Public Health England

Tuberculosis in the UK 2013 report

Health Protection Scotland

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About Public Health England

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This report is accompanied by a slideset which includes the figures presented in this report and additional figures. This slideset can be downloaded from http://www.hpa.org.uk/Publications/InfectiousDiseases/Tuberculosis/

Further tables, such as those containing breakdown by local geography, are also available online at http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Tuberculosis/TBUKSurveillanceData/EnhancedTuberculosisSurveillance/

Foreword

I am pleased to introduce the 2013 UK annual tuberculosis (TB) report, based on data provided by nurses, physicians, microbiologists and surveillance officers from across the UK. This report provides a comprehensive picture of the occurrence and management of TB in the UK, which should be used to inform TB control at both the local and national level.

TB rates in the UK have stabilised at a high level in recent years, and the UK now has one of the highest incidence rates of any Western European country. Within the UK, TB is very unequally distributed, with certain sub-groups, such as new migrants, ethnic minority groups, and those with social risk factors disproportionally affected. Action is required to ensure that best practice in prevention, control and treatment is delivered to all communities across the country.

Given the importance of TB as a public health issue, we have made TB one of the key priorities for Public Health England (PHE) and are working with key stakeholders to oversee the development of a stronger national approach. This will have at its heart support to local clinical, preventive and social care services in the NHS, local government and wider health and social care system. Many of the actions needed to eliminate the burden of TB require strengthened and more integrated local services which ensure consistent, evidence based prevention, treatment and support to patients, their families and other contacts - TB does not exist in isolation from other health and social concerns. We are determined to see a sustained reduction in TB, and will work tirelessly to support local partners in those areas where the burden is greatest.

I trust that we can all work together to ensure that this vision is achieved.

Dr Paul Cosford

Director for Health Protection
Public Health England

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We gratefully acknowledge all those who contributed information on TB cases in the UK, including physicians, nurses, microbiologists, scientists and administrative staff. Special thanks are extended to those who coordinate and oversee TB surveillance at regional/country level for their essential collaboration in the ongoing improvements to TB surveillance.

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Errata list

- Chapter 1, page 9, Figure 1.2 showing three-year average tuberculosis case rates by local authority (England), health board (Scotland and Wales) and Northern Ireland, 2010-2012: the map has been replaced as rates colours did not appear in some areas in the published version of the map

- Chapter 1, page 10, Demographic characteristics: the proportion of patients aged 5 to 14 years is **3%**

- Chapter 1, page 12, Demographic characteristics: the majority of patients aged 0 to 14 years were born **in the UK**

- Chapter 1, page 12, Demographic characteristics, rates by ethnic group in patients aged 0 to 14 years: the highest rates were in the Black, Pakistani and Indian ethnic groups (**30**, **25** and **17** per 100,000 respectively)

- Chapter 1, page 13, Clinical characteristics: in 2011, 4% (326/8,070) of TB cases aged **14 and over** were co-infected with HIV

- Chapter 2, page 20, Figure 2.3. The proportion of cases from Eastern Europe with resistance to at least one second line drug is 61.5%, and the proportion of cases from Eastern Europe with resistance to at least one injectable drug is 61.5%

- Chapter 5, page 33, Table 5.1: in 2012, the completeness of information for the “sputum smear status” field was **61%** for England, Wales and Northern Ireland and **60%** for the UK

- Appendix – Supplementary tables, page 41, Table 1.4: a note has now been added to specify that time since entry to the UK to tuberculosis diagnosis was measured in years

1. Tuberculosis case reports, UK, 2000-2012

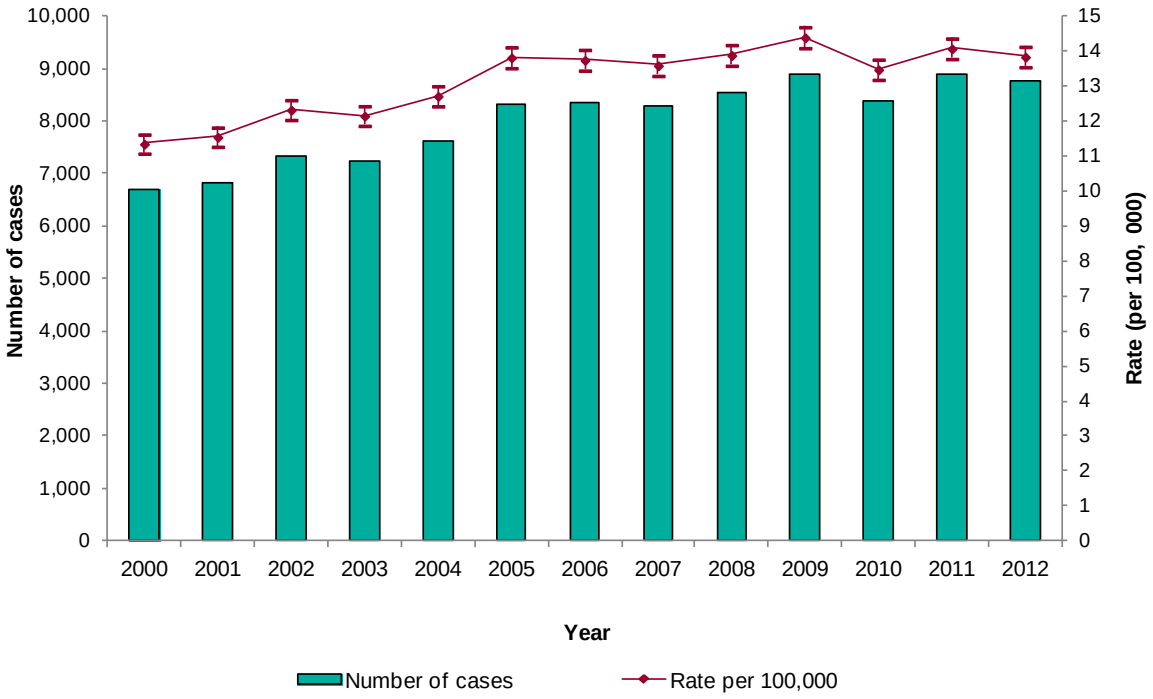
Key messages

- a total of 8,751 cases of TB were reported in the UK in 2012, an incidence of 13.9/100,000
- TB notifications and rates in the UK have remained relatively stable since 2005, following a rise in the previous two decades
- as in previous years, the majority of TB cases (73%) occurred among people born in high-burden countries, and were concentrated in large urban centres
- for cases born outside the UK, almost half were diagnosed within five years of entering the UK
- 7.3% of TB cases had at least one social risk factor (history of homelessness, imprisonment, drug or alcohol misuse); only 43% of these were reported to have started on directly observed therapy

Overall numbers, rates and geographical distribution

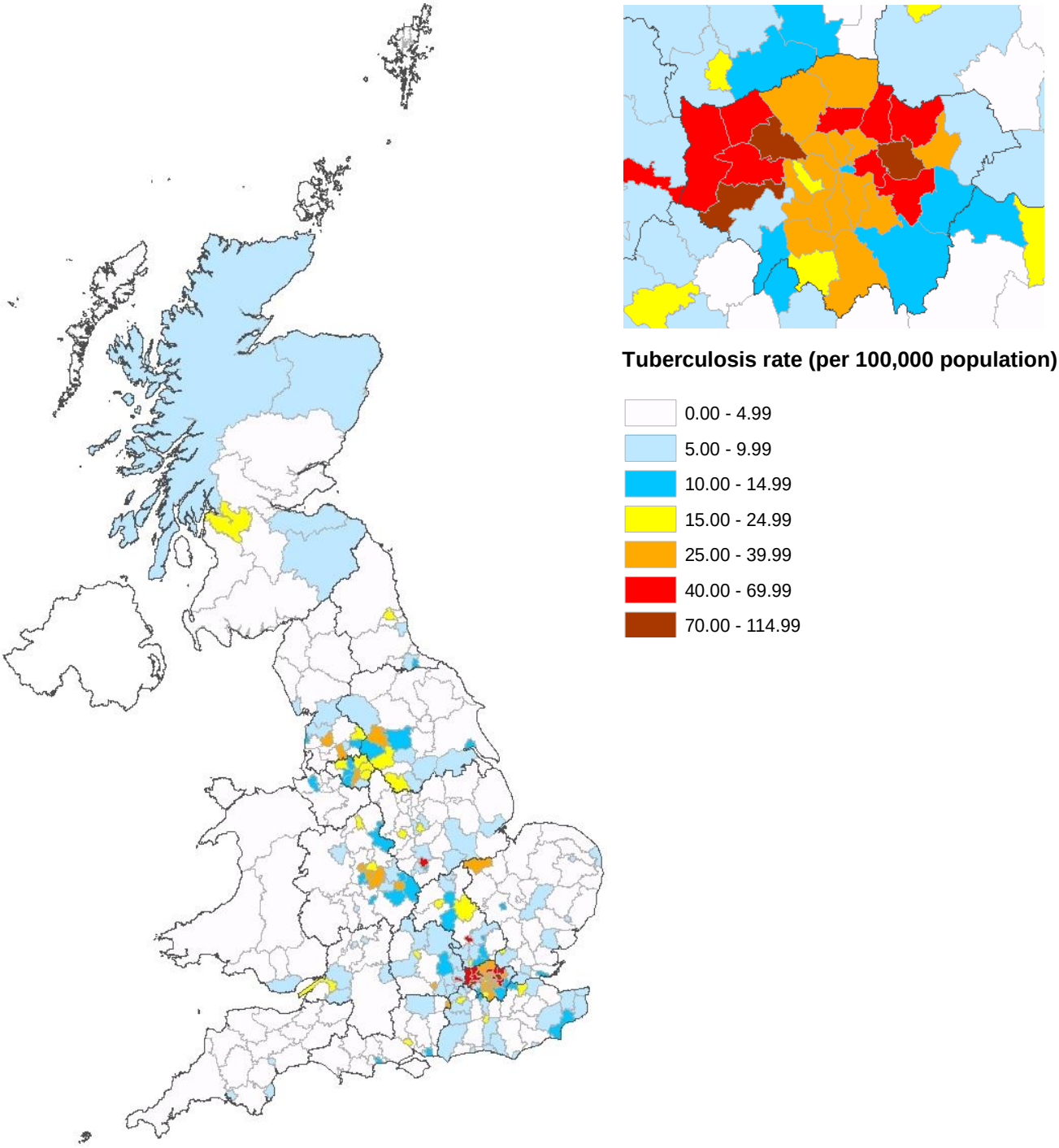
In 2012 in the UK, a total of 8,751 cases of TB were reported, a rate of 13.9 cases per 100,000 population (95% confidence interval (CI) 13.6-14.1) (Figure 1.1, Appendix Table 1.1). TB notifications and rates increased until 2005, and have remained high but relatively stable since.

