Public Health England

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Tuberculosis in the West Midlands: Annual review (2015 data)

Data from 2000 to 2015

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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 field of TB control or the health of at-risk populations, researchers with an interest in TB, and government and non-governmental organisations working in the field of TB. In particular we aim to update the West Midlands TB Control Board and local TB networks.

Data sources

This report presents detailed information on TB case notifications made to the Enhanced Tuberculosis Surveillance system (ETS) in the West Midlands to the end of 2015. 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 sources

The Tuberculosis in England 2016 report: presenting data to the end of 2015 and accompanying slide set are available at https://www.gov.uk/government/publications/tuberculosis-in-england-annual-report.

Additional high-level data on TB notifications in the UK to the end of 2015, 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 and are available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf.

TB indicators are presented at Upper Tier Local Authority and Clinical Commissioning Group level at http://fingertips.phe.org.uk/profile/tb-monitoring. Hyperlinks (presented in red boxes) for specific indicators are also shown throughout this report where data are presented.

Executive summary

Short lay summary

Over 700 new cases of TB were diagnosed in the West Midlands in 2015, making it the region with the highest rate outside of London. TB is a serious, potentially fatal, disease that requires prolonged and complex treatment and is also an infection risk to close contacts, posing a significant burden on the patient, family and NHS.

After rising over the period from 1994 to 2012, the TB rate in the West Midlands declined for the third year in a row in 2015. This suggests that the local and national actions developed in line with the national TB strategy are having a beneficial effect and should continue to be supported. Although significant progress has been made in many areas, some require further improvement, including action to reduce the delay between symptom onset and starting treatment, and action to reduce the proportion of cases without laboratory confirmation of TB. Reducing the burden of disease now will also reduce the future burden through the prevention of later re-activation for cases and the prevention of secondary spread to others.

Substantial inequalities in the burden of TB remain by ethnic group, in those born abroad and in socially excluded groups (such as the homeless, prisoners and drug/alcohol misusers) which continue to pose a challenge for prevention and treatment services to meet.

Key findings

In 2015, 708 new cases of tuberculosis (TB) were notified among West Midlands residents; a rate of 12.3 per 100,000 population. This was a 9% decrease from the rate observed in 2014 and a 35% decrease from 2012. The rate and the number of cases in the West Midlands remained the second highest in England.

The highest numbers and rates of TB were seen in Sandwell, Coventry, Wolverhampton and Birmingham upper tier local authorities (UTLAs), all of which had rates significantly higher than the West Midlands average. As in recent years, the lowest burden areas were Herefordshire and Shropshire. All UTLAs except Sandwell, Dudley and Staffordshire showed a decrease compared to 2015.

In line with previous years, the age group with the highest rate was those aged 30 to 39 years (23.5 per 100,000); while those aged less than 10 years have consistently had the

lowest burden of TB. The majority of TB cases were male (57%), with rates also significantly higher in males compared to females (14.1 versus 10.5 per 100,000).

The majority of cases in the West Midlands were born outside of the UK (64%) and the rate in this population was more than twelve times higher than the rate in the UK born population (62.3 versus 5.0 per 100,000). Despite this, the rate in foreign-born cases has declined by almost a half since 2012 (117.2 per 100,000). India remained the most common country of birth for TB cases in the West Midlands. However, the number of cases from this country has shown a year on year decrease since 2012.

In recent years, the overall decline in numbers in the foreign-born population has been largely due to fewer cases notified in newer migrants (in particular, those notified within five years of entering the UK). However, in 2015 the greatest reduction in cases was seen in those notified within six to ten years of entering the country. The proportion of newer migrants remained steady compared to the previous year.

For the non-UK born population, the highest number of cases and highest rate occurred in the Indian ethnic group (174 cases; 149.8 per 100,000). For the UK born population, the majority of cases were White (146 cases; 3.3 per 100,000). However, the highest rate was seen in the Black-Caribbean ethnic group (32.1 per 100,000). In recent years, the Black-African ethnic group has consistently had the highest rate compared to all other groups in the West Midlands. However, since 2003 this rate has seen a dramatic decline, falling from 466.0 in 2003 to 82.4 per 100,000 in 2015.

Just over half of cases in the West Midlands had pulmonary TB, of which 28% were sputum smear positive. A higher proportion of UK born cases had pulmonary TB compared to non-UK born cases (69% versus 52%). In 2015, one in ten cases had a previous history of TB.

Fifty-seven percent of cases notified in 2015 were culture confirmed; an increase compared to 2014 but lower than the national average (60%). A higher proportion of pulmonary cases (with or without extra-pulmonary disease) were cultured confirmed compared to cases with extra-pulmonary disease only (67% versus 44%). Further action to ensure that appropriate samples are taken by clinicians wherever possible and that appropriate testing is performed by laboratories will allow the maximal benefit to be obtained from the introduction of new technologies both for patients and the public health.

Between 2010 and 2015, 88% of culture confirmed cases in the West Midlands had an isolate with at least 23 loci typed using 24 loci Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats (MIRU-VNTR). Of these cases, just under half (49%) were identified as being clustered with one or more residents in the West

Midlands. Over this time period, 295 molecular clusters were identified; the majority of these were small with just over half consisting of only two cases. In 2015, almost three-quarters of cases with at least one social risk factor clustered with at least one other case in the West Midlands, compared with only 46% of cases with no social risk factors.

Among those with pulmonary TB, the median time between onset of symptoms and treatment start was 78 days; similar to the previous year but higher than the national average (72 days). In 2015, only 40% of pulmonary cases began treatment within two months of symptom onset and the proportion of cases with a delay of greater than four months has increased by 6% since 2011. Action to raise awareness of TB among healthcare workers and the public can be aided by utilising the resources available from TB Alert and the Royal College of General Practitioners.

Of rifampicin sensitive cases without central nervous system (CNS), spinal, miliary or cryptic disseminated disease notified in 2014, 83% completed treatment within 12 months; a decrease compared to the previous year. The most common reason for not completing treatment was death (7%) followed by lost to follow up (4%). As in recent years, the proportion of cases completing treatment within 12 months decreased with age, with only two-thirds of cases aged over 65 completing. Those with extra-pulmonary disease only had a higher completion rate compared to those with pulmonary TB. For cases with CNS, spinal, miliary or cryptic disseminated disease, 79% completed treatment at their last reported outcome and 11% of cases died.

In 2015, 8% of cases with drug susceptibility testing results were resistant to at least one first line antibiotic, an increase of 3% compared to 2014. Two percent of cases had multi-drug resistant/rifampicin resistant TB (MDR/RR-TB), almost three times greater than the previous year but lower than 2013. All cases of MDR/RR-TB were born outside of the UK; the majority were male and most were in the 15 to 44 age group. A much higher proportion of cases that had a previous history of TB had MDR/RR-TB compared to those with no history of TB (9% versus 1%). Only half of cases in 2013 completed treatment at 24 months and 36% were still on treatment. There was one case of extensively-drug resistant TB (XDR-TB) reported in the West Midlands in 2015, the second case reported since 2000. This case was born outside of the UK, aged 15 to 44 years and had pulmonary TB.

Those in under-served-populations (which include migrants, refugees, asylum seekers and those with social risk factors) are at higher risk of acquiring tuberculosis. TB control in this group of individuals has become one of the priority areas of focus across England. In the West Midlands, the proportion of cases with at least one social risk factor is increasing; 13% of cases in 2015 had at least one social risk factor (SRF). The proportion of cases with social risk factors has shown a general increase since 2010, showing greater efforts are needed to control TB in this population. The majority of

cases with SRFs were male and aged between 15 and 44 years. Sixty-two percent of cases with SRFs were UK born and in this population the majority of cases were white. In 2015, 45% of cases with SRFs had between two and four risk factors, a considerable increase from only 21% in 2010. Four cases in 2015 reported having all four social risk factors (homelessness, imprisonment, drug use and alcohol misuse); the highest proportion in the West Midlands in recent years. Those with social risk factors are more likely to have a delayed diagnosis (increasing the risk to other vulnerable people) and are also less likely to be reported as successfully completing TB treatment, with a higher proportion reported as having died and of being lost to follow up. TB services should use the resources and guidance available that specifically target these harder-to-reach groups. In 2015, 44% of TB cases were resident in areas considered to be the most deprived in the West Midlands compared to 8% who were resident in the least deprived areas.

HIV testing being both offered and accepted has increased year on year since 2012, with the proportion being 91% in 2015. In 2014, the West Midlands had the lowest proportion of cases with TB-HIV coinfection in England (2%); a reduction compared to the previous year (3%). Sixteen percent of cases received Directly Observed Therapy (DOT) and 23% of cases had an inpatient stay at some point during their treatment.

The continued reduction in the numbers and rates in 2015, both in the West Midlands and England, is encouraging. However rates still remain high compared to other countries in Western Europe. The year-on-year decrease in the non-UK born population is likely to reflect the lowering burden of TB in other parts of the world and the implementation of pre-entry screening. In 2015, 382 cases of active TB attempting to visit the UK were identified under this programme, thus showing how successful it is in preventing transmission in the UK. Introduction of screening for latent TB for new entrants, already underway in some areas, will further reduce this key health inequality.

To sustain and strengthen TB control in the West Midlands, locally driven reviews of delays in treatment, outcomes and contact tracing should continue to take place. By using standardised performance indicators across services in Cohort Reviews it will be possible to identify common issues and best practice both locally and as a region. In 2015, there was an increase in the proportion of cases with drug resistant TB; these reviews are a forum to discuss how to provide these more complex cases with the most effective and efficient treatments.

A third of pulmonary cases were not culture confirmed in 2015. Samples should be taken wherever possible to ensure each case has drug susceptibility testing. This will then provide early detection of any drug resistance and allow each patient to receive the appropriate treatment as soon as possible. As we move on to Whole Genome Sequencing, we need to ensure maximum use of these quality diagnostic technologies.

Introduction

This report describes the recent epidemiology of TB in the West Midlands. It provides an update for all those who contribute to the work of managing TB, including health protection teams, the TB Control Board, local TB networks, clinical commissioning groups and local authorities. The content of this report summarises trends in numbers and rates since 2000, identifies areas where there is a high burden of disease and describe populations who are at higher risk as well as opportunities for interventions and prevention of future cases.

This report can be used to help local teams plan and evaluate their services and identify how the epidemiology of TB in the West Midlands is changing over time and to design strategies for increasing TB detection and reducing transmission.

The report uses data from the national Enhanced Tuberculosis Surveillance (ETS) System, which includes notification, demographic, clinical and microbiological information, including drug resistance and strain typing provided by the PHE Regional Centre for Mycobacteriology. In addition, more detailed information on the epidemiology of TB, such as risk factors, occupation, travel information, co-morbidities and smoking is collected. Other aspects of epidemiology of TB in the West Midlands covered in this report include overall numbers and rates, transmission of TB, delays in commencement of treatment, outcomes, clustering, drug resistance and HIV testing.

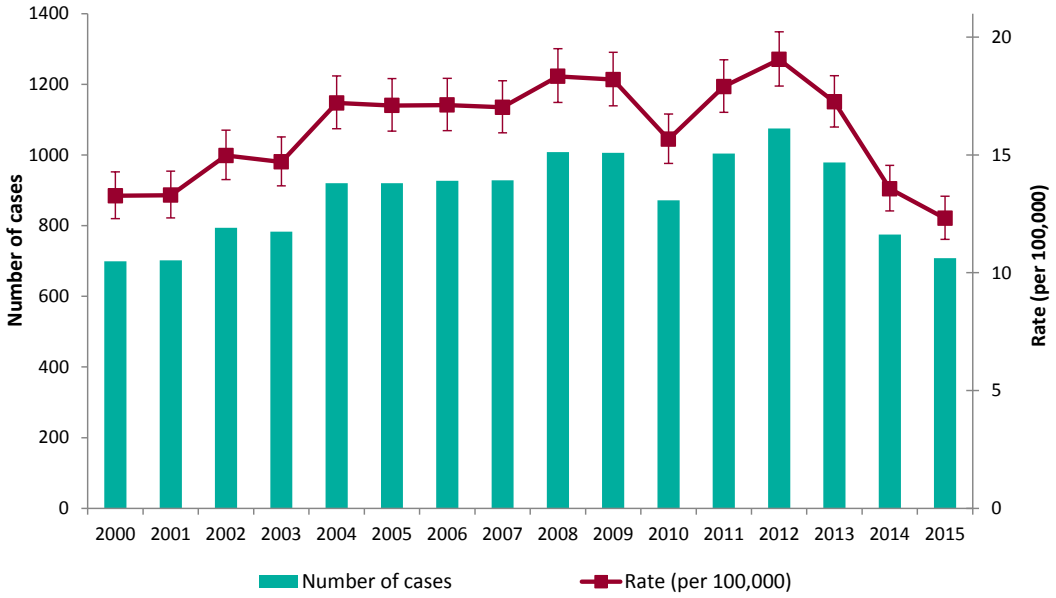
TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2015, 708 cases of tuberculosis (TB) were notified in the West Midlands; a rate of 12.3 per 100,000 population (95% confidence interval (CI) 11.4-13.3). This is a 35.4% decrease compared to the rate in 2012, which peaked after seeing a general increase in incidence in the ten years prior to this (Figure 1). Since this peak there has been a year on year decline in the both numbers and rates. The rate of TB in the West Midlands is significantly higher than the national rate of 10.5 per 100,000 (95% CI 10.2-10.8); despite this, the trends are reflective of TB incidence in England which showed an overall decrease of 32.7% compared to the rate in 2011 [1].

In line with previous years, the West Midlands accounted for the second highest proportion of cases in England (12.3%, 708/5,758); with the highest proportion being in London residents (39.4%, 2,269/5,758). Historically, there has been little change in the local authorities with the highest burden of TB in the West Midlands. In 2015, the upper tier local authorities (UTLAs) with the highest rates of TB were Sandwell (30.4 per 100,000), Coventry (25.5), Wolverhampton (23.2) and Birmingham (22.8) (Table Bii).

