Kingston upon Hull, City of	13	54%	2	1	2	1	7	0
Kirklees	55	93%	1	1	0	1	51	1
Leeds	78	88%	2	2	1	4	69	0
North East Lincolnshire	7	86%	0	0	0	1	6	0
North Lincolnshire	9	67%	0	1	0	2	6	0
North Yorkshire	14	71%	0	1	1	2	10	0
Rotherham	9	89%	1	0	0	0	8	0
Sheffield	61	90%	1	5	0	0	55	0
Wakefield	8	88%	0	0	0	1	7	0
York	2	50%	1	0	0	0	1	0

Appendix C: TB Cohort

Yorkshire and Humber has been taking part in Cohort Review since March 2013. There are four areas covered by separate cohorts – LBA (Leeds, Bradford and Airedale), CKW (Calderdale, Kirklees and Wakefield), SY (Barnsley, Doncaster, Rotherham and Sheffield), and finally NYH (North Yorkshire and Humber). Not all areas started the process straight away, but since November 2016 all areas are represented. The cohort review process collects extra information regarding the cohort of cases, in order to measure against the set of agreed standards shown below. The treatment pathway of each case is then presented to a group of TB professionals for peer review. Since March 2013 up until November 2017, there have been 40 cohort meetings held, and 1608 cases covered. Due to the nature of cohort, and a break for evaluation, not all cases recorded on ETS have been presented in cohort, but the majority of cases from 01/01/2012-30/06/2013 and 01/09/2014-31/03/2017 have been included in the cohort process.

Case Management

- 1) 100% of TB patients will be assessed for need for enhanced case management (ECM)
- 2) 100% of TB patients will be offered HIV testing (adults and children >6)
- 3) At least 95% of fully sensitive pulmonary TB cases will successfully complete a recommended treatment regime within 365 days (12 months).
- 4) 100% of MDR-TB cases are discussed with BTS MDR-TB group.
- 5) Treatment outcomes:
 - a) 100% of fully sensitive TB patients receiving enhanced case management from treatment outset will complete treatment within a recommended treatment regime within 365 days (12 months).
 - b) 85% of patients who have had smear positive pulmonary TB will complete treatment within a recommended treatment regime within 365 days (12 months).
 - c) 70% of patients with any first line drug resistance will complete treatment within a recommended treatment regime within 365 days (12 months).
 - d) Less than 5% of TB cases will be LFU at time of cohort review.

Contact Investigation

- 1) Among pulmonary sputum smear positive cases:
 - a) 95% will have one or more contacts identified.
 - b) 80% will have five or more contacts identified.
 - c) 90% of all contacts will receive a clinical evaluation.
- 2) 85% of all contacts with Latent TB Infection (LTBI), who are started on preventative treatment, will successfully complete the course.

Appendix D: Yorkshire and Humber level data for TB strategy monitoring indicators, 2000-2015

Year	Indicator 1 Overall TB incidence per 100,000 population		Indicator 2 TB incidence in UK born and non-UK born populations				Indicator 5 Incidence of TB in UK born children aged under fifteen years	
	n	Rate (95%CI)	Non UK Born		UK Born		n	Rate (95%CI)
			n	Rate (95%CI)	n	Rate (95%CI)		
2004	535	10.6(9.7 - 11.5)	330	110.4(98.8 - 122.9)	194	4.1(3.6 - 4.8)	36	3.9(2.7 - 5.4)
2005	556	10.9(10.0 - 11.8)	341	107.9(96.8 - 120.0)	180	3.8(3.3 - 4.4)	40	4.3(3.1 - 5.9)
2006	661	12.9(11.9 - 13.9)	415	112.8(102.2 - 124.2)	172	3.7(3.1 - 4.3)	35	3.8(2.7 - 5.3)
2007	632	12.2(11.3 - 13.2)	356	97.3(87.4 - 107.9)	179	3.8(3.3 - 4.4)	42	4.6(3.3 - 6.2)
2008	635	12.2(11.3 - 13.2)	415	105.1(95.2 - 115.7)	174	3.7(3.2 - 4.3)	44	4.8(3.5 - 6.4)
2009	688	13.2(12.2 - 14.2)	406	100.7(91.2 - 111.0)	212	4.5(3.9 - 5.1)	41	4.4(3.2 - 6.0)
2010	628	11.9(11.0 - 12.9)	366	89.5(80.6 - 99.1)	190	4.0(3.4 - 4.6)	40	4.3(3.1 - 5.9)
2011	664	12.6(11.6 - 13.5)	389	90(81.3 - 99.5)	220	4.6(4.0 - 5.2)	62	6.6(5.1 - 8.5)
2012	592	11.1(10.3 - 12.1)	353	77.1(69.2 - 85.6)	189	3.9(3.4 - 4.6)	52	5.5(4.1 - 7.3)
2013	583	10.9(10.1 - 11.9)	360	77.8(69.9 - 86.2)	182	3.8(3.3 - 4.4)	52	5.5(4.1 - 7.2)
2014	516	9.6(8.8 - 10.5)	320	67.1(59.9 - 74.9)	171	3.5(3.0 - 4.1)	21	2.2(1.4 - 3.4)
2015	437	8.1(7.4 - 8.9)	293	61.6(54.7 - 69.0)	126	2.6(2.2 - 3.1)	26	2.7(1.8 - 4.0)
2016	425	7.8(7.1 - 8.6)	278	54.2(48.0 - 61.0)	126	2.6(2.2 - 3.1)	15	1.5(0.9 - 2.6)