Figure 1.1: Tuberculosis case reports, rates and annual percentage change, UK, 2000-2012



As in previous years, London accounted for the highest proportion of cases in the UK (39%, 3,426/8,751) and the highest rate of disease (41.8 cases per 100,000; 95% CI 40.4-43.2), followed by the West Midlands PHE Centre (PHEC) area (12%, 1,085; 19.3 per 100,000; CI 18.2-20.5) (Appendix Table 1.3). The main burden of disease remained concentrated in large urban areas (Figure 1.2).

Figure 1.2: Three-year average tuberculosis case rates by local authority (England), health board (Scotland and Wales) and Northern Ireland. UK, 2010-2012



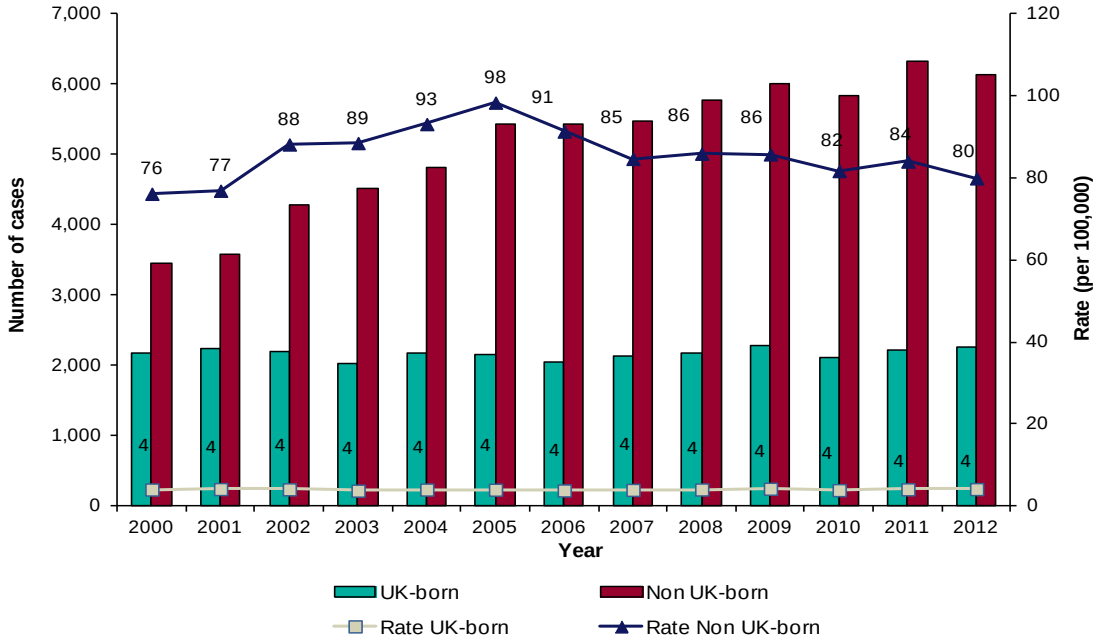
Demographic characteristics

Just over half of all cases in 2012 were male (58%, 5,045/8,751). Over 60% were 15 to 44 years old (5,291/8,751). Patients aged 45 to 64 years accounted for 21%, and those 65 years and over for 14% of all cases. Three percent of patients were aged 5 to 14 years and 2% were aged less than five years.

Place of birth (UK-born/non UK-born) was known for 96% (8,382/8,751) of cases reported in the UK in 2012. Similarly to 2011, 73% (6,125/8,382) of these were born outside the UK. The rate of TB in the UK-born remained similar to previous years at 4.1 per 100,000. The highest rate in the UK-born population was in those aged 75 years and older (6.6 per 100,000) (Appendix Figure 1.1). The rate in UK-born children under five years of age, an indicator of recent transmission, was 4.2 per 100,000. In 2012, the UK child-to-adult ratio in notification rate, which is used as a proxy for ongoing transmission in a community, was 0.23[1] showing a sustained decline over the last decade.

The rate of TB amongst the non UK-born population was almost 20 times the rate in the UK-born, at 80 per 100,000 (Figure 1.3), but continued to decline since the peak of 98 per 100,000 in 2005. As in previous years, the majority of non UK-born cases originated from South Asia (60%, 3,626/6,028) and sub-Saharan Africa (22%, 1,346). India, Pakistan and Somalia were the most common countries of origin of non UK-born cases (31%, 1,858/6,045, 18%, 1091 and 6%, 380 respectively) (Appendix Table 1.4).

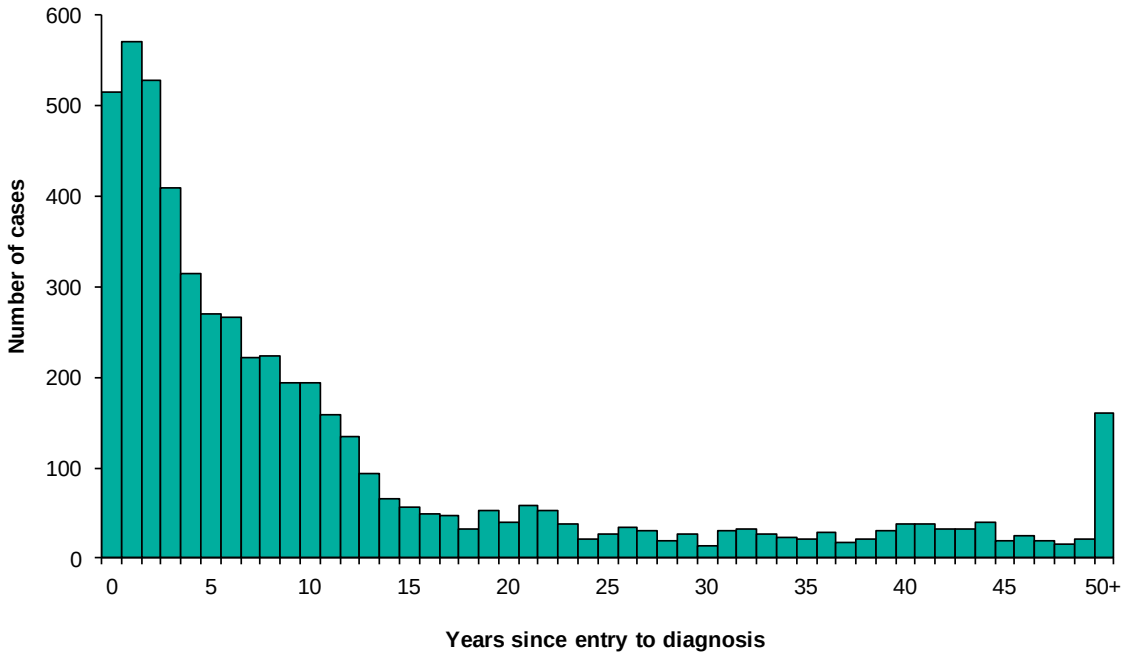
Figure 1.3: Tuberculosis case reports and rates by place of birth, UK, 2000-2012



[1] The child-to-adult ratio is the ratio of the case notification rate in children under 15 years of age, to that in adults. A declining trend in the ratio suggests a decrease in ongoing transmission.

Time between entry to the UK until TB diagnosis was known for 89% (5,430/6,125) of non UK-born cases. Of these, 30% (1,612) were diagnosed within two years and 48% (2,606) within five years of entering the UK (Figure 1.4).