Figure 1: TB case reports and rates, West Midlands, 2000-2015

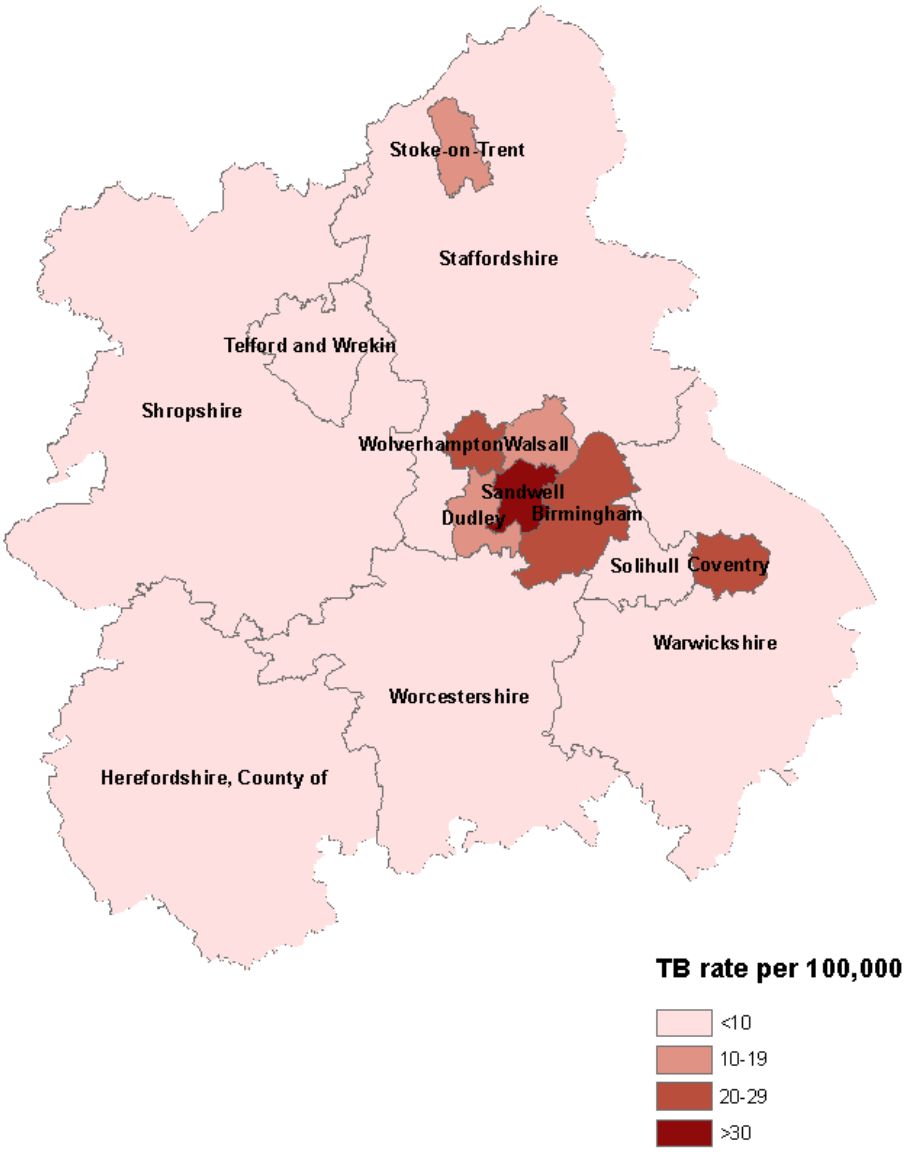


TB Monitoring Indicator 1: Overall TB incidence per 100,000 population (England & PHEC)

In 2015, as in previous years, the lowest burden areas were Herefordshire (1.6 per 100,000), Shropshire (2.2) and Telford & Wrekin (2.9). The remaining UTLAs ranged fairly evenly between 3.5 and 12.0 per 100,000.

Warwickshire saw the greatest decline in rates compared to 2014, falling from 9.8 to 4.5 per 100,000 in 2015. Three UTLAs showed an increase compared to 2014; these were Staffordshire, Dudley and Sandwell (rising by 68.8%, 52.1% and 24.9% respectively). All other UTLAs saw a decrease compared to the previous year.

Figure 2: TB case rates by upper tier local authority of residence, West Midlands, 2015



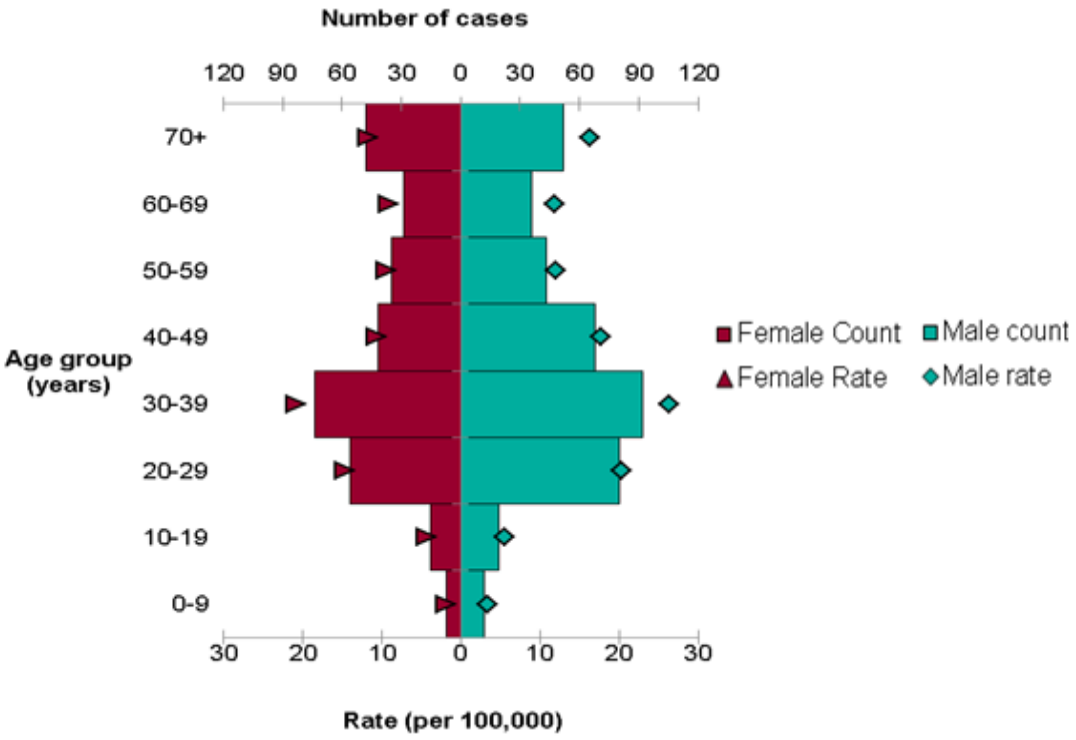
Demographic characteristics

Age and sex

In 2015, 56.8% (402/708) of all cases were male and the male rate was significantly higher than the female rate (14.1 versus 10.5 per 100,000); despite this, the incidence rate in males has decreased by 35.0% since 2012 (21.8 per 100,000). For both genders, the age group with the highest rate was those aged 30 to 39 years; in males, this age group had a rate of 26.2 per 100,000 and in females 20.9 per 100,000 (Figure 3, Table Bv). In 2015, in line with recent years, TB rates were lowest in children aged zero to nine years with a rate of 2.6 per 100,000, followed by those aged 10 to 19 years (5.0 per 100,000) (Figure 4).

Compared to 2014, all age groups either remained the same or showed a decrease in rates; the largest decrease being in those aged 50 to 59 with a reduction of 19.8% (2014: 13.3 versus 2015: 10.7 per 100,000).

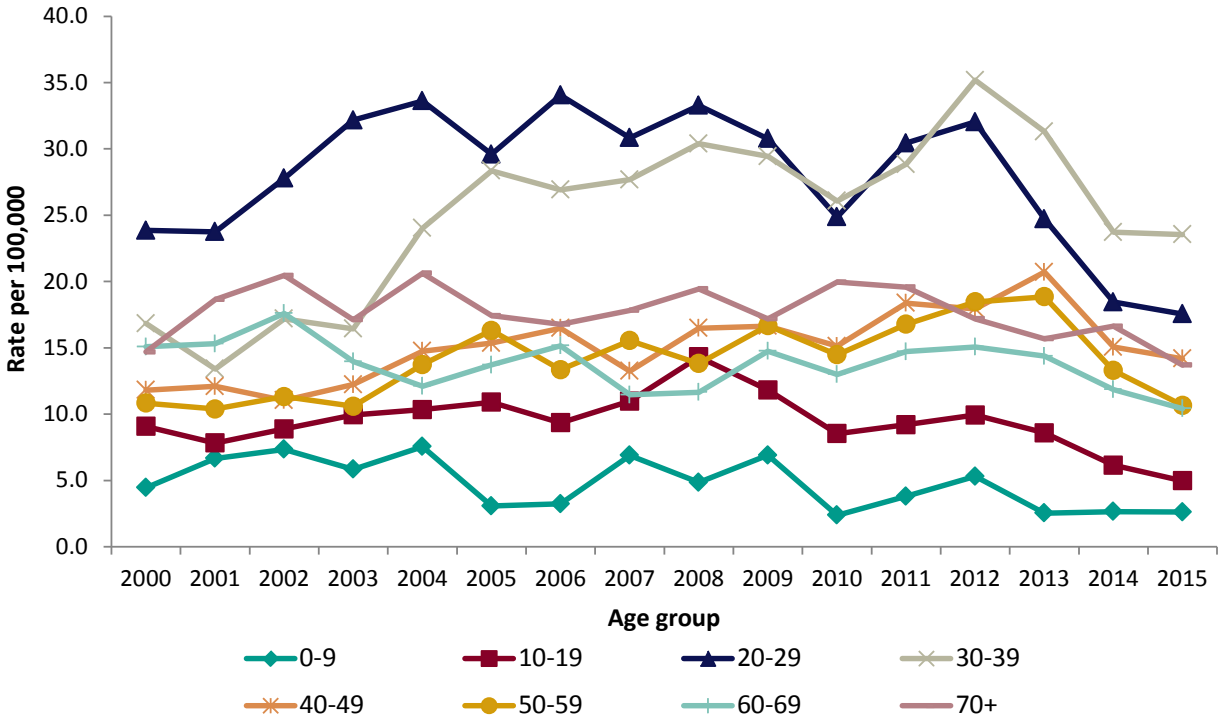
Figure 3: TB case reports and rates by age and sex, West Midlands, 2015



In 2015, 29 children aged less than 15 years were reported to have TB in the West Midlands; a rate of 2.7 per 100,000. This is higher than in 2014 (2.5 per 100,000) but still low compared to previous years. Thirteen children aged less than five years of age were notified in 2015, a rate of 3.6 per 100,000; this is an increase compared to the

previous year (3.3 per 100,000) but a large decrease compared to 2012 (-41.5%; 6.1 per 100,000).

Figure 4: TB case rates by age group, West Midlands, 2000-2015



Place of birth and time since entry

In 2015, place of birth (UK born/non-UK born) was known for 96.5% (683/708) of cases in the West Midlands; 63.5% (434/683) of these cases were born outside of the UK. The proportion born outside of the UK is lower than it was in 2014 (65.2%) and below the national proportion (72.5%). Place of birth varied by area; the UTLAs[1] with the highest proportion of cases that were non-UK born were Sandwell (73.2%), Wolverhampton (72.9%) and Warwickshire (70.8%). The UTLAs[1] with the highest proportion of UK born cases were Staffordshire (60.5%) and Dudley (56.3%).

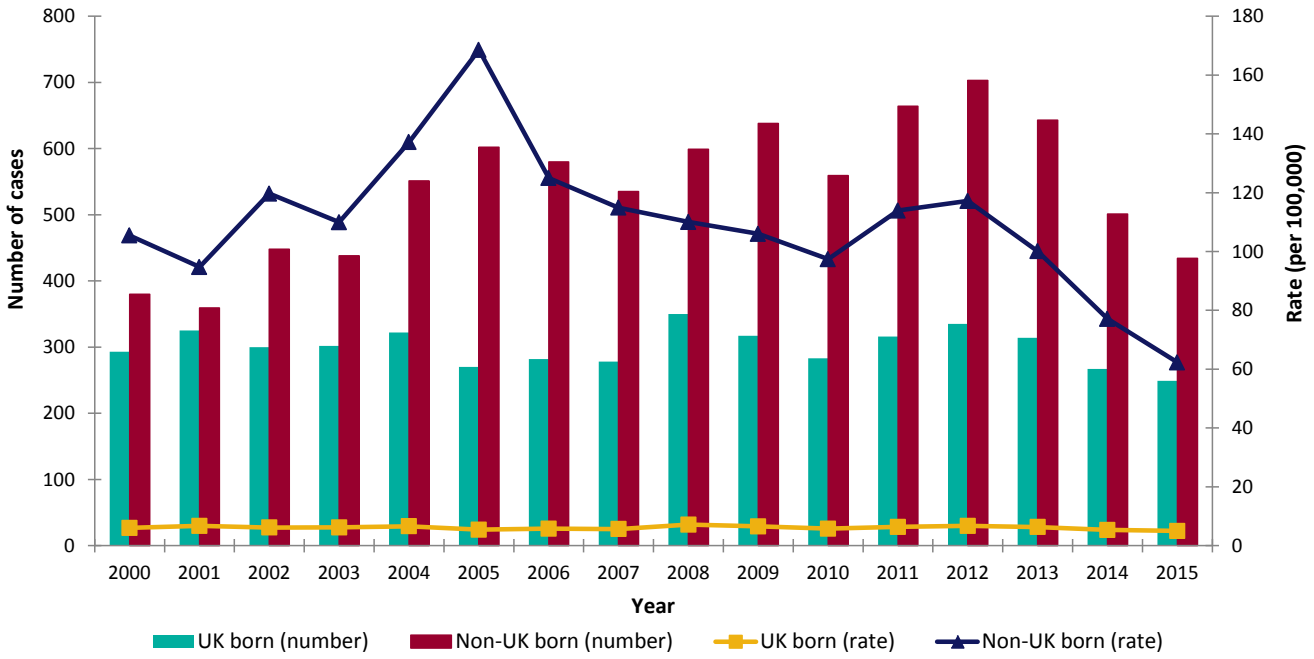
In line with national trends, the rate of TB in the non-UK born population is considerably higher compared with the rates in those born in the UK. In 2015, the rate in the foreign-born population was over twelve times higher than that in the UK born population. Despite this, both groups have seen a year on year decline in numbers since 2012 and the rates are at their lowest level since 2000. In 2015, the rate of TB in the non-UK born population was 62.3 per 100,000 (95% CI 56.6-68.5); this is a 19.1% decrease

[1] with greater than ten cases in 2015

compared to the previous year (77.1) and a 46.8% decrease compared to a peak in 2012 (117.2) (Figure 5, Table Bvi).

In 2015, the rate in the UK born population was 5.0 per 100,000 (95% CI 4.4-5.7), a reduction of 6.7% compared to 2014 (5.4) and 25.8% compared to 2012 (6.7). The rates for both the UK born and non-UK born populations in the West Midlands were higher than the national rates for these groups (UK born: 3.4 and non-UK born: 51.2 per 100,000).