Year	Number and proportion of pulmonary TB cases starting treatment within two months of symptom onset		Number and proportion of pulmonary TB cases starting treatment within four months of symptom onset		Number and proportion of pulmonary TB cases that were culture confirmed		Number and proportion of microbiologically confirmed cases with drug susceptibility testing reported for the four first line agents	
	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)
2004	80	35.2%(29.0 - 41.8)	160	70.5%(64.1 - 76.3)	221	71.5%(66.1 - 76.5)	307	99.7%(98.2 - 100.0)
2005	95	39.1%(32.9 - 45.5)	168	69.1%(62.9 - 74.9)	218	68.6%(63.1 - 73.6)	338	99.7%(98.4 - 100.0)
2006	131	48.5%(42.4 - 54.7)	204	75.6%(70.0 - 80.6)	250	67.2%(62.2 - 72.0)	391	99.2%(97.8 - 99.8)
2007	115	47.3%(40.9 - 53.9)	175	72.0%(65.9 - 77.6)	245	65.7%(60.6 - 70.5)	372	97.4%(95.2 - 98.7)
2008	91	39.1%(32.8 - 45.6)	174	74.7%(68.6 - 80.1)	213	63.4%(58.0 - 68.6)	344	96.4%(93.9 - 98.0)
2009	114	44.4%(38.2 - 50.7)	192	74.7%(68.9 - 79.9)	263	66.8%(61.9 - 71.4)	390	97.5%(95.5 - 98.8)
2010	106	42.2%(36.0 - 48.6)	187	74.5%(68.6 - 79.8)	255	67.1%(62.1 - 71.8)	357	98.3%(96.4 - 99.4)
2011	104	38.5%(32.7 - 44.6)	190	70.4%(64.5 - 75.8)	248	65.4%(60.4 - 70.2)	377	99.5%(98.1 - 99.9)
2012	107	43.0%(36.7 - 49.4)	180	72.3%(66.3 - 77.8)	222	67.5%(62.1 - 72.5)	333	96.5%(94.0 - 98.2)
2013	104	40.8%(34.7 - 47.1)	193	75.7%(69.9 - 80.8)	229	68.8%(63.5 - 73.7)	353	96.7%(94.3 - 98.3)
2014	97	40.9%(34.6 - 47.5)	169	71.3%(65.1 - 77.0)	218	74.7%(69.3 - 79.5)	316	97.2%(94.8 - 98.7)
2015	100	44.8%(38.2 - 51.6)	170	76.2%(70.1 - 81.7)	183	71.5%(65.5 - 76.9)	260	97.4%(94.7 - 98.9)
2016	87	40.7%(34.0 - 47.6)	152	71.0%(64.5 - 77.0)	205	84.7%(79.6 - 89.0)	298	97.7%(95.3 - 99.1)

Tuberculosis in Yorkshire and Humber (2016)

Year	Indicator 10		Indicator 11		Indicator 12	
	Number and proportion of drug sensitive TB cases who had completed a full course of treatment by 12 months * Excludes CNS Miliary and cryptic TB		Number and proportion of drug sensitive TB cases who were lost to follow-up at last reported outcome *Includes CNS Miliary and cryptic TB		Number and proportion of drug sensitive TB cases who had died at last reported outcome	
	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)
2004	303	62.5%(58.0 - 62.6)	17	3.2%(1.9 - 3.4)	36	6.8%(4.8 - 7.8)
2005	354	71.5%(67.3 - 71.6)	31	5.7%(3.9 - 5.8)	38	6.9%(5.0 - 7.8)
2006	420	72.4%(68.6 - 72.5)	39	5.9%(4.3 - 6.0)	43	6.6%(4.8 - 7.4)
2007	405	70.9%(67.0 - 71.0)	45	7.2%(5.3 - 7.3)	41	6.5%(4.7 - 7.4)
2008	435	76.2%(72.5 - 76.3)	44	6.8%(5.0 - 6.9)	40	6.3%(4.6 - 7.1)
2009	468	77.2%(73.7 - 77.3)	48	6.9%(5.1 - 7.0)	43	6.3%(4.6 - 7.1)
2010	428	75.8%(72.0 - 75.8)	40	6.3%(4.5 - 6.4)	46	7.4%(5.5 - 8.3)
2011	431	72.9%(69.2 - 73.0)	52	7.8%(5.8 - 7.9)	46	7.0%(5.2 - 7.8)
2012	440	82.2%(78.7 - 82.3)	28	4.3%(2.8 - 4.4)	31	5.3%(3.6 - 6.1)
2013	458	86.6%(83.4 - 86.6)	28	4.8%(3.2 - 5.0)	29	5.0%(3.4 - 5.8)
2014	401	85.0%(81.4 - 85.0)	16	3.1%(1.8 - 3.3)	31	6.1%(4.2 - 7.0)
2015	322	84.3%(80.2 - 84.4)	18	4.2%(2.5 - 4.4)	21	5.0%(3.1 - 5.9)
2016	-	-	-	-	-	-