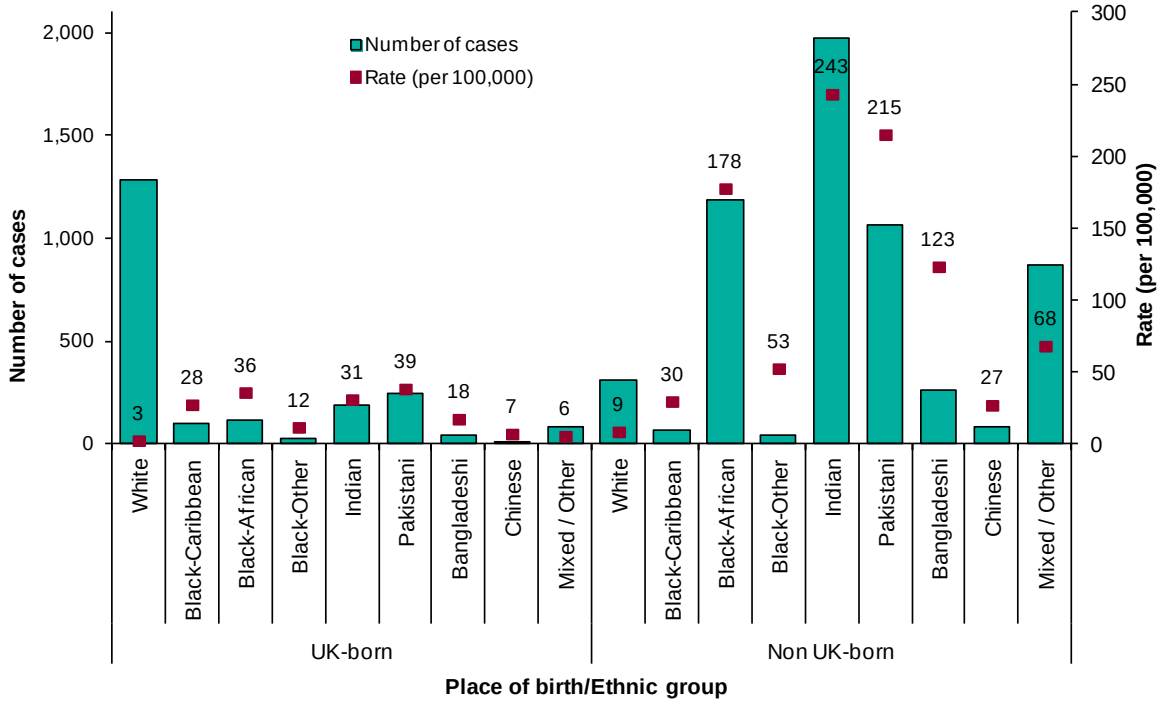
Figure 1.4: Non UK-born tuberculosis case reports by time since entry to the UK to tuberculosis diagnosis, UK, 2012



Information on ethnic group was available for 95% of cases reported in 2012 (8,525/8,751). The largest proportions of cases were from the Indian (27% 2,296/8,525), White (21%, 1,814) and Pakistani (17%, 1,418) ethnic groups. The highest rates were in the Indian, Pakistani and Black[2] ethnic groups (155, 132 and 97 per 100,000 respectively), although rates in all three ethnic groups had declined compared to 2011 (162, 134 and 100 respectively). For England, Wales and Northern Ireland it was possible to calculate incidence rates for all ethnic groups by place of birth (UK-born/non UK-born), as detailed 2011 Census denominator data have now been released. Among the non-UK born, the highest rates were in the Indian, Pakistani and Black-African ethnic groups (243, 215 and 178 per 100,000 respectively) (Figure 1.5).

[2] Number of cases and rates for the Black African, Black Caribbean and Black Other ethnic groups have been grouped together as only cumulative denominator data were available for the whole of the UK at time of publication.

Figure 1.5: Tuberculosis case reports and rates by ethnic group and place of birth, England, Wales and Northern Ireland, 2012[3]



The majority of cases aged 0 to 14 years were born in the UK (67%, 260/386). The largest proportions of children in this age group were from the Black African (30%, 122/407), Pakistani (19%, 78) and White (17%, 69) ethnic groups. Of these, the highest rates were in the Black, Pakistani and Indian ethnic groups (30, 25 and 17 per 100,000 respectively).

Nearly half (44%, 3,226/7,370) of TB cases aged 16 years and over in 2012 with known occupational status were unemployed; 12% (887) were either studying or working in education, 6% (462) were health-care workers, and the remaining cases (2,795) had other occupations.

Clinical characteristics

Just over half of TB cases reported in 2012 where site of disease was known had pulmonary disease (53%, 4,563/8,659). Over one in five cases (830) with pulmonary disease were also reported to have extra-pulmonary disease in at least one additional site. Pulmonary disease was also the most common clinical presentation for cases aged 0 to 14 years (68%, 276/403).

[3] Rates calculated using 2011 ONS Census data. Full 2011 Census data for Scotland not yet published.

Data on the planned course of treatment were known for 51% of cases (4,457/8,751); 92% (4,111) of these were planned to start on a standard 6-month course of treatment. Information on whether a patient was treated with directly observed therapy (DOT) was known for 91% of cases (7,961/8,751); of these 10% (766) were reported to have received DOT treatment.

Information on previous history of TB was available for 94% (8,213/8,751) of cases; of these 6% (452) had a previous diagnosis of TB more than 12 months previously. Among cases known to have a previous diagnosis of TB, 22% (97/441) were assigned to DOT. Information on whether cases were hospital in-patients at diagnosis was available for 95% of cases (8,291/8,751); of these 27% (2,261/8,291) were hospital in-patients at diagnosis.

Data on BCG vaccination status were available for 71% of cases (6,029/8,751); 71% (4,262) of these had previously received BCG vaccination. Almost two-thirds of cases aged 0 to 14 years had received BCG vaccination (68%, 245/358); the proportion of children who had not received BCG vaccination was the same for UK-born children (32%, 76/236) and non UK-born children (32%, 35/108).

The most recent year for which TB-HIV co-infection data are available for England, Wales and Northern Ireland is 2011. In 2011, 3.6% (296/8,120) of TB cases aged 14 and over were co-infected with HIV. This is a continuation of the downward trend observed since the proportion peaked at 9% in 2003-2004.

In 2012, information on HIV testing was known for 63.6% of cases whose HIV status was not previously known (5,401/8,498). Of these, 86.7% of cases (4,685) were offered and received HIV testing, 7.8% of cases (421) were not offered testing, and 5.5% (295) were offered HIV testing but did not receive it, of which 1.7% (93) declined.

Diagnostic delay

Information on time from symptom onset to TB diagnosis was available for 68% of patients (5928/8751), with a median time between onset of symptoms to TB diagnosis of 74 days (interquartile range (IQR) 36-146). Forty three percent (2,545/5,928) of patients were diagnosed more than 90 days after symptom onset. Compared with patients with a diagnostic delay of less than 90 days, a higher proportion of patients with a delay of 90 days or more were aged 45 years or older (38%, 978 versus 32%, 1,089) and had extra-pulmonary disease (54%, 1,370 versus 40%, 1,350).

Social risk factors

The completeness of information on four individual social risk factors ranged from 90-92%. Among cases with known information, 2.8% (228/8,019) had a history of problem drug use, 3.2% (255/7,947) of alcohol misuse/abuse, 2.4% (194/8,088) of homelessness and 2.8% (225/7,918) had a history of

imprisonment. A total of 7.7% of cases (637/8,321) had at least one of these social risk factors, a third of whom (195/637) had more than one risk factor.

A higher proportion of UK-born cases had at least one social risk factor than non UK-born cases (13.4% versus 5.4%). Nearly half of cases with at least one social risk factor were from the White ethnic group (46%, 288/623), and 17% (103) were Black African. Over 60% (387/637) of cases with at least one social risk factor were aged 15 to 44 years.

Of cases with at least one social risk factor, the majority had pulmonary disease (76%, 484/634); of these 66% (238/360) for whom a sputum smear result was available were sputum smear positive. Just under 10% (56/597) of cases with at least one risk factor were reported to have a previous history of TB, and only 43% (239/551) of those for whom information was available were reported to have started on DOT. Two-thirds (60%) of cases with at least one risk factor were diagnosed within 90 days of the onset of their symptoms (284/458).

2. Microscopy, culture confirmation, speciation and drug susceptibility

Key messages

- the proportion of TB cases with resistance to any first line drug (7.4 %) was slightly lower in 2012 than in 2011; the proportion of multi-drug resistant (MDR) TB cases (1.6 %) remained stable
- the majority of cases with MDR TB (89%) were born outside the UK
- although the total number of TB cases born in Eastern Europe remained low (69), a particularly high proportion of those that were culture confirmed had MDR TB (13/54, 24.1%)
- two cases of extensively drug resistant (XDR) TB were reported in 2012, compared with six in 2011

Microscopy, culture and species identification

Of all TB cases reported in 2012, 59.4% (5,200/8,751) were culture confirmed. This proportion was higher for pulmonary cases compared to extra-pulmonary cases (68.7%, 3,135/4,563 versus 49.5%, 2,027/4,096). The proportion of culture confirmed pulmonary cases exceeded the goal of 65% in the Chief Medical Officer's Action Plan [1], but did not reach the target of 80% set by the European Centre for Disease Prevention and Control [2].