Figure 5: TB case reports and rates by place of birth, West Midlands, 2000-2015



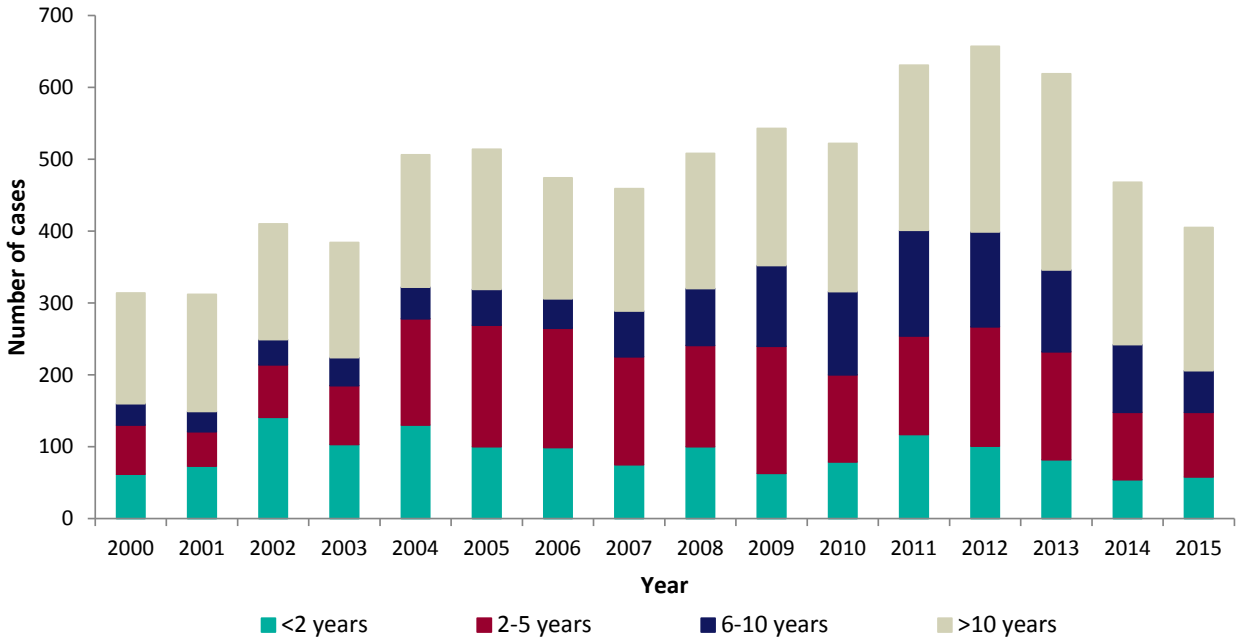
TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations (England)

The time between entry to the UK and TB notification was known for 93.3% (405/434) of non-UK born cases in the West Midlands. Of these, 14.3% (58/405) were diagnosed within two years of entering the UK, 22.2% (90/405) between two and five years, 14.3% (58/405) between six and ten years and 49.1% (199/405) greater than ten years (Figure 6).

In recent years, the overall reduction in the number of TB cases in the non-UK born population has occurred due to a decline in TB notifications in newer migrants. In 2015 however, those being notified within six to ten years of entry showed the greatest decrease in numbers (-38.3%; 2014: 94 cases, 2015: 58 cases), followed by those in greater than ten years (-11.9%). However, the proportion of non-UK born cases

diagnosed within five years remains much lower than the proportion diagnosed in greater than five years (36.5% versus 63.5%).

Figure 6: Time between entry to the UK and TB notification for non-UK born cases, West Midlands, 2000-2015



Country of birth was known for 100% (434/434) of non-UK born cases notified in 2015. As in previous years, India and Pakistan were the most common countries of birth for foreign-born cases notified in the West Midlands (39.2%, 170/434 and 22.6%, 98/434 respectively) (Table 1). These proportions were higher than the national average (India: 26.3% and Pakistan: 15.9%). Of the countries with greater than ten cases in 2015, Bangladeshi born cases saw the largest increase in notifications compared to 2014 (52.9%; 2014: 17 cases; 2015: 26 cases). The largest decrease in notifications was in the Romanian born population with a decline of 26.7% (2014:15 cases; 2015: 11 cases).

Table 1: The ten most common countries of birth of non-UK born TB cases, West Midlands, 2015

	n	% of non-UK born cases	Median time since UK entry (years) (IQR)	
India	170	39.2	14.0	(4-42)
Pakistan	98	22.6	11.5	(4-27)
Bangladesh	26	6.0	8.0	(2-15)
Zimbabwe	15	3.5	13.0	(11-14)
Eritrea	11	2.5	2.0	(0-6)
Romania	11	2.5	1.0	(0-4)
Poland	9	2.1	2.5	(1-9)
Somalia	9	2.1	12.0	(9-14)
Sudan	6	1.4	0.0	(0-1)
Nigeria	5	1.2	5.0	(2-6)

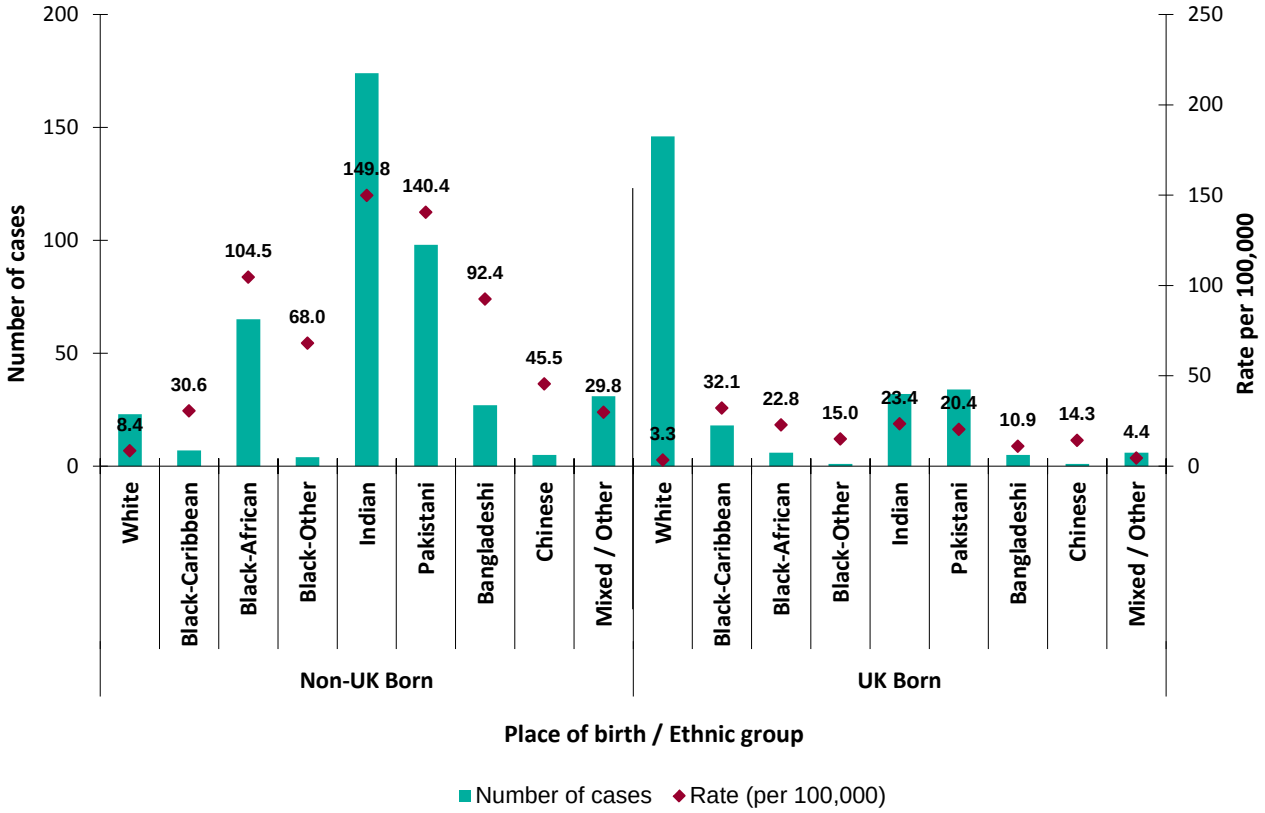
In 2015, cases born in Sudan had the shortest median time between entry to the UK and TB notification (less than one year; IQR: 0-1 years) (Table 1). Nationally, the countries of birth with lowest median time were Romania and Eritrea (both one year). In the West Midlands, the country of birth with the longest median time between entry to the UK and notification was India (14.0 years; IQR: 4-42 years).

Ethnicity

In 2015, ethnicity was known for 99.9% (707/708) of cases in the West Midlands. For the non-UK born population, 68.9% (299/434) of cases were from South Asian ethnic groups (Indian, Pakistani and Bangladeshi) (Figure 7); an increase compared to 2014 (65.2%, 326/500) and higher than the national average (49.4%). The highest rates in the non-UK born population were seen in the Indian, Pakistani and Black-African ethnicity groups (149.8, 140.4 and 104.5 per 100,000 respectively).

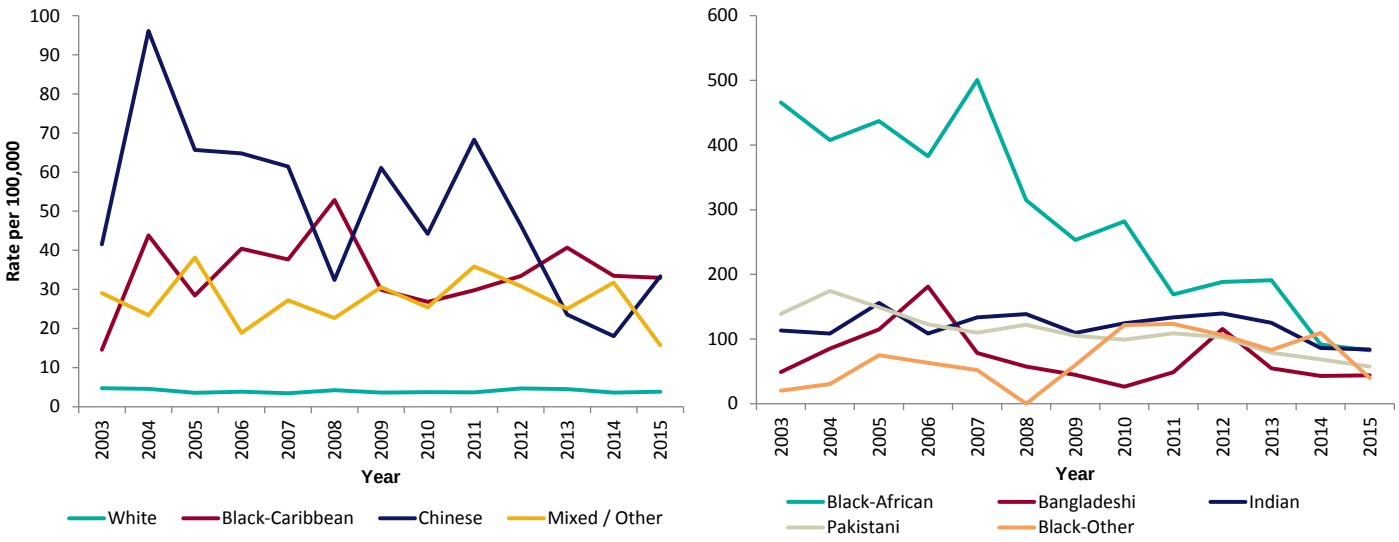
For the UK born population, the greatest proportion of cases were White (58.6%, 146/249) however the highest rates were seen in the Black-Caribbean (32.1 per 100,000), Indian (23.4) and Black-African (22.8) ethnic groups.

Figure 7: TB case notifications and rates by place of birth and ethnic group, West Midlands, 2015



In 2015, six of the nine ethnic groups showed a decrease compared to 2014; of those ethnic groups experiencing an increase, the largest increase was seen the Chinese ethnic group which increased by 85.0% (18.0 versus 33.3 per 100,000), followed by the White ethnic group (5.1%) and the Bangladeshi ethnic group (2.7%). The rate in the Black-African ethnic group has shown a dramatic decline in recent years despite it having the highest rate every year from 2003 to 2013. In 2015, the highest rate was in the Indian ethnic group (83.9 per 100,000).

Figure 8: Tuberculosis rates by ethnic group*, West Midlands, 2003-2015



*** Rates were calculated using estimations from the UK Data Service; denominator estimates for smaller populations varied considerably in some years. Please see Appendix A for more information on data sources. Note: the scales of the two graphs in Figure 8 differ**

Occupation

In 2015, occupational information was available for 94.5% (518/548) of cases aged 18 to 65 years. Of these, 45.0% (233/518) were not in education or employment, 8.7% (45/518) were either studying or working in education, 7.7% (40/518) were working in health care and 0.4% (2/518) were working in social services or prisons. The remainder of cases were classified as working in other occupations (38.2%, 198/518).

Table 2: Occupational category of cases aged 18 to 65 years by place of birth, West Midlands, 2015

	UK Born		Non-UK Born		Total*	
	n	%	n	%	n	%
None	71	42.8	159	46.5	233	45.0
Other	71	42.8	122	35.7	198	38.2
Education	15	9.0	28	8.2	45	8.7
Health care worker	8	4.8	32	9.4	40	7.7
Social service/prison worker	1	0.6	1	0.3	2	0.4
Total	**166**		**342**		**518**	

***includes cases where place of birth is unknown**

Clinical characteristics

Site of disease

In 2015, site of disease was known for 98.9% (700/708) of cases and 99.0% (701/708) of cases were known to have either pulmonary or extra-pulmonary disease. Where site of disease was known, 56.5% (396/701) had pulmonary TB (Table 3), greater than the national average of 53.4%. In the non-UK born population, just over half (51.5%, 221/429) of cases had extra-pulmonary disease only, however, for the UK born population the majority (69.2%, 171/247) had pulmonary TB (with or without extra pulmonary disease). Twenty-one percent (20.9%, 146/700) of cases had TB of the extra-thoracic lymph nodes and 13.1% (92/700) had TB of the intra-thoracic lymph nodes; similar proportions were seen in England overall (23.1% and 13.4% respectively). Eighteen percent (18.4%, 73/396) of cases with pulmonary disease were also reported to have extra-pulmonary disease in at least one other site.

Table 3: Site of disease of TB patients, West Midlands, 2015

	n	%**
Pulmonary*	396	56.5
Extra-thoracic lymph nodes	146	20.9
Intra-thoracic lymph nodes	92	13.1
Unknown extra-pulmonary	55	7.8
Other extra-pulmonary	51	7.3
Pleural	43	6.1
Gastrointestinal	39	5.6
Miliary	24	3.4
Bone - spine	19	2.7
CNS - meningitis	17	2.4
Genitourinary	15	2.1
Bone - other	10	1.4
CNS - other	6	0.9
Cryptic disseminated	4	0.6
Laryngeal	1	0.1

***with or without disease at another site**
****patients may have disease at more than one site, so the total % will not equal 100%**

Previous history of tuberculosis

Information on previous diagnosis of TB was available for 96.2% (681/708) of cases notified in 2015; of these, 9.5% (65/681) had a previous diagnosis of TB - greater than

the previous year (8.1%) and the national average (6.7%). Of the cases that were previously diagnosed with TB, 53.8% (35/65) were born outside of the UK. The median number of years since previous diagnosis for cases in 2015 was seven years. For those with a previous history of TB reported, information on previous treatment was known for 69.2% (45/65) of cases; of these 86.7% (39/45) were previously treated. Twenty-eight percent (27.7%, 18/65) of cases with a previous diagnosis of TB received Directly Observed Therapy (DOT) during their current notification of TB.

BCG vaccination

In 2015, information on BCG vaccination status was known for 75.4% (534/708) of cases; 59.0% (315/534) of these had previously received BCG vaccination. Sixty-two percent (61.5%, 8/13) of cases under the age of five and 70.6% (24/34) of cases under the age of 16 received BCG vaccination.

Table 4: Number and proportion of TB cases receiving BCG vaccination, West Midlands, 2015

	<5 years old			<16 years old			All ages		
	n	Total	%	n	Total	%	n	Total	%
Non-UK born	1	2	50.0	6	10	60.0	195	332	58.7
UK born	7	11	63.6	18	24	75.0	119	196	60.7
Country of birth unknown	0	0	-	0	0	-	1	6	16.67
All cases	**8**	**13**	**61.5**	**24**	**34**	**70.6**	**315**	**534**	**59.0**

Smoking status

Information on current smoking status at onset of symptoms, presentation or during care was collected for cases notified on or after 02 July 2015. There were 329 cases notified in the West Midlands from this date to the end of 2015. Information on smoking status was available for 73.3% (241/329) of which 12.0% (29/241) were current smokers; this was lower than the national average of 19.3%.