Year	Indicator 13		Indicator 14		Indicator 15	
	Number and proportion of TB cases with rifampicin resistance or MDR-TB who had completed treatment at 24 months		Number and proportion of TB cases with rifampicin resistance or MDR-TB who were lost to follow-up at last reported outcome		Number and proportion of TB cases with rifampicin resistance or MDR-TB who had died at last reported outcome	
	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)
2004	3	42.9%(36.4 - 50.0)	1	11.1%(7.4 - 18.0)	0	0.0%(0.0 - 7.4)
2005	3	50.0%(42.1 - 57.9)	1	12.5%(8.3 - 20.1)	0	0.0%(0.0 - 8.3)
2006	4	80.0%(68.6 - 87.1)	0	0.0%(0.0 - 12.9)	0	0.0%(0.0 - 12.9)
2007	2	50.0%(38.6 - 61.4)	0	0.0%(0.0 - 15.9)	0	0.0%(0.0 - 15.9)
2008	3	100.0%(79.4 - 100.0)	0	0.0%(0.0 - 20.6)	0	0.0%(0.0 - 20.6)
2009	1	33.3%(20.6 - 50.0)	1	25.0%(15.9 - 38.6)	1	25.0%(15.9 - 38.6)
2010	5	71.4%(63.6 - 77.2)	0	0.0%(0.0 - 9.4)	0	0.0%(0.0 - 9.4)
2011	2	50.0%(38.6 - 61.4)	3	42.9%(36.4 - 50.0)	1	14.3%(9.4 - 22.8)
2012	5	100.0%(87.1 - 100.0)	0	0.0%(0.0 - 9.4)	1	14.3%(9.4 - 22.8)
2013	3	75.0%(61.4 - 84.1)	1	20.0%(12.9 - 31.4)	1	20.0%(12.9 - 31.4)
2014	2	40.0%(31.4 - 50.0)	1	12.5%(8.3 - 20.1)	1	12.5%(8.3 - 20.1)
2015	-	-	-	-	-	-
2016	-	-	-	-	-	-

Tuberculosis in Yorkshire and Humber (2016)

Year	Indicator 16		Indicator 17		Indicator 18		Indicator 19	
	Number and proportion of TB cases offered an HIV test*where HIV status not known		Number and proportion of drug sensitive TB cases with at least one social risk factor who completed treatment within 12 months		Number and proportion of culture confirmed TB cases with any first line drug resistance		Number and proportion of culture confirmed TB cases with multi-drug resistance TB	
	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)	n	Proportion(95%CI)
2004	-	-	-	-	26	8.4%(7.8 - 8.6)	9	2.9%(2.5 - 3.2)
2005	-	-	-	-	31	9.1%(8.5 - 9.3)	6	1.8%(1.5 - 2.0)
2006	-	-	-	-	27	6.9%(6.4 - 7.0)	5	1.3%(1.0 - 1.5)
2007	-	-	-	-	21	5.6%(5.1 - 5.7)	3	0.8%(0.6 - 1.0)
2008	-	-	-	-	15	4.3%(3.9 - 4.5)	2	0.6%(0.4 - 0.8)
2009	-	-	-	-	19	4.8%(4.3 - 4.9)	3	0.8%(0.5 - 0.9)
2010	-	-	24	61.5%(60.2 - 62.7)	18	5.0%(4.5 - 5.2)	7	1.9%(1.6 - 2.2)
2011	-	-	22	61.1%(59.6 - 62.4)	30	7.9%(7.4 - 8.1)	6	1.6%(1.3 - 1.8)
2012	75	12.9%(12.9 - 13.0)	26	74.3%(72.6 - 75.5)	21	6.2%(5.7 - 6.4)	4	1.2%(0.9 - 1.4)
2013	265	48.0%(47.9 - 48.1)	23	65.7%(64.1 - 67.0)	19	5.3%(4.8 - 5.5)	5	1.4%(1.1 - 1.6)
2014	303	62.9%(62.8 - 63.0)	34	81.0%(79.5 - 81.9)	18	5.6%(5.1 - 5.8)	8	2.5%(2.1 - 2.7)
2015	311	77.6%(77.4 - 77.7)	28	75.7%(74.1 - 76.8)	26	9.7%(9.0 - 10.0)	9	3.4%(2.9 - 3.7)
2016	333	82.6%(82.5 - 82.7)	-	-	27	8.9%(8.3 - 9.1)	4	1.3%(1.0 - 1.6)

**Where it is not recorded whether a case was offered a HIV test or not these have been included in the denominator as not offered.