Among all culture-confirmed cases, 97.1% (5,048/5,200) were identified with *Mycobacterium tuberculosis* infection; 1.0% (54) with *Mycobacterium africanum;* 0.7% (35) with *Mycobacterium bovis*; and 1.2% (63) with *Mycobacterium tuberculosis* complex (MTBC) bacteria which were not further differentiated. This distribution is similar to previous years.

For 60.5% of pulmonary TB cases (2,761/4,563) a sputum smear result was known, and of these 51.1% (1,411/2,761) were sputum smear positive.

First line drug resistance and MDR TB

Drug susceptibility test results for at least isoniazid and rifampicin, were available for 99.1% (5,151/5,200) of the culture-confirmed cases. At the start of treatment, 6.8% (351/5,151) of these were resistant to isoniazid, 1.8% (91/5,151) were resistant to rifampicin, 1.0% (51/5,151) were resistant to ethambutol, 0.9% (45/5,151) were resistant to pyrazinamide, 7.4% (379/5,151) had

resistance to at least one first line antibiotic, and 1.6% (81/5,151) were MDR, with resistance to at least isoniazid and rifampicin.

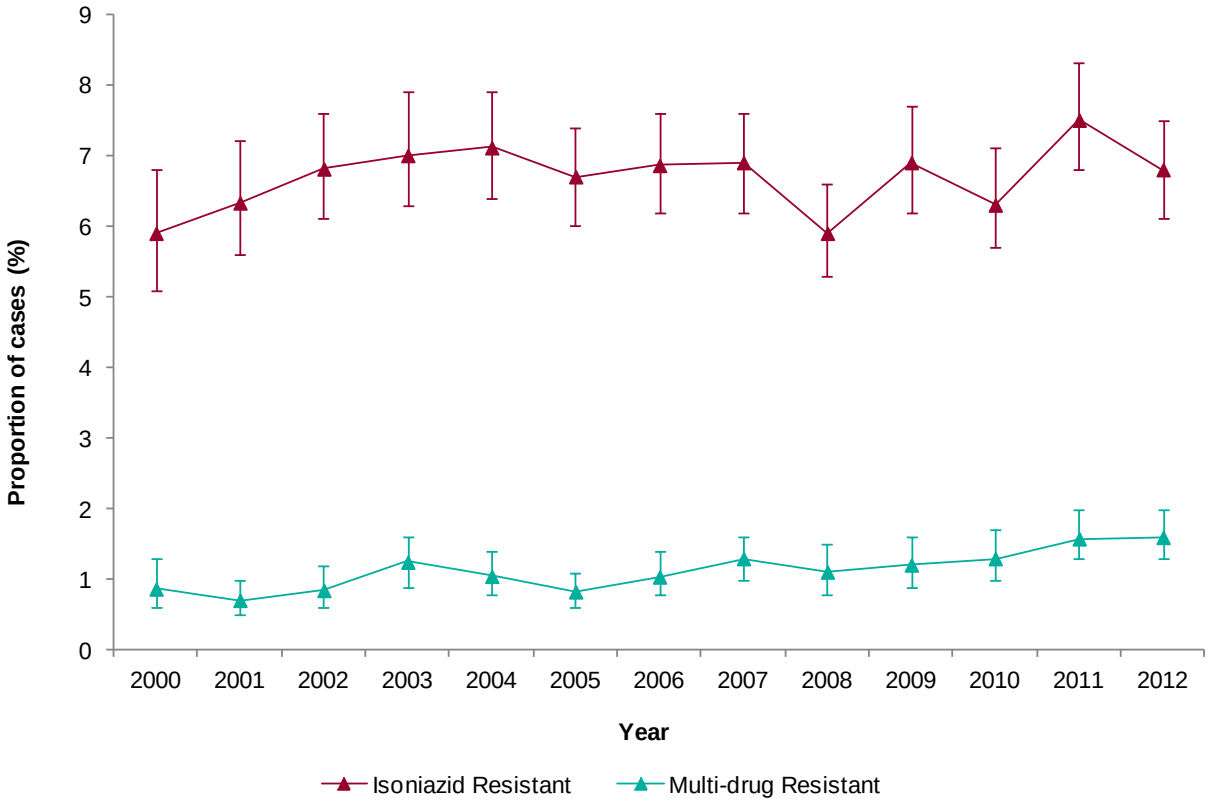
Table 2.1: Number and proportion of tuberculosis cases with drug resistance by place of birth, UK, 2012*

Place of birth	Isoniazid resistant		Resistant to any first line drug**		Multi-drug resistant		Total[$]
	n	%	n	%	n	%	
UK-born	64	5.3	70	5.8	9	0.7	1,216
Non UK-born	274	7.4	296	8.0	71	1.9	3,709
Central Europe	6	4.3	6	4.3	5	3.6	139
Eastern Europe	19	35.2	20	37.0	13	24.1	54
Western Europe	10	10.4	10	10.4	5	5.2	96
East Mediterranean	2	4.9	3	7.3	0	0.0	41
East Asia	4	6.5	4	6.5	0	0.0	62
South Asia	151	7.0	163	7.6	31	1.4	2,144
South East Asia	19	10.1	23	12.2	2	1.1	189
North Africa	0	0.0	0	0.0	0	0.0	35
Sub-Saharan Africa	51	6.2	54	6.6	13	1.6	819
North America and Oceania	0	0.0	0	0.0	0	0.0	5
South and Central America and the Caribbean	7	10.3	8	11.8	0	0.0	68

* Cases with unknown place of birth are excluded. Region of birth is shown for those who are non UK-born. Non UK-born cases with unknown region of birth are excluded from regional breakdown
** First line drugs – isoniazid, rifampicin, ethambutol and pyrazinamide
[$] Culture confirmed cases with drug susceptibility results for at least isoniazid and rifampicin

The proportion of isoniazid resistant cases decreased slightly from 7.5% (400/5,325) in 2011 to 6.8% (351/5,151) in 2012. The proportion of isoniazid resistance was higher in non UK-born cases compared to UK-born cases (7.4%, 274/3,709 versus 5.3%, 64/1,216). The proportion of cases resistant to isoniazid was particularly high among individuals born in Eastern Europe (35.2%; 19/54), Western Europe (10.4%; 10/96), South and Central America and the Caribbean (10.3%; 7/68) and South East Asia (10.1%; 19/189) (Table 2.1). The proportion of cases resistant to isoniazid was also higher in those with known social risk factors (history of drug or alcohol use, imprisonment or homelessness) compared to those known to have none of these risk factors (8.6%, 39/453 versus 6.7%, 297/4,428). In particular, isoniazid resistance was high in those reporting a history of homelessness (13.5%; 19/141).

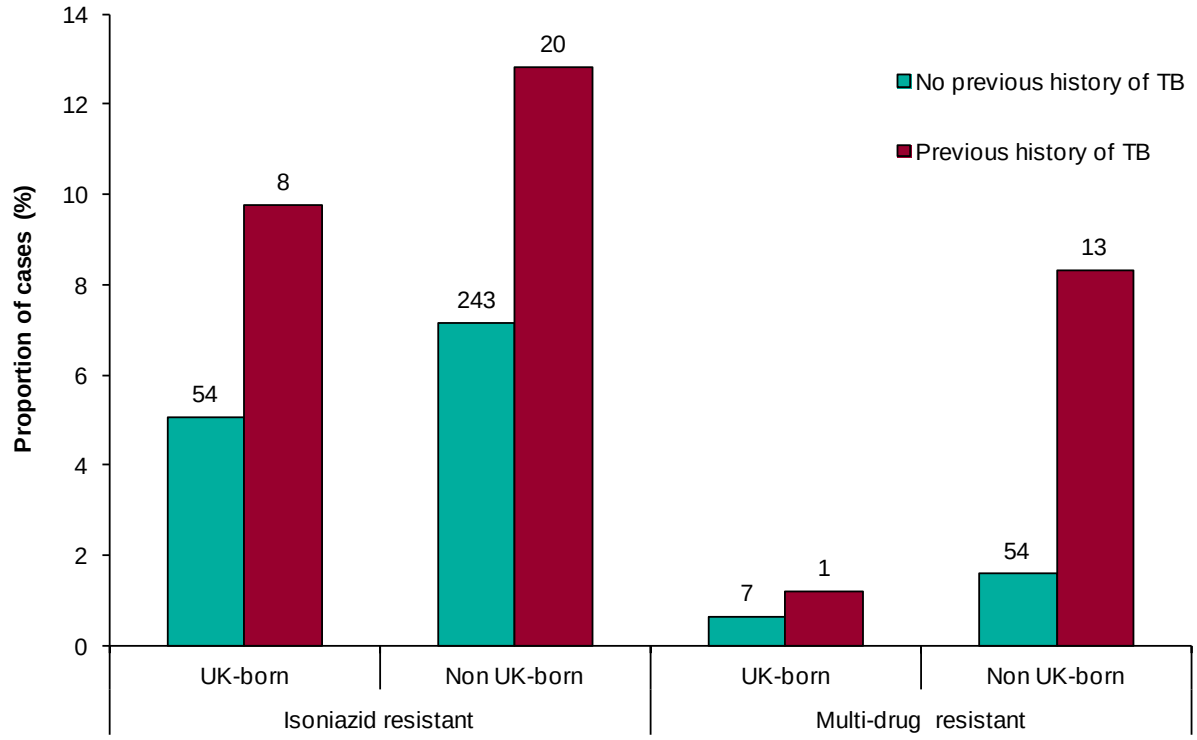
Figure 2.1: Proportion of tuberculosis cases with first line drug resistance, UK, 2000-2012



Compared to 2011, there was a slight decrease in the proportion of cases resistant to any first line drug (2011: 8.4%, 448/5,325 versus 2012: 7.4%, 379/5,151). The proportion of MDR cases remained stable at 1.6% (2011: 84/5,324 versus 2012: 81/5,151) (Figure 2.1).