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

In 2015, 56.8% (402/708) of cases were culture confirmed, this is higher than 2014 (54.7%) but lower than the national average (60.1%) (Table Bvii). In 2015, a higher proportion of pulmonary cases were culture confirmed (67.4%, 267/396) (Table Bviii) compared to extra-pulmonary only cases (44.3%, 135/305). For both sites of disease culture confirmation was lower than the national average in 2015 (pulmonary: 72.7% and extra-pulmonary only: 45.9%).

Culture confirmation varied by upper tier local authority; the UTLAs[2] with the highest proportion of culture confirmed cases were Worcestershire (80.0%, 16/20) and Sandwell (60.8%, 59/97) (Table Bvii). The lowest proportion of culture confirmed cases was seen in Solihull (35.7%, 5/14) and Coventry (45.5%, 40/88).

In recent years, the proportion of cases that are cultured confirmed has been consistently lower in those aged 0 to 14 years compared to all other age groups. The average proportion between 2000 and 2015 for those aged under 15 years was 21.5%; 15 to 44 years: 62.7%; 45 to 64 years: 53.3%; aged over 65 years: 54.9%.

In 2015, 96.3% (387/402) of culture confirmed cases were identified with *Mycobacterium tuberculosis* (*M. tuberculosis*), 2.0% (8/402) with *Mycobacterium bovis* (*M.bovis)*, 1.0% (4/402) with *Mycobacterium tuberculosis complex* (MTBC; which were not further differentiated) and 0.7% (3/402) with *Mycobacterium africanum* (*M. africanum).* There were no cases of *Mycobacterium microti* (*M. microti*).

[2] with greater than ten cases in 2015

Sputum smear

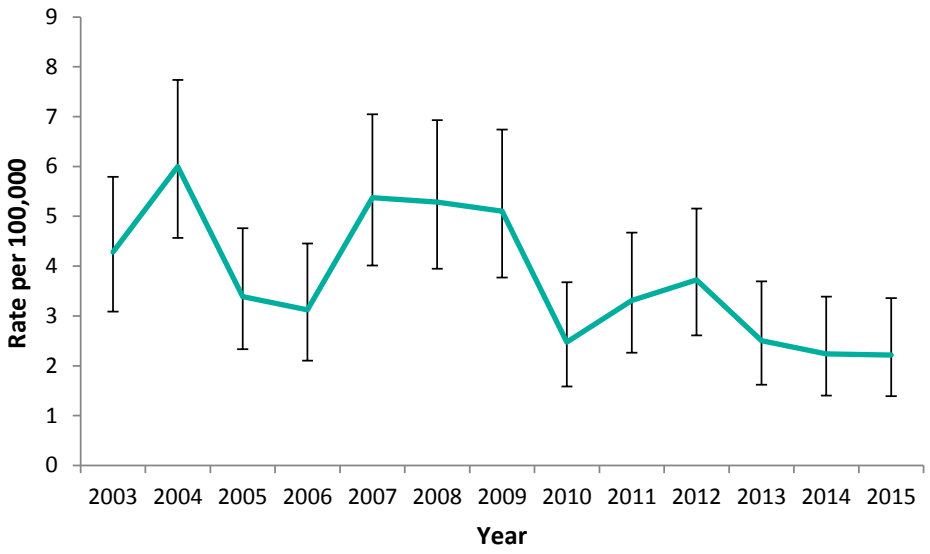
Of all pulmonary cases notified in 2015, 52.8% (209/396) had a sputum (microscopy) result reported; of these, just over half (52.6%, 110/209) were positive. This is similar to the national average of 52.4%. Of those with a positive sputum smear result, 97.3% (107/110) were also culture confirmed, higher than England overall (93.4%). Less than half (48.5%, 48/99) of sputum smear negative cases were culture confirmed; this is low compared to the England average of 63.4%. Nineteen percent (18.9%, 75/396) of pulmonary cases had no sputum smear result or culture confirmation.

TB transmission

Rate of TB in UK born children

In 2015, the rate of TB in UK born children (aged 0 to 14 years), an indirect indicator of recent transmission, was 2.2 per 100,000 (95% CI 1.4-3.4); this is unchanged from the previous year but higher than the national average (1.8 per 100,000). A peak in 2004 saw the rate in UK born children rise to 6.0 per 100,000, the rate in 2015 was 63.0% lower than this peak year.

Figure 9: Rate of TB in UK born children aged under 15 years, West Midlands, 2003-2015



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

Strain typing and clustering

The National TB Strain Typing Service in England, established in 2010, prospectively types TB isolates using MIRU-VNTR. Clusters of TB cases with indistinguishable MIRU-VNTR strain types (clustered cases) may reflect cases that are part of the same chain of transmission, but could also reflect common endemic strains circulating either within England or abroad. MIRU-VNTR strain typing can be used to refute transmission between individuals who have a different strain type, but a common strain type does not

confirm transmission; additional epidemiological information is required to assess whether a common strain type is likely to reflect recent transmission.

In 2015, 97.0% (390/402) of culture confirmed cases notified in the West Midlands had an isolate strain typed using MIRU-VNTR; of which, 87.9% (343/390) had at least 23 loci typed and 61.8% (241/390) had 24 loci typed. Overall, for culture confirmed cases notified between 2010 and 2015, 86.0% (2,611/3,037) of cases had strain typing completed for at least 23 loci (Table 5).

Table 5: Number and proportion of culture confirmed cases typed, or with 23 or 24 loci typed, West Midlands, 2010-2015

Year	Notified cases	Culture confirmed cases		Typed cases*		≥ 23 loci typed cases**		24 loci typed cases†	
	n	n	%	n	%	n	%	n	%
2010	872	524	60.1	501	95.6	407	81.2	327	65.3
2011	1,004	615	61.3	606	98.5	523	86.3	413	68.2
2012	1,075	590	54.9	579	98.1	506	87.4	418	72.2
2013	979	550	56.2	538	97.8	465	86.4	366	68.0
2014	775	424	54.7	423	99.8	367	86.8	272	64.3
2015	708	402	56.8	390	97.0	343	87.9	241	61.8
Total	**5,413**	**3,105**	**57.4**	**3,037**	**97.8**	**2,611**	**86.0**	**2,037**	**67.1**

***% typed is the proportion of culture confirmed cases which have at least one loci typed**
****% ≥23 loci is the proportion of culture confirmed cases which have had at least 23 loci typed**
†% 24 loci is the proportion of culture confirmed cases which had all 24 loci typed

Of culture confirmed cases with at least 23 loci typed notified between 2010 and 2015, almost half (49.0%, 1,280/2,611) were in 295 molecular clusters; the remaining 51.0% had a unique strain type. The majority (53.2%, 157/295) of molecular clusters consisted of two cases, 28.5% (84/295) had between three and five cases, 11.5% (34/295) had between five and nine cases and 6.8% (20/295) had a cluster size of ten or more cases. The median cluster size was two and the range was two to 89 cases. The proportion of individuals clustering with one other case increased in 2015 compared to the previous year (2015: 50.7%, 174/343; 2014: 44.7%, 164/367), however during 2010 to 2015 the proportion remained largely stable (range: 44.7%-53.0%).

Cluster lineage

In the time period between 2010 and 2015, 40.3% (516/1,280) of clustered cases were of Central Asian lineage (Table 6). Clusters of Euro-American lineage accounted for 29.5% (378/1,280) of cases, those with *M. Bovis, M. Africanum,* MTBC, multiple lineages and cases with unknown lineage accounted for 19.9% (255/1,280), followed by Beijing lineage

(6.6%, 85/1,280) and East African Indian lineage (3.6%, 46/1,280). The distribution of cluster size varied across lineage, the greatest proportion of the Beijing and Central Asian lineages consisted of clusters of greater than ten cases (51.8%, 44/85 and 45.5%, 235/516 respectively), the largest proportion of the East African Indian lineage consisted of clusters between five to nine cases (41.3%, 19/46) whereas for Euro-American lineage the largest proportion consisted of clusters with two cases (38.1%, 144/378).

Table 6: Cluster size and lineage, West Midlands, 2010-2015

Cluster size	Euro-American		Central Asian		East African Indian		Beijing		Other*		Total
	n	%	n	%	n	%	n	%	n	%	
2	144	38.1	106	20.5	16	34.8	14	16.5	34	13.3	314
3	67	17.7	36	7.0	3	6.5	6	7.1	41	16.1	153
4	44	11.6	52	10.1	8	17.4	16	18.8	12	4.7	132
5-9	51	13.5	87	16.9	19	41.3	5	5.9	43	16.9	205
>10	72	19.0	235	45.5	0	0.0	44	51.8	125	49.0	476
Total	**378**	**29.5**	**516**	**40.3**	**46**	**3.6**	**85**	**6.6**	**255**	**19.9**	**1,280**

***includes cases with *M. Bovis, M. Africanum,* MTBC, multiple lineages and cases with unknown lineage**

Characteristics of cases in clusters

Of the clustered cases notified between 2010 and 2015 in the West Midlands, 61.0% (781/1,280) were male and 63.9% (818/1,280) were aged between 15 and 44 years. Although 54.0% (677/1,253) of clustered cases were born outside of the UK, a higher proportion of UK born cases were clustered with at least one other case (69.2%, 576/832 versus 39.2%, 677/1,725). Of the non-UK born population that were clustered and time from entry to TB notification was known, the greatest proportion had been in the country for greater than ten years prior to diagnosis (40.8%, 264/647).

In the six year period between 2010 and 2015, the greatest proportion of clustered cases were in the Indian ethnic group (26.3%, 337/1,280), followed by those in the White ethnic group (25.3%, 324/1,280). Eighty percent (72/90) of culture confirmed cases in the Black-Caribbean ethnic group and 59.9% (324/541) in the White ethnic group were clustered with at least one other case.

Just under three quarters (74.6%, 220/295) of culture confirmed cases with at least one social risk factor (SRF; for the definition of a SRF see section Social Risk Factors) clustered with at least one other case, compared to only 45.8% (1,060/2,316) of cases with no social risk factors.

Just over three-quarters (75.9%, 971/1,280) of clustered cases had pulmonary TB (with or without extra pulmonary TB); of which 69.3% (419/605) were sputum smear positive. Eight percent (7.6%, 74/971) of clustered cases with pulmonary disease had a previous diagnosis of TB and 6.1% (59/971) had resistance to at least one first-line drug (isoniazid, rifampicin, pyrazinamide or ethambutol).

Delay from onset of symptoms to start of treatment

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

Information on time from symptom onset to treatment start was available for 86.9% (344/396) of pulmonary cases notified in 2015. Data completeness has improved greatly in recent years; the proportion of cases with an unknown onset of symptoms to treatment time has decreased considerably since 2000 (2000: 67.0%, 280/418; 2015: 13.1%, 52/396). The median time between symptom onset and treatment start date for pulmonary cases in 2015 was 78 days (IQR: 36-144 days); this was similar to 2014 (77 days; IQR: 38-144 days) but higher than the national average of 72 days (IQR: 36-132 days). Since 2011 there has been a year on year increase in the median time in the West Midlands (Table 7).

Only 40.1% (138/344) of pulmonary cases in 2015 began treatment within two months of symptom onset and 27.0% (93/344) between two and four months (Table 7); these proportions are both lower than the England average (42.8% and 29.4% respectively). Since 2011, the proportion of cases with a delay of four months from symptom onset to treatment start has increased, rising from 26.8% (126/471) to 32.8% (113/344) in 2015.

Table 7: Time between symptom onset and treatment start in pulmonary TB cases*, West Midlands, 2011-2015

Year	0-2 months		2-4 months		>4 months		Median days (IQR)	Total
	n	%	n	%	n	%		
2011	210	44.6	135	28.7	126	26.8	68 (32-131)	471
2012	200	42.0	138	29.0	138	29.0	70 (35-139)	476
2013	173	38.7	146	32.7	128	28.6	75 (38-136)	447
2014	155	41.8	97	26.1	119	32.1	77 (38-144)	371
2015	138	40.1	93	27.0	113	32.8	78 (36-144)	344

***excluding asymptomatic cases and those with missing onset dates.**

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

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

In 2015, delay from symptom onset to treatment varied by UTLA; the shortest delay[3] (the proportion of cases starting treatment within four months of symptom onset) was recorded in Staffordshire (77.8%, 14/18), followed by Coventry (70.7%, 29/41). Sandwell saw the longest delay with 42.0% (21/50) cases with a delay of greater than four months.

Characteristics of pulmonary TB cases with a delay from onset of symptoms to treatment start of greater than four months

In 2015, for those in age groups 15 to 44 years, 45 to 64 years and 65 years and over, the proportion of cases with a delay of greater than four months were relatively similar, ranging from 32.2% to 38.5%. For children aged less than 15 years, only 6.3% (1/16) had a delay of greater than four months from symptom onset to start of treatment.

A greater proportion of the UK born population had a delay of greater than four months compared to the non-UK born population (37.3%, 56/150 and 28.6%, 52/182 respectively). The ethnic group[4] with the greatest proportion of cases with a delay of greater than four months was the Black-African ethnic group (35.5%, 11/31).

[3] in UTLAs with greater than 15 cases with time from onset to treatment information available in 2015
[4] with greater than 15 cases with time from onset to treatment start information known in 2015

TB outcome in drug sensitive cohort

Drug sensitive cohort

For the purposes of TB outcome reporting the drug sensitive cohort excludes all TB cases with rifampicin resistant TB (initial or amplified) including MDR-TB (initial or amplified), and non-culture confirmed cases treated as MDR-TB [2]. Under this definition, cases with resistance to isoniazid, ethambutol and/or pyrazinamide but without resistance to rifampicin are included in the drug sensitive cohort. For TB outcomes in the drug resistant cohort, see pages 32-34.

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

1. For cases with an expected duration of treatment of less than 12 months, TB outcomes at 12 months are reported. This group excludes cases with 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.

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

In 2014, 775 cases were notified in the West Midlands, of which 99.1% (768/775) were sensitive to rifampicin and were therefore included in the drug sensitive cohort.

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

Of the cases included in the drug sensitive cohort, 90.1% (692/768) were classified as group 1 (ie had non-CNS, spinal, miliary or cryptic disseminated disease). Since 2000, there has been a general increase in the proportion of cases in this group completing treatment within 12 months. In 2014, 83.1% (575/692) of cases completed treatment within 12 months, a decrease compared to the previous year (85.8%, 735/857) but an 18.8% increase compared to 2002 (69.9%; Table 8). The proportion completing treatment within 12 months in the West Midlands in 2014 was below the England average (84.4%).

Table 8: Number and proportion of drug sensitive cases with expected treatment duration less than one year completing treatment at 12 months*, West Midlands, 2002-2014

Year	n	Total	% completed
2002	526	752	**69.9**
2003	514	733	**70.1**
2004	631	864	**73.0**
2005	570	830	**68.7**
2006	565	835	**67.7**
2007	672	871	**77.2**
2008	758	917	**82.7**
2009	743	908	**81.8**
2010	633	791	**80.0**
2011	723	891	**81.1**
2012	823	962	**85.6**
2013	735	857	**85.8**
2014	575	692	**83.1**

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

Information on TB outcome at 12 months was known for 99.6% (689/692) of cases notified in 2014. In addition to the 83.1% of cases completing treatment at 12 months, a further 3.0% (21/692) went on to complete at their last reported outcome; thus brining the overall treatment completion rate to 86.1% (596/692) for this cohort. The most common reason for not completing treatment was death (6.8%, 47/692) (Table 9, Table Bix). Of these cases, TB contributed to death in 21.3% (10/47), was incidental to death in 17.0% (8/47) and caused death in 10.6% (5/47).