The proportion of cases resistant to any first line drug was higher in those with a previous history of TB diagnosis compared to those without (12.7%, 31/244 versus 7.2%, 329/4,570), with the same pattern observed in MDR cases (5.7%, 14/244 versus 1.4%, 62/4,570). This proportion was higher in non UK-born cases with a history of previous diagnosis (8.3%; 13/156) compared to UK-born cases (1.2%; 1/82) (Figure 2.2).

Figure 2.2: Proportion of cases UK-born and non UK-born with previous tuberculosis diagnosis and resistance, UK, 2012



The proportion of resistance to any first line antibiotic was higher in non UK-born cases compared to UK-born cases (8.0%; 296/3,709 versus 5.8%; 70/1,216).

The vast majority of MDR cases were non UK-born (89%; 71/80). Of non UK-born MDR cases, the majority (44.9%; 31/69) were born in South Asia, followed by Eastern Europe (18.8%; 13/69) and Sub-Saharan African (18.8%; 13/69). MDR cases represented 24.1% (13/54) of culture confirmed TB cases of those born in Eastern Europe, 1.6% (13/819) in Sub-Saharan Africa and 1.4% (31/2,144) in South Asia (Table 2.1). Compared to 2011, there was an increase in the number and proportion of MDR cases born in Western Europe (5.2%; 5/96 versus 0/76 in 2011) and Central Europe (3.6%; 5/139 versus 0.8%; 1/125 in 2011).

Table 2.2: Number and proportion of tuberculosis cases with drug resistance by age group, UK, 2012

Age Group	Isoniazid resistant		Resistant to any first line drug*		Multi-drug resistant		Total**
	n	%	n	%	n	%	
0-14	10	9.7	10	9.7	7	6.8	103
15-44	240	7.2	264	7.9	65	2.0	3,333
45-65	77	7.6	78	7.7	8	0.8	1012
65+	24	3.4	27	3.8	1	0.1	703

* First line drugs – isoniazid, rifampicin, ethambutol and pyrazinamide
** Culture confirmed cases with drug susceptibility results for at least isoniazid and rifampicin

The number of MDR cases in the 0 to 14 years of age group increased to seven (6.8%, 7/103) in 2012 (Table 2.2), compared to only one case (1.1% (1/94) in 2011. Three of these cases were UK-born, three were non UK-born and one was of unknown place of birth. Strain type clustering was identified in five of these seven cases. The three non UK-born cases were family members who clustered together and had had contact with an adult MDR case abroad. The two UK-born cases were in two separate clusters containing adult household contacts, suggesting household transmission within the UK.

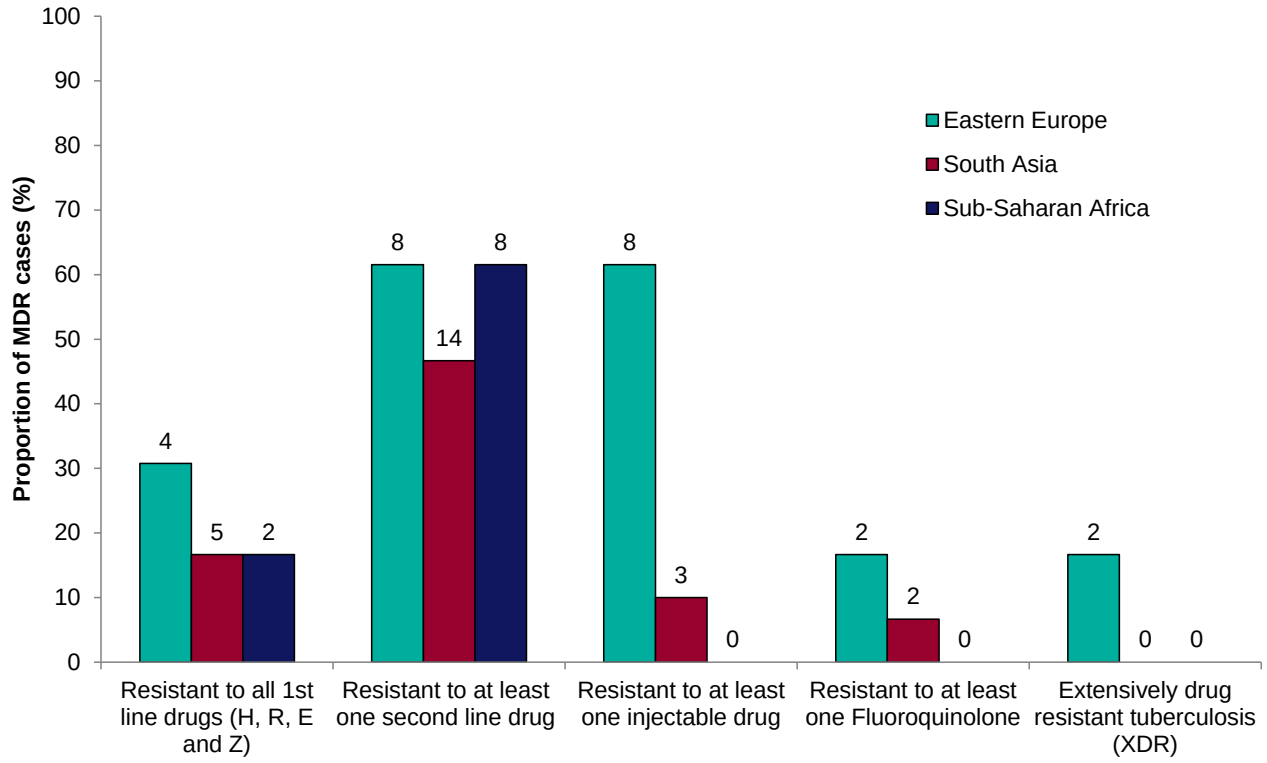
In addition to the culture confirmed MDR TB cases, in 2012 three TB cases who were not culture confirmed in the UK received MDR TB treatment. Two of these cases were contacts of a culture confirmed MDR TB case and one entered the UK having been culture confirmed abroad.

Second line drug resistance and XDR TB

Of those MDR TB cases that were tested for all first line drugs (isoniazid, rifampicin, ethambutol and pyrazinamide), almost one quarter were resistant to all four (20/79). Fifty-six percent (45/80) of MDR cases were resistant to at least one second line drug. Twenty percent (16/80) were resistant to an injectable agent (amikacin, capreomycin or kanamycin). Only 5% (4/79) were resistant to a fluoroquinolone (either ofloxacin or moxifloxacin), a decrease of 19.6% compared to fluoroquinolone resistance in 2011 (24.7%; 20/81).

A greater proportion of MDR strains from cases born in Eastern Europe had resistance to an injectable drug (61.5%; 8/13) compared to those from South Asia (10.0%, 3/30) (Figure 2.3). Fifty percent (6/12) of the MDR cases born in Eastern Europe had MDR TB with resistance to either an injectable or a fluoroquinolone, compared to 16.7% (5/30) of cases born in South Asia. Two cases from Eastern Europe had XDR TB; both had been in the UK for less than a year before diagnosis. A total of 26 XDR cases have been reported by UK laboratories since 1995.

Figure 2.3: Proportion* of MDR TB cases from Eastern Europe, South Asia and Sub-Saharan Africa with additional resistance, UK, 2012



* Proportions were calculated out of those who were tested

Development of drug resistance on repeat culture

In 2012, 0.2% (8/4,885) of culture confirmed cases with initial drug susceptibility for at least isoniazid and rifampicin were identified as having amplified resistance on repeat culture. In the three years from 2010-2012, two cases each year had developed MDR TB on repeat culture. Of these six cases, four were rifampicin sensitive and isoniazid resistant on initial culture, and two had been sensitive to both isoniazid and rifampicin. The median time until MDR development for these cases was 148 days (range 65-1066). For five of these six cases strain typing was available on the initial isolate and subsequent isolates, and the same strain was cultured each time.

Nine of the 66 MDR TB cases (14%) notified in 2010 were found to have developed further resistance in subsequent cultures taken during treatment. This proportion was lower for MDR cases diagnosed in 2011 (3.6%; 3/84) and 2012 (3.7%; 3/81); however not all the cases diagnosed in 2011 and 2012 had completed treatment at the time of analysis, so these proportions may increase.