In 2014, as in recent years, the proportion of cases completing treatment in 12 months decreased with age; from 96.0% (24/25) of those aged less than 15 years to 66.9% (91/136) in cases aged over 65 years. More than one in five cases aged over 65 years died (22.8%, 31/136). Treatment completion at 12 months was slightly higher in females compared to males (85.1%, 245/288 and 81.7%, 330/404 respectively).

Table 9: TB outcome at 12 months for drug sensitive cases expected to complete treatment within one year*, West Midlands, 2014

	n	%
Completed	575	83.1
Died	47	6.8
Lost to follow up	28	4.0
Still on treatment	27	3.9
Treatment stopped	12	1.7
Not evaluated**	3	0.4
Total	**692**	

***excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease**
****not evaluated includes missing or unknown outcomes and transferred out**

Treatment completion at 12 months was higher in those with extra-pulmonary disease compared to those with pulmonary TB (87.6%, 262/299 versus 79.5%, 310/390). Those diagnosed with gastrointestinal TB had the greatest proportion of cases[5] completing treatment within 12 months (89.3%, 25/28) followed by those with TB of the intra-thoracic lymph nodes (88.5%, 85/96).

Treatment completion varied by UTLA; Walsall saw the largest proportion of cases completing within 12 months (93.8%, 30/32) followed by Solihull (91.7%, 11/12). The UTLAs[6] with the lowest proportion of cases completing within 12 months were Coventry (75.3%, 58/77) and Stoke-on-Trent (76.9%, 20/26).

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

Information on the last recorded outcome was available for 100% (76/76) of drug sensitive cases with CNS, spinal, miliary or cryptic disseminated TB notified in 2014; of these 78.9% (60/76) completed treatment (Table 10, Table Bx). The proportion completing treatment in the West Midlands was higher than the national average of 67.2%.

Seven percent (6.6%, 5/76) of cases in 2014 were still on treatment at the last reported outcome; as there is a shorter follow-up period for cases notified in this year, a further proportion of these are expected to go on to complete treatment. Eight cases (10.5%)

[5] of sites of disease with greater than fifteen cases in 2015
[6] with greater than ten cases in 2015

died at the last reported outcome; of these, two cases (25%) died as a result of TB, TB contributed to the death of two cases (25%) and for one case (12.5%) TB was incidental to death.

Table 10: Last recorded outcome for cases with rifampicin sensitive, CNS, spinal, miliary or cryptic disseminated disease, West Midlands, 2014

	n	%
Completed	60	78.9
Died	8	10.5
Lost to follow up	2	2.6
Still on treatment	5	6.6
Treatment stopped	1	1.3
Not evaluated*	0	0.0
Total	**76**	

***not evaluated includes missing or unknown outcomes and transferred out**

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

In 2014, the proportion of cases reported to have died at the last reported outcome in the entire drug sensitive cohort showed an increase compared to 2013 (7.2%, 55/768 and 5.0%, 48/965 respectively). The cause of death and relation to TB was known for 50.9% (28/55) of cases who died in the entire drug sensitive cohort; for 42.9% (12/28) of these cases TB contributed to death, TB was incidental to death in 32.1% (9/28) and TB caused death in 25.0% (7/28). Eleven percent (10.9%, 6/55) of cases were diagnosed post-mortem; lower than the national average of 18.2%.

As in previous years, the majority (69.1%, 38/55) of cases who died in the entire drug sensitive cohort in 2014 were aged 65 years and older and just under two-thirds (65.5%, 36/55) of cases that died were male. In 2014, 78.2% (43/55) of cases that died had pulmonary disease, however, a higher proportion of miliary TB cases (23.5%, 4/17) died than cases with TB in any other site, followed by cases with CNS - meningitis TB (12.5%, 2/16).

Of cases that weren't diagnosed post mortem, 91.8% (45/49) had information on time from treatment start to death. The median time to death from treatment start was 36 days (range: 0-308 days) which is shorter than the previous year (48 days) and the national average (40 days). Two-thirds (30/45) of these cases died within two months of starting treatment; of which, 66.7% (20/30) were aged over 65. The proportion of deaths was almost twice the amount in those with a previous history of TB compared to those without (12.1%, 7/58 and 6.2%, 42/674 respectively).

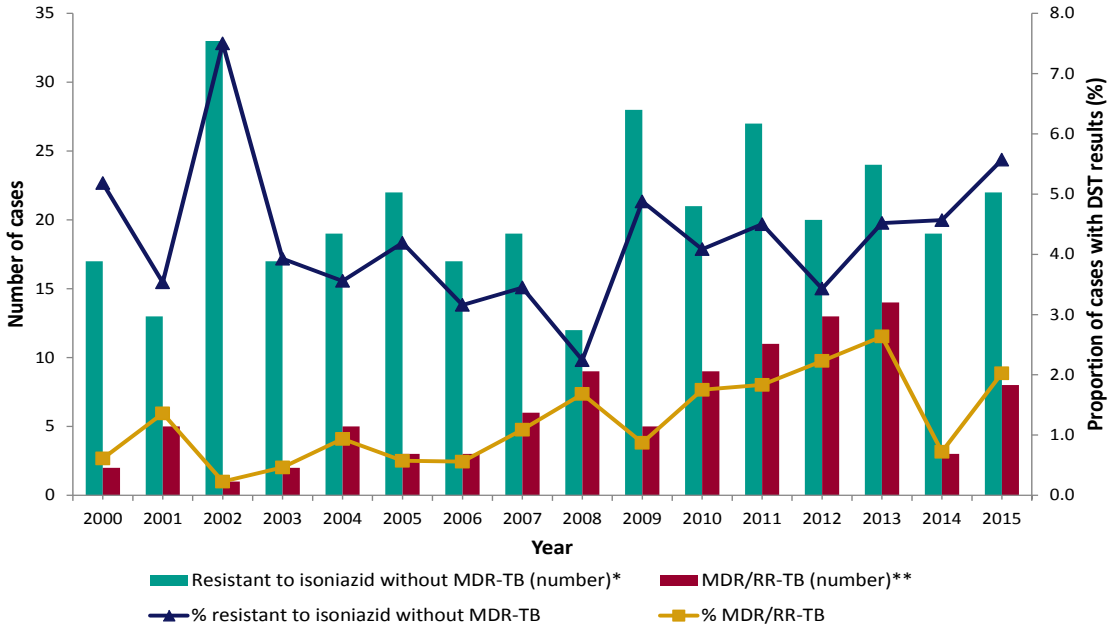
In 2014, 3.9% (30/768) of drug sensitive TB cases were lost to follow-up at the last reported outcome; lower than the previous year (4.2%) and the England average (4.3%). Where the reason for lost to follow-up was recorded, 55.0% (11/20) had left the UK, of which, 90.9% (10/11) were non-UK born. A higher proportion of males, compared to females, were recorded as lost to follow-up (8.1%, 36/447 and 5.9%, 19/321 respectively), as were cases with pulmonary TB compared to cases with extra-pulmonary disease only (10.4%, 43/413 and 3.4%, 12/352 respectively).

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

Overall initial drug resistance and geographical distribution

In 2015, drug susceptibility testing (DST) results for at least isoniazid and rifampicin sensitivity were available for 98.3% (395/402) of culture confirmed cases; this proportion has remained fairly stable since 2000 (range: 96.5-100%). Seven percent (7.3%, 29/395) of cases were resistant to isoniazid, 2.0% (8/395) were resistant to rifampicin, 0.8% (3/397) were resistant to ethambutol and 1.3% (5/383) were resistant to pyrazinamide (Table Bxi). All proportions in the West Midlands were either greater than or equal to the national average (isoniazid: 6.9%, rifampicin: 1.6%, ethambutol: 0.8% and pyrazinamide: 0.7%). Eight percent (8.1%, 32/395) of cases were resistant to at least one first line antibiotic and 1.8% (7/395) had multidrug resistant TB (MDR-TB; cases with resistance to at least isoniazid and rifampicin) (Table Bxi).

Figure 10: Proportion of TB cases with initial first line drug resistance, West Midlands, 2000-2015



*** Culture confirmed cases with DST results for at least isoniazid and rifampicin resistance and resistant to isoniazid without MDR-TB**

****Culture confirmed cases with DST results for at least isoniazid and rifampicin resistance and resistant to rifampicin, including those with MDR-TB**

In 2015, 5.7% (22/388) of cases had initial resistance to isoniazid without MDR-TB; higher than the previous year (4.6%) but similar to the England average (5.6%) (Figure 10). Unlike previous years where the proportion in both genders was relatively similar, in 2015, the proportion of females that were resistant to isoniazid but sensitive to rifampicin was higher than males (9.2%, 14/152 versus 3.4%, 8/236). For females this was the highest proportion since 2000 and higher than the national average of 5.3%. In 2015, all age groups except children aged 0 to 14 years, had a relatively similar proportion of those resistant to isoniazid without MDR-TB (range: 5.6%-5.9%). There were no cases in those aged less than 15 years. The proportion of cases born outside of the UK with this type of resistance was over two times higher than those born in the UK (7.3%, 18/245 and 3.1%, 4/129 respectively).

Cases with resistance to rifampicin, one of the most powerful anti-TB medicines, require MDR-TB treatment[4]. Therefore, TB cases with any resistance to rifampicin, including those with MDR-TB, are hereafter referred to as multi-drug resistant/rifampicin resistant TB (MDR/RR-TB). In 2015, 2.0% (8/395) of cases with DST results had MDR/RR-TB; this was almost three times larger than 2014 (0.7%, 3/413) (Figure 10) and higher than the national average of 1.6%. The majority (75.0%, 6/8) of cases with MDR/RR-TB were male and 87.5% (7/8) of cases were in the 15 to 44 years age group.

All cases (8/8) of MDR/RR-TB in 2015 were born outside of the UK; the same proportion as the previous year (100%, 3/3) but higher than the England average (90.6%). Half of the cases were born in South Asian countries.

A much higher proportion of cases that had a previous history of TB had MDR/RR-TB (9.4%, 3/32 versus 1.1%, 4/350[7]) and a slightly higher proportion of culture confirmed cases with at least one social risk factor had MDR/RR-TB than those with no social risk factors (3.3%, 2/60 and 1.7%, 5/295 respectively[8]).

TB outcome at 24 months for patients with rifampicin resistant disease

For the purposes of TB outcome reporting, the drug resistant cohort includes MDR/RR-TB (initial and acquired) cases and those treated with an MDR-TB regimen[2]. In 2013, there were no cases with acquired MDR/RR-TB or treated with an MDR-TB regimen. Half (7/14) of cases in 2013 with rifampicin resistant disease completed treatment at 24 months (Table 11). Thirty-six percent (35.7%, 5/14) were still on treatment and 14.3% (2/14) were lost to follow up.

[7] one case of MDR/RR-TB had no previous diagnosis history available
[8] one case of MDR/RR-TB had no social risk factor information available

Table 11: TB outcome at 24 months for patients with rifampicin resistant disease, West Midlands, cases diagnosed in 2013

	n	%
Completed	7	50.0
Died	0	0.0
Lost to follow up	2	14.3
Still on treatment	5	35.7
Treatment stopped	0	0.0
Not evaluated*	0	0.0
Total	**14**	

***not evaluated includes missing, unknown and transferred out**

Second line drug resistance and extensively drug resistant (XDR) TB

In 2015, all but one of the MDR/RR-TB cases (87.5%, 7/8) had drug susceptibility testing for all first line drugs (rifampicin, isoniazid, ethambutol and pyrazinamide), of which two cases (28.6%) were resistant to all four. One case of MDR/RR-TB (14.2%, 1/7[9]) was resistant to at least one injectable agent (amikacin, capreomycin or kanamycin) and two cases (25.0%, 2/8) were resistant to a fluoroquinolone (ofloxacin, moxifloxacin or ciprofloxacin).

There was one case of extensively-drug resistant TB (XDR-TB) in 2015 in the West Midlands; this case was born outside of the UK, in the 15 to 44 years age group and had pulmonary TB. This is the second case of XDR-TB reported in the West Midlands since 2000.

[9] one case of MDR-RR/TB did not have injectable resistance information

TB in under-served populations

Social risk factors

In the Enhanced TB surveillance system (ETS), data is collected on four social risk factors (SRF) that are known to increase the risk of acquiring TB; these are a current or previous history of homelessness, imprisonment or drug use and current alcohol misuse. In 2015, among TB cases aged over 14 years and with known SRF information, 3.5% (22/632) of cases had a current or previous history of homelessness, 6.8% (43/631) of imprisonment, 5.3% (33/625) had reported drug use and 4.8% (30/629) reported alcohol misuse (Table 12). The proportion of cases imprisoned, with reported drug use and alcohol misuse was higher than the national average (3.9%, 4.3% and 3.9% respectively), whereas the proportion reported as homeless was lower (4.4%). All four risk factors showed an increase compared to 2014 in the West Midlands (Table Bxii).

Table 12: Individual social risk factors among TB patients*, West Midlands, 2015

	n	%
Homelessness	22	3.5
Imprisonment	43	6.8
Drug misuse	33	5.3
Alcohol misuse	30	4.8

***excludes cases aged less than 15 years**

Of cases with a current or previous history of drug use, 24.2% (8/33) reported current drug use; lower than the national average of 40.7%. Fourteen percent (13.6, 3/22) of homeless cases were reported currently homeless at time of notification. Information on the timing of prison stay was known for 88.4% (38/43) of cases with a current or previous history of imprisonment; of these 28.9% (11/38) were currently in prison. Sixty-one percent (60.5%, 26/43) of cases with a reported prison history were imprisoned in the UK.

In 2015, of cases aged 15 years and over, 12.9% (78/603) had at least one social risk factor (Table 13). This is a 38.7% increase compared to the previous year (9.3%, 62/665) and the highest proportion since reporting began in 2010. This was also higher than the England average of 11.8%.

Table 13: Number and proportion of cases with at least one social risk factor*, West Midlands, 2010-2015

Year	n	%	Total
2010	61	8.9	683
2011	61	7.4	819
2012	75	8.4	890
2013	88	10.6	831
2014	62	9.3	665
2015	78	12.9	603
Total	**425**	**9.5**	**4,491**

***excludes cases aged less than 15 years**

The majority (80.8%, 63/78) of cases with social risk factors were male and the proportion of male cases with SRFs was over three times higher than the proportion of females with SRFs (19.1%, 63/330 and 5.5%, 15/273 respectively). Sixty-three percent (62.8%, 49/78) of cases were aged 15 to 44 years, however the age group with the highest proportion of cases with social risk factors was the 45 to 64 years age group (17.2%, 27/157).

Sixty-two percent (61.8%, 47/76[10]) of cases with social risk factors were UK born and the proportion of UK born cases with a SRF was considerably higher than in foreign born cases (22.9%, 47/205 and 7.6%, 29/383 respectively). The proportion in both groups was lower than the national average (UK born: 21.7% and non-UK born: 8.3%). The proportion of cases in the UK born population that had at least one SRF increased by 43.5% compared to 2014 (16.0%, 35/219). Of this population, 66.0% (31/47) were White; however the ethnic group[11] with the highest proportion of cases with at least one SRF was Black-Caribbean (35.3%, 6/17). The greatest proportion of non-UK born cases with SRFs were of Black-African ethnicity (37.9%, 11/29) this group also had the highest proportion of cases with at least one social risk factor (19.3%, 11/57). Eighty percent (79.5%, 62/78) of cases with SRFs had pulmonary disease.

In 2015, the highest proportion of cases with at least one SRF were resident in Birmingham (41.0%, 32/78). Of the UTLAs with greater than ten cases in 2015, Stoke-on-Trent had the highest proportion of cases with SRFs (24.0%, 6/25), followed by Staffordshire (23.8%, 10/42). Solihull had the lowest proportion with no cases (0/13), followed by Sandwell (5.1%, 4/78).

[10] two cases did not have place of birth information available
[11] with greater than ten cases in 2015

A higher proportion of cases with a previous history of TB had at least one social risk factor compared to those with no history (18.3%, 11/60 and 12.4%, 67/540 respectively). Seventy percent (69.4%, 50/72[12]) of cases with SRFs received DOT; higher than the national average of 55.5%.

The proportion of cases with more than one risk factor has increased in recent years; in 2015, 39.7% (31/78) of cases with social risk factors had between two or three risk factors. This proportion has doubled since 2010 (19.7%, 12/61). Five percent (5.1%, 4/78) of cases had all four risk factors reported in 2015, the highest proportion in recent years.

Table 14: Last recorded TB outcome for the entire drug sensitive cohort by social risk factor*, West Midlands, 2014

	At least one SRF		No SRF	
	n	%	n	%
Treatment completed	45	75.0	524	87.6
Died	7	11.7	38	6.4
Lost to follow up	5	8.3	19	3.2
Still on treatment	1	1.7	6	1.0
Treatment stopped	2	3.3	9	1.5
Not evaluated**	0	0.0	2	0.3
Total	**60**		**598**	

***includes cases aged over 14 years but excludes cases in the drug resistant cohort**
****not evaluated includes missing, unknown and transferred out**

In 2014, the proportion of cases in the entire drug sensitive cohort completing treatment at their last reported outcome was lower in those with at least one social risk factor compared to those with no SRFs (75.0%, 45/60 and 87.6%, 524/598 respectively; Table 14). Drug sensitive cases with at least one SRF were associated with poorer outcomes; a higher proportion of these cases died, were lost to follow up or had their treatments stopped compared to those without a social risk factor. Fifteen percent (3/20) of drug sensitive cases with reported alcohol misuse died compared with only 6.3% (42/669) of cases with no alcohol misuse.

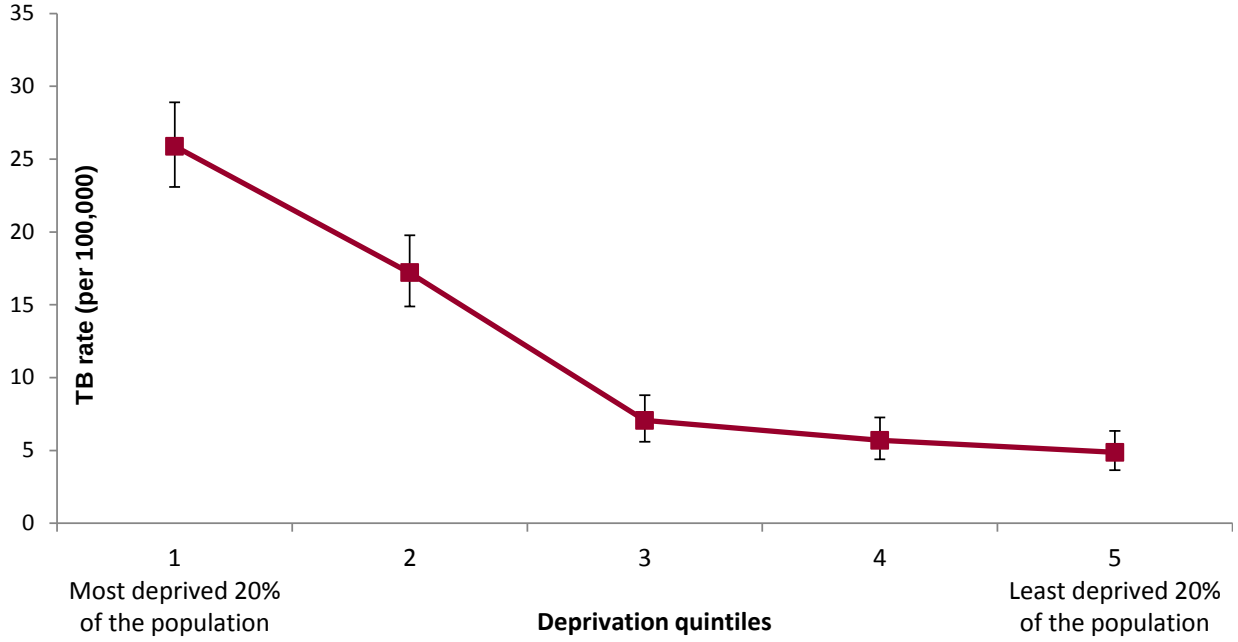
Deprivation

In 2015, 44.2% (313/708) of TB cases were resident in the 20% of the population living in the most deprived areas in the West Midlands, compared to only 7.6% (54/708) in the

[12] where DOT information was available

20% of the population living in the least deprived areas [3] (Figure 11). Similarly, TB rates were highest in the most deprived quintile (25.9 per 100,000) compared with the least deprived quintile (4.9 per 100,000).

Figure 11: Rate of TB by deprivation quintile, West Midlands, 2015



Patient care: HIV testing and co-infection, hospitalisation & directly observed therapy

HIV testing

Information on HIV testing was known for 84.6% (595/703) of cases not diagnosed post mortem in 2015; the HIV status for 4.0% (24/595) of these cases was already known. Ninety-one percent (91.1%, 520/571) of cases with an unknown HIV status were offered and received HIV testing, 2.8% (n=16) were offered testing but did not receive it, and 1.4% (n=8) were offered testing but refused (Table 15). The proportion of cases that have been offered and received HIV testing has improved in recent years (2012: 83.8%; 2015:91.1%) The proportion of those offered HIV testing and accepting was lowest in those aged 65 years and over (81.6%, 71/87) and highest in those aged 15 to 44 years (94.0%, 299/318). The proportion of children aged less than 15 years being offered and receiving testing has increased considerably compared to 2014 (2014: 66.7%, 14/21; 2015: 84.0%, 21/25).

Table 15: HIV testing in TB cases, West Midlands, 2012-2015

Year	Not offered		Offered and received		Offered but not received		Offered but refused		Total*
	n	%	n	%	n	%	n	%	
2012	65	9.9	550	83.8	32	4.9	9	1.4	**656**
2013	56	6.9	696	86.2	38	4.7	17	2.1	**807**
2014	36	5.2	610	88.3	28	4.1	17	2.5	**691**
2015	27	4.7	520	91.1	16	2.8	8	1.4	**571**
Total	**184**	**6.8**	**2,376**	**87.2**	**114**	**4.2**	**51**	**1.9**	**2,725**

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

HIV co-infection rates

In 2014, the West Midlands had the lowest proportion of cases with TB-HIV coinfection in England (2.4%, 18/750) [1]; this was also lower than the proportion with TB-HIV coinfection reported in the West Midlands in 2013 (3.3%) (Table 16) and was the lowest proportion since 2002.

Table 16: Number and proportion of notified and un-notified TB cases matched to a HIV case [1], West Midlands, 2001-2014

Year	n	%
2001	4	0.6
2002	21	2.9
2003	33	4.6
2004	44	5.2
2005	38	4.3
2006	40	4.5
2007	34	4.0
2008	36	3.8
2009	37	3.9
2010	25	3.0
2011	32	3.3
2012	28	2.8
2013	31	3.3
2014	18	2.4
Total	**421**	**3.5**

Directly observed therapy (DOT)

Information on whether cases received DOT was known for 89.6% (634/708) of cases notified in 2015. Of these, 15.6% (99/634) were reported to have received DOT; higher than the previous year (10.8%, 72/782) and the national average (13.8%). Forty-eight percent (47.5%, 47/99) of cases receiving DOT were aged 15 to 44 years, however the age group with the highest proportion of cases receiving DOT were children aged less than 15 years (44.4%, 12/27).

Hospital inpatient stays

In 2015, information on hospital inpatient stays at any point throughout a cases' treatment was available for 94.9% (672/708) of cases; of these, 22.8% (153/672) had been an inpatient. Those aged 65 years and over had the highest proportion of cases that were inpatients (32.4%, 36/111). Those with at least one social risk factor had a higher proportion of cases requiring an inpatient stay compared with those with no social risk factors (35.9%, 28/78 and 21.0%, 125/594 respectively).

Discussion

The PHE and NHS England Collaborative TB Strategy for England [5] sets out clear actions and areas for improvement needed to achieve a reduction in TB incidence. This report presents a detailed overview of the epidemiology of TB in the West Midlands using enhanced TB surveillance data in order to allow local monitoring of progress towards achievement of the strategy's aims.

In line with national figures, the rate of TB in the West Midlands has declined year on year since 2012. The areas of highest burden were Sandwell, Coventry, Wolverhampton and Birmingham, all of which have consistently had high rates of TB in recent years. Eleven of the 14 upper tier local authorities showed a decrease compared to 2014, despite this reduction, the West Midlands accounted for the second highest proportion of cases in England.

As in previous years, the rate of TB in the non-UK born population was considerably higher than those born in the UK. However, in recent years, the decline in the foreign-born population has been much more rapid than the decline in the UK-born population. Since 2012, the reduction in non-UK born TB cases has been due to the decline in newer migrants, however 2015 saw a smaller reduction in this group. Despite this, the greatest proportion of cases is those living in the UK for more than ten years prior to notification. Pre-entry screening for individuals applying for a UK visa for more than six months and who are resident in a country where the incidence of TB is greater than 40 per 100,000 has likely contributed to this. In 2015, 265,115 applicants were screened under this programme in the UK; of these, 382 active cases of TB were identified [6]. Although the largest reduction of cases has been in individuals born in Pakistan and India, these countries still account for the highest proportion of cases in the West Midlands.

Those in South Asian ethnic groups accounted for over two-thirds of foreign born TB cases, with the highest rates occurring in those of Indian and Pakistani ethnicity. The majority of the UK born cases were White, but the highest rates occurred in the Black-Caribbean ethnic group. In the past decade, when disregarding place of birth, the rate in those of Black-African ethnicity has been considerably larger than all other ethnic groups, however the rate has reduced dramatically and in 2015 was overtaken by the Indian ethnic group.

Despite the rate in the UK born population being significantly lower than that in the non-UK born population, in the past sixteen years it has remained relatively stable in comparison to the decline in rate of the foreign born cases. This may be a result of the

increasing proportion of cases in this group having at least one of the social risk factor, which are known to increase the risk of acquiring TB. In 2015, one in five cases in the UK born population had at least one social risk factor. This perhaps shows that tuberculosis control measures that have been introduced have been less effective in decreasing the number of cases in marginalised groups. Reporting of social risk factors has improved each year since 2010 and may explain why the number of cases with SRFs is increasing. Despite this, we are still able to demonstrate that a higher number of UK-born cases, compared to non-UK born cases, are within this particular underserved group.

The rate of TB in UK born children remained the same in 2015 when compared to the previous year but has shown a decline over the past 12 years. This is likely to reflect a reduction in recent TB transmission and the developments made in contact tracing and early diagnosis.

The National TB Strain Typing service was established in 2010 and since then 86% of culture confirmed TB cases in the West Midlands had strain typing results for at least 23 loci. Of these cases, just under half were in 295 molecular clusters (consisting of one or more other cases) in the West Midlands. Whilst MIRU-VNTR can detect relatedness between one or more cases it does not ascertain how recent the transmission occurred. Whole Genome Sequencing (WGS) will soon provide the means to understand the connectedness between cases. WGS will provide a clearer, fuller and more efficient way of understanding whether isolates are likely to be a part of the same transmission train and aid in determining the timing and pathway of transmission [7,8,9].

Since 2011, information on the delay between symptom onset and treatment start has been collected for pulmonary TB cases. Since then, there has been a general year on year increase in the proportion of cases with a delay of greater than four months. It is of concern that just under a third of TB cases in 2015 had a delay of this proportion as this increases the opportunity and probability of transmission. A priority area of focus in the Collaborative TB Strategy is those in underserved populations as this is where the risk of delayed diagnosis is high. The strategy identifies that late diagnosis may be caused by delays in presentation to health services or in the diagnostic process; current data completeness does not allow us to distinguish between late presentation to health services and delays occurring within the health service. Actions required to raise awareness in underserved groups are set out in the strategy; these include tackling the stigma among populations at high risk, provision of training for agencies working within migrant communities and improving the accessibility of clinic venues and times. Cohort reviews have now been implemented in the majority of TB services across the West Midlands. These meetings discuss detailed information about cases and will help us to better understand why these delays occur and will provide insight in to how they can be overcome.

Of drug sensitive cases notified in 2014 that were expected to complete treatment within 12 months (ie rifampicin sensitive or excluding those with CNS, spinal, cryptic disseminated or miliary disease), 83% completed within a year. This is a decrease compared to the previous year but a considerable improvement compared to 2002 (70%), after which there was a general year-on-year increase. At the last reported outcome, a further 21 cases went on to complete treatment, bringing the overall completion rate to 86%. For those in the drug sensitive cohort with CNS, spinal, miliary or cryptic disseminated disease (ie those with an expected treatment length of greater than 12 months), just over half (55%) completed within one year but a further 24% went on to complete treatment at the last recorded outcome. The median number of days to completion for those still on treatment at 12 months was 378 days.

In 2015, over two-thirds of pulmonary cases were culture confirmed; efforts to increase this proportion are necessary given the growing proportion of cases with resistance to standard TB treatment. It is important to establish the correct treatment for each case in order to allow a faster and more effective recovery. Those with resistance to rifampicin require the same treatment as those with MDR-TB; these cases are expected to be on treatment for greater than 12 months. For rifampicin resistant cases notified in 2013, only half completed treatment at 24 months; this was lower than both the national proportion (58%) and the global proportion (52%) [10]. The proportion of cases with MDR/RR-TB in the West Midlands almost tripled compared to 2014 but was still lower than the peak in 2013. All cases of MDR/RR-TB in 2015 were born outside of the UK and in countries where the MDR/RR-TB incidence rate was between 2.7 and 17.0 per 100,000 (all considerably higher than the UK rate of 0.2 per 100,000). There was one case of XDR-TB in the West Midlands, one of three cases reported in England in 2015.

TB in underserved populations has become a priority area of focus in England. One of the actions set out in the TB Collaborative Strategy [5] is to ensure commissioners and service providers follow the recommendations set out in the NICE guidance [12] for identifying and managing tuberculosis among harder-to-reach populations. Certain groups of individuals are disproportionately affected by TB; these include ethnic minorities, refugees and asylum seekers, and those with social risk factors (SRFs; homelessness, imprisonment, alcohol misuse and drug use). From 2010, the Enhanced Tuberculosis Surveillance system began collecting information on these four SRFs for all cases of TB in England. In 2015, the proportion of cases with at least one SRF was at its highest since 2010. The majority of cases were male, aged between 15 and 44 years, UK born and of White ethnicity. The proportion of cases with more than one risk factor has also increased in recent years. In 2015, 38% of cases with social risk factors had two or three risk factors and 5% had all four. Social risk groups are associated with poorer outcomes. TB cases with SRFs were twice as likely to die or stop treatment compared to those with no social risk factors. Twelve percent of cases were lost to

follow up in 2014; this is a concern as on average 80% of cases with SRFs have pulmonary, and therefore infectious, tuberculosis.