TB isolates not matched to notified cases

The PHE Tuberculosis Surveillance Unit receives data from the mycobacterial reference laboratories in England, Wales and Northern Ireland on all laboratory confirmed TB isolates, including speciation, drug resistance and MIRU-VNTR strain type, and matches this data with notified cases. In addition to the 5,200 cases with a matched laboratory-confirmed isolate presented in this chapter, in 2012 TB isolates cultured from 579 individuals could not be matched to a notified case. Unmatched isolates may be from TB cases that were not notified to the surveillance system or isolates may have failed to match to a notified case if personal identifiers were incomplete or inaccurate, or if the case was notified in 2013; a small number may represent contaminants.

The unmatched isolates were similar to the isolates from notified cases in terms of speciation and drug resistance. The majority of isolates (95.2%; 551/579) were *M. tuberculosis*, 3.3% (19/579) were MTBC, 0.9% (5/579) were *M. bovis* and 0.7% (4/579) were *M. Africanum*.

Drug susceptibility test results, for at least isoniazid and rifampicin, were available for 96.9% (561/579) of these unmatched isolates. From initial culture, 6.2% (35/561) were resistant to isoniazid and 1.6% (9/561) were MDR TB. Two of the MDR isolates were resistant to all first line drugs, four were resistant to at least one second line drug, one was resistant to an injectable drug, one was resistant to a fluoroquinolone and none had XDR TB.

3. Strain typing, 2010-2012

Key messages

- the National Strain Typing Service has now been in operation for more than three years
- in 2012, 88% of culture confirmed cases had their strains typed at 23 loci or more
- based on MIRU-VNTR strain typing, the proportion of TB cases in the UK likely to be due to recent transmission was 40%
- non UK-born cases were more likely to have unique strain types than UK-born cases

The National Strain Typing Service, which was established in 2010, involves prospectively typing TB isolates using 24 loci Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats (MIRU-VNTR). Molecular clusters of patients with indistinguishable 24 loci MIRU-VNTR profiles which fulfil certain criteria are investigated to try to identify epidemiological links and transmission settings and inform public health action [3].

In 2012, 99.4% (4,901/4,932) of culture confirmed cases in England, Wales and Northern Ireland had strain typing completed and reported. Wales and Northern Ireland started 24 MIRU-VNTR strain typing later than England, and typed more than 99% of culture confirmed cases in 2012 (Table 3.1). Between January 2010 and December 2012, there were a total of 11,745 (79.9%) isolates from culture confirmed cases on which strain typing was completed for at least 23 loci; of these 6,113 cases were in 1,401 molecular clusters and 5,632 cases had a unique strain type.

Table 3.1: Number and proportion of culture confirmed cases typed or with 23 loci typed by year and country

Year	England		Wales		Northern Ireland		All	
	typed	≥23 loci	typed	≥23 loci	typed	≥23 loci	typed	≥23 loci
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
2010	4,038 (89.6)	3,133 (69.5)	22 (20.8)	19 (17.9)	3 (6.0)	3 (6.0)	4,063 (87.1)	3,155 (67.7)
2011	4,920 (99.2)	4,163 (83.9)	85 (94.4)	63 (70.0)	46 (95.8)	43 (89.6)	5,051 (99.1)	4,269 (83.8)
2012	4,752 (99.4)	4,195 (87.7)	99 (99.0)	85 (85.0)	50 (100.0)	41 (82.0)	4,901 (99.4)	4,321 (87.6)
Total	**13,710 (96.2)**	**11,491 (80.6)**	**206 (69.6)**	**167 (56.4)**	**99 (66.9)**	**87 (58.8)**	**14,014 (95.4)**	**11,745 (80.0)**

Clusters of TB cases with identical MIRU-VNTR strain types may reflect recent transmission, and the n-1 method[4] [4] can be used to estimate the proportion of cases likely to be due to recent

[4] n-1 method (number of cases in a cluster-number of clusters/number of cases with a strain type)

transmission in a population. This method has some limitations, as only around half of all TB cases in the UK are culture confirmed and genotyped, and clusters of TB cases with identical MIRU-VNTR strain types could reflect clustering of common endemic strain circulating either in the UK or abroad rather than recent transmission. However, it provides a useful estimate of the proportion of cases likely to be preventable through public health measures to reduce transmission in the UK. Applying this method to the three years of strain typing data, in England, Wales and Northern Ireland the proportion of cases likely to be due to recent transmission was 40%. This proportion varied by country, with lower estimates in Wales (8%) and Northern Ireland (14%). In England, the overall estimate was 40% and varied by PHEC area, with the highest proportion in London (34%), and the lowest in Cheshire and Merseyside (9%) (Table 3.2). The proportion of cases likely to be due to recent transmission in UK-born cases was 40%, with only 35% (977/2756) of cases having a unique strain. This proportion was lower (34%) for non UK-born cases, 51.9% (4,438/8,549) of whom had a unique strain (Table 3.3).

There were 532 new clusters in 2012, similar to the number in 2011 (525). Over the three year period from 2010-2012 there were a total of 1,401 clusters, with a median cluster size of three cases (range 2-121). The majority of clusters (79.1%, 1,110/1,401) were small in size (<5 cases), 14.1% (198) were medium sized (5-9 cases), 6.2% (87) were large clusters (>10 cases) and six clusters (0.4%) were very large (>50 cases).

The proportion of clusters with a median age of less than 15 years was higher for clusters with only UK-born cases (6/128, 4.7%) than for clusters with only non UK-born cases (<15 years, 3/732, 0.4%). More than one-quarter of clusters (370/1,401) had at least one case with a social risk factor, and 10.7% (150/1,401) of clusters had at least 50% of cases with at least one social risk factor. Having more than 50% of cases with social risk factors was more common in clusters consisting of exclusively UK-born cases (23.4%, 30/128), compared to clusters of exclusively non UK-born individuals (7.4%, 54/732).

About 35% (480) of clusters consisted of exclusively pulmonary cases and 9.1% (127) of exclusively extra-pulmonary cases, with the remainder being mixed. Almost all clusters consisting of exclusively UK-born cases included at least one pulmonary case (96.9%, 124/128); a lower proportion of clusters consisting of non UK-born cases had at least one pulmonary case (85.8%, 628/732).

The fact that a higher proportion of clusters of exclusively UK-born cases contained children, at least one pulmonary case and cases with social risk factors suggests that transmission of TB is occurring within certain subgroups of the UK-born population.

Table 3.2: Number of tuberculosis clusters and proportion of clustering by country and Public Health England Centre, 2010-2012

Country	Culture confirmed cases n	Cases with a strain type* n (%)	Number of cases clustered** n	Number of clusters n	Estimated proportion of cases likely due to recent transmission[$] %	Number of clusters by cluster size 2-4	5-9	10+
England, Wales and Northern Ireland[‡]	**14,692**	**11,745 (79.9)**	**6,113**	**1,401**	**40**	**1,110**	**198**	**93**
England[§]	14,248	11,491 (80.6)	5,973	1,371	40	1,084	198	89
Wales	296	167 (56.4)	26	12	8	12	0	0
Northern Ireland[#]	148	87 (58.8)	21	9	14	9	0	0
PHE Region/Centre								
North of England								
North East	310	223 (71.9)	46	17	13	16	1	0
Cumbria and Lancashire	347	238 (68.6)	79	22	24	17	4	1
Yorkshire and Humber	1,080	819 (75.8)	228	65	20	53	9	3
Greater Manchester	890	639 (71.8)	154	47	17	41	3	3
Cheshire and Merseyside	218	171 (78.4)	26	11	9	11	0	0
Midlands and East of England								
East Midlands	747	620 (83.0)	197	63	22	53	9	1
West Midlands	1,706	1,401 (82.1)	599	154	32	129	13	12
Anglia and Essex	466	376 (80.7)	81	33	13	32	1	0
South Midlands and Hertfordshire	610	486 (79.7)	122	41	17	37	3	1
London	5,997	4,999 (83.4)	2,286	593	34	487	69	37
South of England								
Sussex, Surrey and Kent	613	506 (82.5)	138	52	17	47	5	0
Thames Valley	516	424 (82.2)	87	36	12	35	1	0
Wessex	291	241 (82.8)	62	21	17	20	0	1
Devon, Cornwall and Somerset	152	122 (80.3)	30	8	18	7	0	1
Avon, Gloucestershire and Wiltshire	305	226 (74.1)	55	20	15	19	1	0

* Culture confirmed cases with a MIRU-VNTR profile with at least 23 complete loci
** Clustered cases are clustered within geographical area
[$] Calculated using the n-1 method (number of cases in a cluster-number of clusters/number of cases with a strain type)
[‡] The number of clusters in England, Wales and Northern Ireland is higher than the sum of all clusters in the three countries because it includes clusters that span more than one country
[§] The number of clusters in England is higher than the sum of all PHEC clusters because it includes clusters that span more than PHEC
[#] The number of culture confirmed cases in Northern Ireland reported here is less than the 157 culture confirmed cases known about locally

More than half of all clusters contained non UK-born cases only (732/1401); a higher proportion of these clusters contained cases with extra-pulmonary disease only (104/732, 14.2%). Clusters made up of exclusively non UK-born cases with extra-pulmonary disease were likely to reflect clusters of individuals with common imported strains, rather than recent transmission in the UK.

About 16% (220) of clusters had one or more isoniazid resistant case and 4.2% (59) had one or more MDR TB case.

Over 40% of clusters (606) were of Euro-American lineage, followed by 28% (392) Central Asian strain (CAS), 10% (149) East African Indian (EAI) lineage and less than 5% (67) Beijing strain.

A total of 196 clusters (14%) were investigated over the last three years. By December 2012, 108 (55%) clusters remained under active investigation and 88 (45%) had been closed following investigation, because either no epidemiological links were found or links were found but no further public health action was required. Eighty six (44%) of the clusters that were investigated were national clusters; 47.7% (41) of these had at least one epidemiological link identified between individuals within the cluster.

Data on epidemiological links obtained from the cluster investigations is being combined with the MIRU-VNTR data for the three years 2010-2012, and will be used to conduct more detailed epidemiological analyses. These should enable more accurate estimates of the proportion of cases due to recent transmission in the UK, and exploration of the characteristics of cases and clusters associated with transmission.

Table 3.3: Number of tuberculosis cases and proportion of clustering stratified by place of birth, 2010-2012

	Culture confirmed cases n	Cases with a strain type* n (%)	Number of cases clustered n	Number of clusters n	Estimated proportion of cases likely due to recent transmission** %	Proportion of cases with a unique strain %
England, Wales and Northern Ireland[$]	**14,692**	**11,745 (80)**	**6,113**	**1,401**	**40**	**48.0**
UK-born[‡]	3,327	2,756 (82.8)	1,779	669	40	35.4
Non UK-born[§]	10,782	8,549 (79.3)	4,111	1,229	34	51.9

* Culture confirmed cases with a MIRU-VNTR profile with at least 23 complete loci
** Calculated using the n-1 method (number of cases in a cluster-number of clusters/number of cases with a strain type)
[$] The number of cases in England, Wales and Northern Ireland is higher than the sum UK-born and non UK-born as 583 cases have unknown UK-born information
[‡] Number of clusters with at least one UK-born person in the cluster
[§] Number of clusters with at least one non UK-born person in the cluster

4. Treatment outcomes reported, 2012

Key messages

- the proportion of cases who had completed treatment by 12 months continued to improve gradually, reaching 82.9% notified in 2011
- a lower proportion of cases with at least one social risk factor (74.7%) had completed treatment at 12 months
- the proportion of cases who had died by 12 months (4.9%) has declined over the last 5 years
- more than half of the cases that were lost to follow up (55.8%) had left the UK
- the proportion of MDR cases diagnosed in 2010 who had completed treatment by 24 months was 74%, with zero deaths
- none of the three XDR cases notified in 2010 had died at 24 months, and two had completed treatment

Treatment outcomes in 2012 are reported in accordance with the revised 2013 World Health Organization (WHO) treatment outcome definitions [5]. Under these revised definitions, treatment outcome is reported for the cohort of patients with drug sensitive TB (excluding patients with rifampicin resistance or MDR) at 12 months, and for the cohort of patients with rifampicin resistance or MDR at 24 months. A treatment outcome is assigned to each member of these cohorts; those that have an unknown treatment outcome are assigned the outcome “not evaluated”. Treatment outcomes reported using these new definitions are not directly comparable with treatment outcomes in previous reports.

Treatment outcome at 12 months (excluding patients with rifampicin resistance or MDR)

A treatment outcome at 12 months was assigned to all TB cases notified in 2011, excluding the 84 initial MDR cases, two cases who developed MDR while on treatment and eight rifampicin resistant TB cases. Information on treatment outcome was available for 8,548 (97%) of the 8,805 cases, and not evaluated for 257 (2.9%) cases. Of the cases without a treatment outcome evaluated, 26.5% (68) were reported to have been transferred to a different clinic within the UK and no treatment outcome form was completed.

The proportion of cases completing treatment within 12 months of starting treatment was 82.9% (7,302/8,805) (Table 4.1).

Table 4.1: Treatment outcome at 12 months for tuberculosis cases, UK, 2011*

Treatment outcome	n	%
Completed	7,302	82.9
Died	434	4.9
Lost to follow-up	435	4.9
Still on treatment	289	3.3
Stopped	88	1.0
Not evaluated	257	2.9
Total	8,805	100

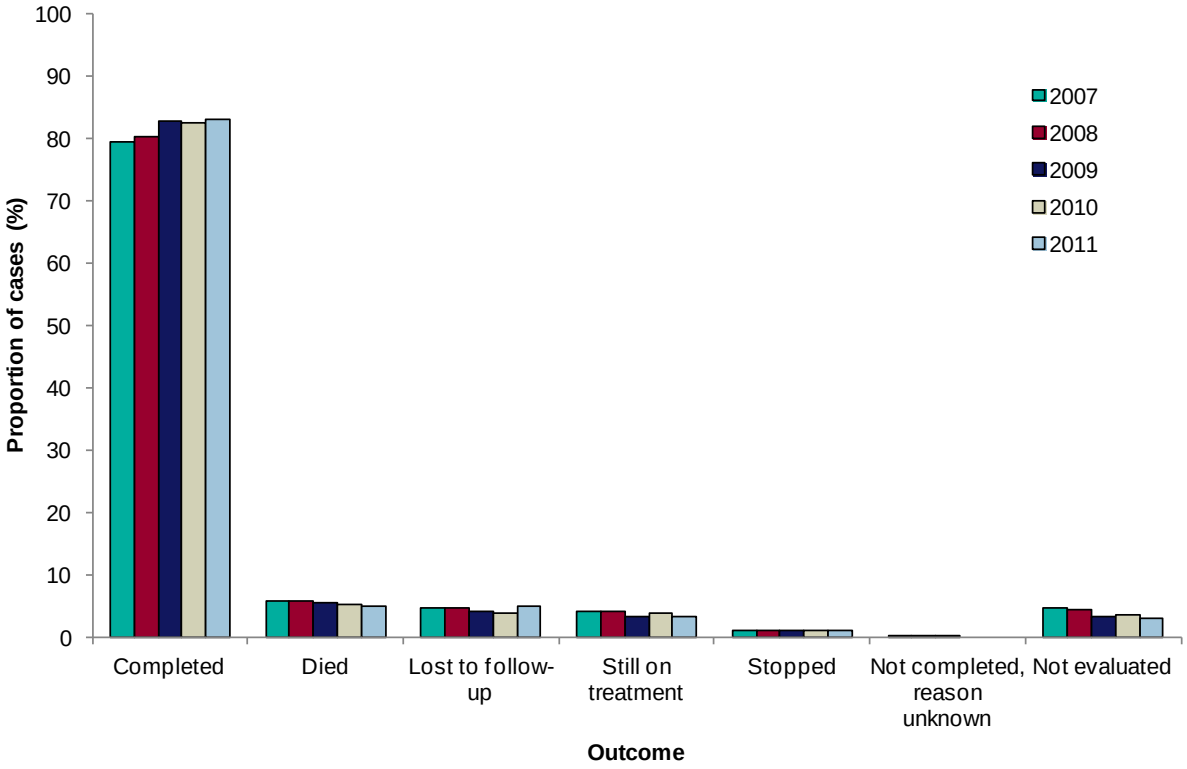
* Excludes MDR-TB and RMP-resistant TB cases. Not evaluated includes missing, unknown and transferred out.

The most common reasons for not completing treatment were death (4.9%) and loss to follow-up (4.9%). The most common reason given for being lost to follow up was moving abroad (55.8%, 241/432). Of the 434 deaths, TB caused or contributed to 42.9% (186/434), was incidental to death in 25.1% (109/434), and the relationship between TB and death was unknown in 32.0% (139/434). Among those reported to have died, 18.2% (79/434) were diagnosed with TB post-mortem. The majority of those diagnosed at post-mortem had pulmonary disease (83.5%, 66), were 65 years or over (62.0%, 49), male (62.0%, 49) and were born in the UK (62.3%, 33). Ten (17.9%) had at least one social risk factor, of which eight had misused alcohol.

The majority of people who were still on treatment at 12 months had a planned treatment regimen that exceeded 12 months (55.0%; 159/289) although only 11.3% (18/159) of these cases were initially drug resistant. Other reasons for still being on treatment at 12 months included treatment interruption (24.9%; 72/289) and a change in treatment (20.1%; 58/289). Intolerance or side effects were reported in 36.2% (47/130) of these cases.

Revised trends in treatment outcomes for the last five years using the revised WHO definitions showed an increase in the proportion of cases completing treatment from 79.2% to 82.9% between 2007 and 2011 (Figure 4.1). Over the same time period there was a reduction in the proportion of deaths from 5.9% to 4.9%. From 2007 to 2012, the proportion of cases that did not have a treatment outcome evaluated decreased from 4.7% to 2.9%, suggesting that part of the increase in treatment completion rates could be explained by improvements in completeness of reporting.