In recent years, a high proportion of cases were offered and received HIV testing in the West Midlands; this has increased each year since 2012. Encouragingly the proportion of children being offered and receiving HIV testing has increased considerably. Early diagnosis of HIV in children is paramount and so greater efforts are needed to overcome the barriers of HIV testing in this group.

Conclusion and recommendations

The continued reduction in the number of tuberculosis cases in the West Midlands is encouraging. However the rate remains higher than the national average, with only London having a higher rate.

The considerable decrease in cases in the non-UK born population in recent years is likely to be reflective of the reduction of TB in other parts of the world and successful pre-entry screening for active TB; however, increased TB control efforts in England since the publication of the Collaborative TB Strategy for England [5] may also play a part. The national roll-out of latent TB screening and treatment for new migrants began in April 2015 and targeted the highest TB burden clinical commissioning groups (GGCs) across England. In the West Midlands, the CCGs currently participating in the programme are: Sandwell and West Birmingham, Birmingham CrossCity, Birmingham South Central, Wolverhampton, Coventry and Rugby and Stoke CCGs.

To sustain and strengthen TB control in the West Midlands, locally driven reviews of delays, outcomes and contact tracing should continue to take place. Cohort review is currently implemented in the majority of services in the West Midlands and is due to be rolled out to all services by early 2017. Standardised key performance indicators have been introduced for these reviews which will enable service providers and stakeholders to identify, monitor and find solutions to common issues both locally and regionally. These meetings will also help TB services to identify the best possible care for cases with drug resistance. Despite the general increase in treatment completion in cases with drug sensitive TB, the proportion completing treatment in those with drug resistance remains low. The poorer outcomes of these cases are probably due to multiple factors given their complexity. In order to find the best solutions for current and future cases that require enhanced case management, more in-depth discussions and reviews are essential.

In 2015, a third of pulmonary cases were not culture confirmed. Wherever possible, TB services should obtain diagnostic samples to ensure as many patients as possible receive drug susceptibility testing. This will ensure the most effective and efficient treatment is given to each patient.

In the West Midlands, the proportion of cases with social risk factors is increasing. These cases are more likely to be infectious, experience poorer outcomes and require enhanced case management. One of the key aims of the Collaborative TB Strategy [5], guided by recommendations provided in NICE guidance [12], is strengthening awareness in service providers working with under-served populations in order to make them more aware of the health care available to them. TB services should use these resources and the guidance available to target these harder-to-reach groups.

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Appendix A: Data sources and definitions

Data sources
Data on TB cases in the West Midlands 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 Birmingham Reference Laboratory.

Definitions
Social risk factors and directly observed therapy are defined in the RCN TB case management guidance:
https://www2.rcn.org.uk/__data/assets/pdf_file/0010/439129/004204.pdf

Treatment outcome
Information on outcomes was 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. Proportions and percentage changes were calculated using unrounded figures and so may differ from calculations from rounded figures seen in this report.

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

Population denominator
Tuberculosis rates by geographical area (Centre, UTLA, MSOA and LSOA), age and sex were calculated using ONS mid-year population estimates. Tuberculosis rates by place of birth and ethnicity were calculated using Labour Force Survey estimates from the UK Data Service website: https://discover.ukdataservice.ac.uk/series/?sn=2000026.

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 the West Midlands was carried out on cases that clustered in this region and were notified between 2010 and 2015.

Appendix B: TB among West Midland residents

Table Bi: TB cases notifications by upper tier local authority of residence, West Midlands, 2000-2015

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Birmingham	351	312	328	342	393	376	414	373	431	470	358	401	447	388	319	253
Coventry	78	61	76	58	79	87	95	131	107	91	80	120	131	100	91	88
Dudley	12	18	48	30	33	32	34	43	38	29	35	34	29	42	21	32
Herefordshire	4	2	4	1	6	1	3	4	8	5	3	6	7	5	3	3
Sandwell	77	81	86	88	90	118	112	112	107	107	101	106	118	121	77	97
Shropshire	3	8	4	11	18	13	14	7	13	8	8	10	14	11	10	7
Solihull	8	10	9	16	13	11	21	15	18	20	4	21	23	15	15	14
Staffordshire	10	21	15	29	28	23	25	19	31	42	45	30	35	39	26	44
Stoke-on-Trent	0	29	35	32	26	42	39	27	30	30	32	46	40	35	28	28
Telford and Wrekin	6	4	3	3	16	12	12	11	13	12	10	7	14	12	9	5
Walsall	68	60	59	54	60	44	52	61	56	46	48	68	50	52	36	33
Warwickshire	20	32	40	33	45	41	28	49	59	49	48	44	53	44	54	25
Wolverhampton	46	49	69	74	87	90	62	66	76	76	81	90	76	81	63	59
Worcestershire	16	15	18	12	26	30	16	10	21	21	19	21	38	34	23	20
West Midlands	**699**	**702**	**794**	**783**	**920**	**920**	**927**	**928**	**1008**	**1006**	**872**	**1004**	**1075**	**979**	**775**	**708**

Table Bii: TB rates per 100,000 by upper tier local authority of residence, West Midlands, 2000-2015

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Birmingham	35.6	31.7	33.1	34.3	39.2	37.1	40.6	36.2	41.5	44.8	33.7	37.3	41.2	35.5	29.0	22.8
Coventry	25.7	20.1	25.2	19.3	26.5	29.2	31.7	43.5	35.1	29.6	25.7	37.9	40.5	30.3	27.0	25.5
Dudley	3.9	5.9	15.7	9.8	10.8	10.4	11.0	13.9	12.2	9.3	11.2	10.9	9.2	13.4	6.6	10.1
Herefordshire	2.3	1.1	2.3	0.6	3.4	0.6	1.7	2.2	4.4	2.7	1.6	3.3	3.8	2.7	1.6	1.6
Sandwell	27.0	28.5	30.1	30.6	31.2	40.6	38.3	38.0	35.9	35.4	33.0	34.3	37.9	38.5	24.3	30.4
Shropshire	1.1	2.8	1.4	3.8	6.2	4.5	4.8	2.4	4.3	2.6	2.6	3.3	4.5	3.6	3.2	2.2
Solihull	4.0	5.0	4.5	8.0	6.5	5.5	10.4	7.4	8.8	9.7	1.9	10.2	11.1	7.2	7.1	6.7
Staffordshire	1.2	2.6	1.9	3.6	3.4	2.8	3.0	2.3	3.7	5.0	5.3	3.5	4.1	4.6	3.0	5.1
Stoke-on-Trent	0.0	12.1	14.6	13.3	10.8	17.4	16.0	11.1	12.2	12.2	12.9	18.5	16.0	14.0	11.2	11.1
Telford and Wrekin	3.8	2.5	1.9	1.9	10.0	7.4	7.4	6.7	7.9	7.3	6.0	4.2	8.3	7.1	5.3	2.9
Walsall	26.7	23.7	23.2	21.1	23.4	17.0	20.0	23.4	21.3	17.4	18.0	25.2	18.5	19.1	13.1	12.0
Warwickshire	4.0	6.3	7.8	6.4	8.7	7.8	5.3	9.2	10.9	9.0	8.8	8.1	9.7	8.0	9.8	4.5
Wolverhampton	19.2	20.6	28.9	30.9	36.2	37.2	25.5	27.1	31.0	30.9	32.7	36.0	30.3	32.2	24.9	23.2
Worcestershire	3.0	2.8	3.3	2.2	4.7	5.4	2.9	1.8	3.7	3.7	3.4	3.7	6.7	5.9	4.0	3.5
West Midlands	**13.3**	**13.3**	**15.0**	**14.7**	**17.2**	**17.1**	**17.1**	**17.0**	**18.3**	**18.2**	**15.7**	**17.9**	**19.1**	**17.3**	**13.6**	**12.3**

Table Biii: TB case numbers by CCG of residence, West Midlands, 2000-2015

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NHS Birmingham CrossCity	182	162	168	168	195	185	197	174	204	225	199	192	232	198	168	125
NHS Birmingham South and Central	58	54	66	69	73	64	80	58	69	97	66	76	80	78	55	43
NHS Dudley	12	18	48	30	33	32	34	43	38	29	35	34	29	42	21	32
NHS Sandwell and West Birmingham	188	177	180	193	215	245	249	253	265	255	194	239	253	233	173	182
NHS Solihull	8	10	9	16	13	11	21	15	18	20	4	21	23	15	15	14
NHS Walsall	68	60	59	54	60	44	52	61	56	46	48	68	50	52	36	33
NHS Wolverhampton	46	49	69	74	87	90	62	66	76	76	81	90	76	81	63	59
Birmingham, Solihull & The Black Country	**562**	**530**	**599**	**604**	**676**	**671**	**695**	**670**	**726**	**748**	**627**	**720**	**743**	**699**	**531**	**488**
NHS Coventry and Rugby	86	71	90	66	90	91	103	147	130	108	92	126	145	112	100	96
NHS Herefordshire	4	2	4	1	6	1	3	4	8	5	3	6	7	5	3	3
NHS Redditch and Bromsgrove	5	7	3	3	13	13	7	3	6	3	5	6	29	13	10	5
NHS South Warwickshire	3	5	12	18	20	16	12	20	16	18	19	19	20	11	20	11
NHS South Worcestershire	8	7	9	8	9	15	8	6	7	16	13	13	9	19	9	14
NHS Warwickshire North	9	17	14	7	14	21	8	13	20	14	17	19	19	21	25	6
NHS Wyre Forest	3	1	6	1	4	2	1	1	8	2	1	2	0	2	4	1
Arden, Herefordshire & Worcestershire	**118**	**110**	**138**	**104**	**156**	**159**	**142**	**194**	**195**	**166**	**150**	**191**	**229**	**183**	**171**	**136**
NHS Cannock Chase	2	0	0	4	3	1	2	1	0	2	1	1	5	0	2	1
NHS East Staffordshire	3	2	4	4	11	10	5	4	14	17	23	9	16	13	7	9
NHS North Staffordshire	0	12	7	7	8	3	9	7	7	6	5	8	6	9	9	6
NHS Shropshire	3	8	4	11	18	13	14	7	13	8	8	10	14	11	10	7
NHS South East Staffs and Seisdon and Peninsular	5	5	4	9	5	6	8	4	4	10	12	2	6	1	2	19
NHS Stafford and Surrounds	0	2	0	4	1	3	1	3	6	7	4	10	2	15	6	8
NHS Stoke on Trent	0	29	35	33	26	42	39	27	30	30	32	46	40	36	28	29
NHS Telford & Wrekin	6	4	3	3	16	12	12	11	13	12	10	7	14	12	9	5
Shropshire & Staffordshire	**19**	**62**	**57**	**75**	**88**	**90**	**90**	**64**	**87**	**92**	**95**	**93**	**103**	**97**	**73**	**84**

Table Biv: TB rates by CCG of residence, West Midlands, 2000-2015

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NHS Birmingham CrossCity	27.7	24.7	25.5	25.4	29.3	27.5	29.0	25.4	29.5	32.2	28.2	26.9	32.2	27.3	23.0	17.1
NHS Birmingham South and Central	30.9	28.8	34.7	36.1	38.2	33.3	41.7	30.1	35.7	49.7	33.6	38.3	40.1	38.8	27.2	21.3
NHS Dudley	3.9	5.9	15.7	9.8	10.8	10.4	11.0	13.9	12.2	9.3	11.2	10.9	9.2	13.4	6.6	10.1
NHS Sandwell and West Birmingham	44.2	41.7	42.0	44.7	49.5	55.8	56.3	56.7	58.6	55.6	41.7	50.8	53.2	48.5	35.7	37.6
NHS Solihull	4.0	5.0	4.5	8.0	6.5	5.5	10.4	7.4	8.8	9.7	1.9	10.2	11.1	7.2	7.1	6.7
NHS Walsall	26.7	23.7	23.2	21.1	23.4	17.0	20.0	23.4	21.3	17.4	18.0	25.2	18.5	19.1	13.1	12.0
NHS Wolverhampton	19.2	20.6	28.9	30.9	36.2	37.2	25.5	27.1	31.0	30.9	32.7	36.0	30.3	32.2	24.9	23.3
Birmingham, Solihull & The Black Country	**24.8**	**23.4**	**26.3**	**26.4**	**29.4**	**29.0**	**29.9**	**28.6**	**30.8**	**31.4**	**26.1**	**29.7**	**30.5**	**28.5**	**21.5**	**19.7**
NHS Coventry and Rugby	22.1	18.2	23.1	16.9	23.2	23.4	26.2	37.1	32.4	26.7	22.4	30.2	34.2	26.0	22.7	21.8
NHS Herefordshire	2.3	1.1	2.3	0.6	3.4	0.6	1.7	2.2	4.4	2.7	1.6	3.3	3.8	2.7	1.6	1.6
NHS Redditch and Bromsgrove	3.0	4.2	1.8	1.8	7.6	7.6	4.1	1.7	3.4	1.7	2.8	3.4	16.2	7.3	5.6	2.8
NHS South Warwickshire	1.3	2.1	5.0	7.4	8.1	6.4	4.8	7.8	6.2	7.0	7.4	7.3	7.7	4.2	7.7	4.2
NHS South Worcestershire	2.9	2.5	3.2	2.9	3.2	5.3	2.8	2.1	2.4	5.6	4.5	4.5	3.1	6.5	3.0	4.7
NHS Warwickshire North	5.0	9.4	7.7	3.8	7.7	11.5	4.4	7.0	10.8	7.5	9.1	10.1	10.1	11.2	13.3	3.2
NHS Wyre Forest	3.1	1.0	6.2	1.0	4.1	2.0	1.0	1.0	8.2	2.0	1.0	2.0	0.0	2.0	4.0	1.0
Arden, Herefordshire & Worcestershire	**7.8**	**7.2**	**9.0**	**6.8**	**10.1**	**10.3**	**9.1**	**12.3**	**12.3**	**10.4**	**9.4**	**11.8**	**15.0**	**11.2**	**10.4**	**8.2**
NHS Cannock Chase	1.6	0.0	0.0	3.1	2.3	0.8	1.6	0.8	0.0	1.5	0.8	0.8	3.8	0.0	1.5	0.7
NHS East Staffordshire	2.7	1.8	3.5	3.5	9.5	8.6	4.3	3.4	11.6	14.0	18.8	7.3	12.9	10.4	5.6	7.2
NHS North Staffordshire	0.0	5.8	3.3	3.3	3.8	1.4	4.3	3.3	3.3	2.8	2.4	3.8	2.8	4.2	4.2	2.8
NHS Shropshire	1.1	2.8	1.4	3.8	6.2	4.5	4.8	2.4	4.3	2.6	2.6	3.3	4.5	3.6	3.2	2.3
NHS South East Staffs and Seisdon and Peninsular	2.4	2.4	1.9	4.2	2.3	2.8	3.7	1.8	1.8	4.5	5.4	0.9	2.7	0.4	0.9	8.5
NHS Stafford and Surrounds	0.0	1.4	0.0	2.8	0.7	2.1	0.7	2.0	4.1	4.7	2.7	6.6	1.3	9.9	3.9	5.3
NHS Stoke on Trent	0.0	11.7	14.1	13.3	10.4	16.8	15.5	10.7	11.8	11.8	12.5	17.9	15.5	13.9	10.8	11.2
NHS Telford & Wrekin	3.8	2.5	1.9	1.9	10.0	7.4	7.4	6.7	7.9	7.3	6.0	4.2	8.3	7.1	5.3	3.0
Shropshire & Staffordshire	**2.1**	**4.5**	**4.6**	**5.0**	**5.8**	**5.9**	**5.9**	**4.2**	**6.1**	**5.9**	**6.1**	**5.9**	**6.5**	**6.7**	**4.6**	**5.3**

Table Bv: TB case notifications and rates by age group and sex, West Midlands, 2015

	Female		Male	
	n	Rate	n	Rate
0-9	7	2.0	12	3.2
10-19	15	4.5	19	5.4
20-29	56	14.7	80	20.3
30-39	74	20.9	92	26.2
40-49	42	10.8	68	17.6
50-59	35	9.5	43	11.8
60-69	29	9.1	36	11.7
70+	48	11.8	52	16.2
West Midlands	**306**	**10.5**	**402**	**14.1**

Table Bvi: TB case notifications and rates by place of birth*, West Midlands, 2000-2015

	Non-UK born		UK born	
	n	Rate	n	Rate
2000	380	105.4	293	6.0
2001	359	94.7	325	6.7
2002	448	119.7	300	6.2
2003	438	110.0	302	6.2
2004	551	137.2	322	6.6
2005	602	168.6	270	5.4
2006	580	125.0	282	5.8
2007	535	114.9	278	5.7
2008	599	110.1	350	7.2
2009	638	106.0	317	6.5
2010	559	97.4	283	5.7
2011	664	113.9	316	6.4
2012	703	117.2	335	6.7
2013	643	100.1	314	6.3
2014	501	77.1	267	5.4
2015	434	62.3	249	5.0

***excluding cases where country of birth is unknown**

Table Bvii: Number and proportion* of cases culture confirmed by UTLA, 2009-2015

	2009		2010		2011		2012		2013		2014		2015	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Birmingham	278	59.1	231	64.5	250	62.3	256	57.3	237	61.1	178	55.8	148	58.5
Coventry	49	53.8	34	42.5	62	51.7	62	47.3	48	48.0	45	49.5	40	45.5
Dudley	10	34.5	18	51.4	19	55.9	21	72.4	26	61.9	11	52.4	16	50.0
Herefordshire	2	40.0	3	100.0	3	50.0	4	57.1	2	40.0	3	100.0	2	66.7
Sandwell	57	53.3	61	60.4	64	60.4	57	48.3	65	53.7	37	48.1	59	60.8
Shropshire	5	62.5	7	87.5	6	60.0	9	64.3	6	54.5	5	50.0	4	57.1
Solihull	10	50.0	1	25.0	12	57.1	11	47.8	5	33.3	7	46.7	5	35.7
Staffordshire	27	64.3	24	53.3	16	53.3	21	60.0	18	46.2	18	69.2	25	56.8
Stoke-on-Trent	25	83.3	22	68.8	34	73.9	23	57.5	18	51.4	16	57.1	17	60.7
Telford and Wrekin	11	91.7	5	50.0	3	42.9	9	64.3	4	33.3	8	88.9	2	40.0
Walsall	28	60.9	28	58.3	46	67.6	29	58.0	34	65.4	18	50.0	19	57.6
Warwickshire	24	49.0	26	54.2	21	47.7	21	39.6	19	43.2	28	51.9	14	56.0
Wolverhampton	43	56.6	52	64.2	64	71.1	50	65.8	52	64.2	38	60.3	35	59.3
Worcestershire	15	71.4	12	63.2	15	71.4	17	44.7	16	47.1	12	52.2	16	80.0
West Midlands	**584**	**58.1**	**524**	**60.1**	**615**	**61.3**	**590**	**54.9**	**550**	**56.2**	**424**	**54.7**	**402**	**56.8**

***proportion of all cases that are culture confirmed**

Table Bviii: Number and proportion of pulmonary culture confirmed TB cases by UTLA, West Midlands, 2009-2015

	2009		2010		2011		2012		2013		2014		2015	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Birmingham	181	69.9	158	81.9	161	73.9	161	72.2	152	75.6	110	70.5	97	71.3
Coventry	29	61.7	16	35.6	40	59.7	34	46.6	25	49.0	30	58.8	28	52.8
Dudley	6	42.9	10	62.5	15	68.2	13	76.5	19	76.0	6	66.7	12	63.2
Herefordshire	1	33.3	2	100.0	2	50.0	2	50.0	1	50.0	1	100.0	0	0.0
Sandwell	38	56.7	36	66.7	44	78.6	34	59.6	40	65.6	25	54.3	42	71.2
Shropshire	2	66.7	7	87.5	5	62.5	9	75.0	5	100.0	5	62.5	4	66.7
Solihull	7	77.8	1	33.3	9	81.8	8	88.9	2	28.6	5	83.3	3	42.9
Staffordshire	18	81.8	13	59.1	11	68.8	13	76.5	13	59.1	15	83.3	15	65.2
Stoke-on-Trent	14	82.4	13	76.5	23	79.3	15	62.5	12	57.1	11	55.0	10	66.7
Telford and Wrekin	7	87.5	3	50.0	3	75.0	7	70.0	3	33.3	4	80.0	2	100.0
Walsall	21	80.8	18	69.2	28	77.8	17	60.7	20	74.1	14	70.0	13	81.3
Warwickshire	19	65.5	19	67.9	12	52.2	11	40.7	16	53.3	16	53.3	8	61.5
Wolverhampton	29	64.4	27	73.0	40	80.0	32	66.7	35	70.0	23	71.9	22	66.7
Worcestershire	11	78.6	10	66.7	14	70.0	12	66.7	9	45.0	8	47.1	11	84.6
West Midlands	**383**	**68.0**	**333**	**70.6**	**407**	**72.2**	**368**	**64.9**	**352**	**66.3**	**273**	**65.2**	**267**	**67.4**

***proportion of all pulmonary cases that are culture confirmed**

Table Bix: TB outcome at 12 months for drug sensitive cases with expected treatment duration of less than 12 months*, West Midlands, 2001-2014

	Treatment completed		Died		Lost to follow up		Still on treatment		Treatment stopped		Not evaluated**		Total
	n	%	n	%	n	%	n	%	n	%	n	%	
2001	425	64.7	41	6.2	29	4.4	10	1.5	4	0.6	148	22.5	**657**
2002	526	69.9	42	5.6	50	6.6	21	2.8	12	1.6	101	13.4	**752**
2003	514	70.1	51	7.0	42	5.7	10	1.4	5	0.7	111	15.1	**733**
2004	631	73.0	62	7.2	47	5.4	20	2.3	4	0.5	100	11.6	**864**
2005	570	68.7	46	5.5	33	4.0	18	2.2	8	1.0	155	18.7	**830**
2006	565	67.7	51	6.1	43	5.1	14	1.7	5	0.6	157	18.8	**835**
2007	672	77.2	57	6.5	44	5.1	21	2.4	5	0.6	72	8.3	**871**
2008	758	82.7	69	7.5	32	3.5	18	2.0	8	0.9	32	3.5	**917**
2009	743	81.8	48	5.3	26	2.9	51	5.6	8	0.9	32	3.5	**908**
2010	633	80.0	52	6.6	32	4.0	53	6.7	8	1.0	13	1.6	**791**
2011	723	81.1	54	6.1	37	4.2	59	6.6	9	1.0	9	1.0	**891**
2012	823	85.6	43	4.5	34	3.5	50	5.2	9	0.9	3	0.3	**962**
2013	735	85.8	35	4.1	31	3.6	43	5.0	13	1.5	0	0.0	**857**
2014	575	83.1	47	6.8	28	4.0	27	3.9	12	1.7	3	0.4	**692**

***excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease**
****not evaluated includes missing or unknown outcomes and transferred out**

Table Bx: Last recorded outcome for cases with rifampicin sensitive, CNS, spinal, miliary or cryptic disseminated disease, West Midlands, 2001-2014

	Treatment completed		Died		Lost to follow up		Still on treatment		Treatment stopped		Not evaluated**		Total
	n	%	n	%	n	%	n	%	n	%	n	%	
2001	23	57.5	5	12.5	3	7.5	0	0.0	1	2.5	8	20.0	**40**
2002	28	70.0	4	10.0	2	5.0	0	0.0	0	0.0	6	15.0	**40**
2003	34	70.8	5	10.4	1	2.1	0	0.0	1	2.1	7	14.6	**48**
2004	33	64.7	7	13.7	4	7.8	2	3.9	0	0.0	5	9.8	**51**
2005	49	56.3	8	9.2	8	9.2	2	2.3	0	0.0	20	23.0	**87**
2006	55	61.8	9	10.1	1	1.1	2	2.2	0	0.0	22	24.7	**89**
2007	38	77.6	5	10.2	2	4.1	0	0.0	0	0.0	4	8.2	**49**
2008	56	70.9	14	17.7	3	3.8	0	0.0	0	0.0	6	7.6	**79**
2009	78	84.8	8	8.7	3	3.3	2	2.2	0	0.0	1	1.1	**92**
2010	53	74.6	11	15.5	5	7.0	0	0.0	0	0.0	2	2.8	**71**
2011	83	83.8	5	5.1	10	10.1	0	0.0	0	0.0	1	1.0	**99**
2012	84	84.0	9	9.0	7	7.0	0	0.0	0	0.0	0	0.0	**100**
2013	85	78.7	13	12.0	9	8.3	0	0.0	1	0.9	0	0.0	**108**
2014	60	78.9	8	10.5	2	2.6	5	6.6	1	1.3	0	0.0	**76**

***not evaluated includes missing or unknown outcomes and transferred out**

Table Bxi: Drug resistance among culture confirmed TB cases, West Midlands, 2000-2015

	Resistance to at least one first line drug		Rifampicin resistant		Isoniazid resistant		Multi-drug resistant	
	n	%*	n	%**	n	%†	n	%*
2000	19	5.8	2	0.6	19	5.8	2	0.6
2001	21	5.7	5	1.4	17	4.6	4	1.1
2002	35	8.0	1	0.2	33	7.5	0	0.0
2003	20	4.6	2	0.5	19	4.4	2	0.5
2004	26	4.9	5	0.9	23	4.3	4	0.7
2005	27	5.1	3	0.6	24	4.6	2	0.4
2006	21	3.9	3	0.6	20	3.7	3	0.6
2007	27	4.9	6	1.1	25	4.5	6	1.1
2008	22	4.1	9	1.7	20	3.7	8	1.5
2009	34	5.9	5	0.9	32	5.6	4	0.7
2010	31	6.0	9	1.7	30	5.8	8	1.6
2011	41	6.8	11	1.8	38	6.3	11	1.8
2012	34	5.8	13	2.2	31	5.3	11	1.9
2013	41	7.7	14	2.6	36	6.8	12	2.3
2014	23	5.5	3	0.7	21	5.0	2	0.5
2015	32	8.1	8	2.0	29	7.3	7	1.8

***proportion of cases with DST results for at least rifampicin and isoniazid**
****proportion of cases with DST results for rifampicin**
†proportion of cases with DST for isoniazid

Table Bxii: Number and proportion of cases by social risk factor for TB cases greater than 14 years, West Midlands, 2010-2015

	At least one social risk factor		Drug misuse		Alcohol misuse		Homeless†		Prison†		Two or more SRFs	
	n	%*	n	%**	n	%**	n	%**	n	%**	n	%*
2010	61	8.9	19	2.5	23	3.1	16	2.1	20	2.8	13	1.9
2011	61	7.4	27	3.1	23	2.6	14	1.6	27	3.1	24	2.9
2012	75	8.4	26	2.8	26	2.8	14	1.5	36	3.9	20	2.2
2013	88	10.6	37	4.2	24	2.8	30	3.4	31	3.6	29	3.5
2014	62	9.3	29	4.1	21	3.0	16	2.3	25	3.6	20	3.0
2015	78	12.9	33	5.3	30	4.8	22	3.5	43	6.8	35	5.8

***proportion of cases with social risk factor information available**
****proportion of cases with information available for each individual social risk factor**
†current or previous history of

Appendix C: Local authority TB epidemiological summaries

Local authority TB epidemiological summaries will provide further information about TB cases among residents of West Midland upper tier local authorities with an average of at least 50 TB cases per year over the previous three years. Please contact your local FES team for information.

Appendix D: Latent TB infection testing and treatment

Please see the Tuberculosis in England: 2015 report for information on Latent TB infection testing and treatment at a national level.
https://www.gov.uk/government/publications/tuberculosis-in-england-annual-report

Glossary

Acquired resistance
Acquired resistance is classed as resistance identified on repeat culture after three months of the first specimen date. Cases with a change from a sensitive to resistant result following treatment start are reclassified as acquired resistance, even if this is within the three-month period.

BCG
Bacillus Calmette-Guérin vaccination

Cluster
Clusters in this document refer to molecular clusters only. These are defined as two or more patients who are infected with a strain of *Mycobacterium tuberculosis* complex with indistinguishable MIRU-VNTR profiles. Each cluster must have at least one person with a full 24 MIRU-VNTR profile, and other members of the cluster may have a maximum of one missing loci.

Drug resistant cohort
The drug resistant cohort includes any cases with rifampicin resistant TB (initial or acquired), including MDR-TB (initial or acquired), as well as those without culture confirmation treated with an MDR-TB regimen.

Drug sensitive cohort
The drug sensitive cohort excludes all TB cases with rifampicin resistant TB (initial or acquired) including MDR-TB (initial or acquired), and non-culture confirmed cases treated with an MDR-TB regimen.

Extensively-drug resistant TB (XDR-TB)
XDR-TB is defined as resistance to isoniazid and rifampicin (MDR-TB), at least one injectable agent (capreomycin, kanamycin or amikacin) and at least one fluoroquinolone (moxifloxacin, ofloxacin, ciprofloxacin).

First-line drug resistance
First-line drug resistance is defined as resistance to at least one of the first line drugs (isoniazid, rifampicin, ethambutol, pyrazinamide).

Initial resistance
Initial resistance is class as resistance identified within three months of the first specimen date.

Multi-drug resistant TB (MDR-TB)

MDR-TB is defined as resistance to at least isoniazid and rifampicin, with or without resistance to other drugs.

Multi-drug resistant/ Rifampicin resistant TB (MDR/RR-TB)

MDR/RR-TB is defined as resistance to rifampicin including MDR-TB cases.

Post-mortem diagnosis

A case diagnosed at post-mortem is defined as a case where TB was not suspected before death, but a TB diagnosis was made at post-mortem, with pathological and/or microbiological findings consistent with active TB that would have warranted anti-TB treatment if discovered before death.

Pulmonary tuberculosis

A pulmonary case is defined as a case with TB involving the lungs and/or tracheo-bronchial tree, with or without extra-pulmonary TB diagnosis. In this report, in line with the WHO's recommendation and international reporting definitions, miliary TB is classified as pulmonary TB due to the presence of lesions in the lungs.