Figure 4.1: Trends in tuberculosis treatment outcomes at 12 months, UK*



* Cases who developed MDR or rifampicin resistance while on treatment were not available for years prior to 2010 and will remain in the 12 month treatment outcome cohort for these years. These data were also not available for Scotland.

The highest level of treatment completion was in the Thames Valley PHEC area (89.7%, 260/290). Three other PHEC areas exceeded the CMO's Action Plan goal of 85% [6] treatment completion; London (86.8%, 2,989/3,445), South Midlands and Hertfordshire (86.3%, 296/343) and Wessex (86.2%, 162/188). Three further PHEC areas were close to achieving this goal (East Midlands, 84.7% (361/426), Greater Manchester, 84.2% (427/507) and Anglia and Essex, 84.0% (225/268)).

Treatment completion levels declined with age from 88.7% (360/406) in 0-14 year olds to 66.4% (812/1,223) in those aged 65 years and over, while the proportion who died before starting or while on treatment rose from 0.3% (1/406) in 0-14 year olds to 23.6% (288/1,223) in patients aged 65 years and over (Table 4.2).

Table 4.2: Treatment outcomes at 12 months by age group, UK, 2011

Age group	Completed		Died		Lost to follow-up		Still on treatment		Stopped		Not evaluated		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
0-14	360	88.7	1	0.3	10	2.5	19	4.7	0	0.0	16	3.9	406
15-44	4,568	85.8	46	0.9	350	6.6	172	3.2	37	0.7	150	2.8	5,323
45-64	1,562	84.3	99	5.3	57	3.1	65	3.5	21	1.1	49	2.6	1,853
65+	812	66.4	288	23.6	18	1.5	33	2.7	30	2.5	42	3.4	1,223
Total	**7,303**	**82.9**	**434**	**4.9**	**435**	**4.9**	**289**	**3.3**	**89**	**1.0**	**257**	**2.9**	**8,807**

Treatment completion was higher among non UK-born cases compared with UK-born cases (85.3%, 5311/6,229 versus 79.4%, 1,758/2,213), while a lower proportion of non UK-born cases died (3.0%, 184 versus 8.5%, 187) (Table 4.3). A higher proportion of non UK-born cases were lost to follow up (6.0%, 373 versus 1.9%, 43); the majority of these were reported to have left the UK (60.8%, 225/370).

Table 4.3: Treatment outcomes at 12 months by place of birth, UK, 2011

Place of birth	Completed		Died		Lost to follow-up		Still on treatment		Stopped		Not evaluated		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Non UK-Born	5,311	85.3	184	3.0	373	6.0	180	2.9	55	0.9	126	2.0	6,229
UK-Born	1,758	79.4	187	8.5	43	1.9	97	4.4	33	1.5	95	4.3	2,213

Patients with a history of current problem drug or alcohol use, imprisonment and/or homelessness completed treatment less often than patients without such a history (74.7%, 469/628 versus 84.4%, 6,602/7,825), and a higher proportion died (6.8%, 43 versus 4.2%, 331) or were lost to follow up (7.5%, 47 versus 4.6%, 361) (Table 4.4).

Table 4.4: Treatment outcome at 12 months for tuberculosis cases with at least one social risk factor (prison, alcohol, homelessness, drug use), UK, 2011

Social risk factor	Completed		Died		Lost to follow-up		Still on treatment		Stopped		Not evaluated		Total
	n	%	n	%	n	%	n	%	n	%	n	%	
Yes	469	74.7	43	6.8	47	7.5	27	4.3	11	1.8	31	4.9	628
No	6602	84.4	331	4.2	361	4.6	251	3.2	75	1.0	205	2.6	7825
Unknown	231	65.6	60	17.0	27	7.7	11	3.1	2	0.6	21	6.0	352

Treatment completion was higher in those with extra-pulmonary disease than those with pulmonary disease (85.9%, 3,564/4,150 versus 80.3%, 3,703/4,613), which reflects the higher proportion of deaths in those with pulmonary disease (7.2%, 334 versus 3.0%, 150). The highest proportion of deaths was seen in those with miliary TB (11.7%, 26/222) and TB meningitis (10.5%, 20/191). A higher proportion of those with TB meningitis were still on treatment at 12 months.

Treatment completion was lower in cases with a previous history of TB compared to those not having reported TB previously (82.2%, 393/478 versus 84.1%, 6,574/7,815). Those with a previous diagnosis were more likely to die (6.3%, 30/478 versus 4.1%, 319/7,817) and also more likely to still be on treatment at 12 months (4.8%, 23/478 versus 3.1%, 243/7,817).

Treatment outcome at 24 months for patients with rifampicin resistance or MDR

A treatment outcome at 24 months was assigned to all cases notified in 2010 who had rifampicin resistance or MDR. There were 66 cases of initially MDR TB notified in 2010 and two cases who developed MDR TB while on treatment. Of these, 72.1% (49) completed treatment at 24 months and there were zero deaths (Table 4.5). The most common reason for not completing treatment was still being on treatment at 24 months (10.3%, 7). A relatively high proportion were lost to follow up (8.8%, 6); all of these cases were non UK-born and information about whether or not they had left the UK was not reported. In addition, treatment had been stopped for four patients, treatment was not completed for one patient (reason unknown), and one patient did not have a treatment outcome evaluated. Three of the MDR cases notified in 2010 were also XDR, and of these two completed treatment and one was still on treatment at 24 months.

There were 10 initial rifampicin mono-resistant cases notified in 2010 and one case who developed rifampicin resistance while on treatment. Six of these completed treatment, two were lost to follow up and three had an unknown outcome at 24 months.

Table 4.5: Treatment outcome at 24 months for MDR and rifampicin resistant tuberculosis cases, UK, 2010

Treatment outcome	n	%
Completed	49	72.1
Died	0	0.0
Lost to follow-up	6	8.8
Still on treatment	7	10.3
Stopped	4	5.9
Not completed, no reason	1	1.5
Not evaluated	1	1.5
Total	68	100

5. Surveillance data quality

Key messages

- data completeness monitoring is important to assess the quality of surveillance data and identify areas for improvement.
- completeness of all fields except “Sputum smear status” continued to improve.
- reporting of treatment outcomes at 12 months has improved in the last five years, but could be further improved by reducing the number of cases that do not have an outcome evaluated
- patients who are still on treatment at 12 months should have a treatment outcome reported at 24 months

High quality surveillance is essential to inform efforts to control, and eventually eliminate TB in the UK. The collection of data through the national Enhanced Tuberculosis Surveillance (ETS) system, including the recording of treatment outcome, is governed by an overarching quality framework developed by the PHE Surveillance and Epidemiology Governance Group. A steering group with stakeholders’ engagement oversees the national surveillance system. The principles of governance of the quality system include the commitment of senior management, a circle of local and national audits and evaluation, record-keeping to allow tracing of problems, customer input allowing for complaints and feedback, a documented development process which includes tests for quality and user satisfaction and mechanisms for implementing quality improvement through software development.

Monitoring of key data fields

Audits of records are undertaken annually based on the criteria suggested in the 2007 Department of Health TB Toolkit for Commissioners [7] which outlines the minimum quality standards for surveillance. Table 5.1 shows the level of completeness of the information for the Toolkit fields and their targets for completion. As last year, the fields “Name”, “Postcode”, “Date of birth” and “Date of notification” were mandatory fields in ETS, so completeness was 100%, and these fields are not included in Table 5.1.

Although the level of completion shows some variation across different countries/regions, it has continued to increase since the introduction of the web-based ETS. Similarly to 2011, the only field for which completeness did not meet the targets set by the toolkit was “Sputum smear status”.

In 2009, the collection of information on BCG vaccination and on four individual risk factors (history of imprisonment, of alcohol misuse/abuse, of homelessness, and of problem drug use) was initiated in England, Wales and Northern Ireland, although reporting on these variables began in each region at different points throughout the year. Encouragingly, completeness of information of these fields has continued to increase and is above 90% for all fields, except for BCG status, which is known for only 66% of cases.

If treatment outcome at 12 months was reported as “unknown” or “transferred out”, this outcome is reported as “not evaluated” this year, in line with the 2013 revised WHO guidelines. Patients still on treatment at 12 months should also be followed up again to document their treatment outcome at 24 months. Treatment outcomes were actively followed up at 24 months for MDR TB patients, and outcomes for these cases are almost complete in most areas (98.5%, 65/66). It is important to follow up all cases in the treatment cohort to get accurate information on the proportion of patients who eventually complete treatment or have another outcome.

Table 5.1: Completeness of key data fields, UK, 2012

	Ethnic group		UK-Born/ Non UK-born		Previous TB diagnosis		Start of treatment[$]	Sputum smear status[‡]		Site of Disease	Treatment Outcome reported at 12 months[#]	
Country	**Known***	**Reported****	**Known**	**Reported**	**Known**	**Reported**	**Reported**	**Known**	**Reported**	**Known[§]**	**Known**	**Reported**
England	98	99	96	99	94	98	95	59	63	99	97	98
Wales	95	98	95	100	93	100	92	53	58	96	96	97
Northern Ireland	100	100	100	100	97	100	100	81	83	100	97	97
Scotland	90	90	82	82	86	86	92	79	79	93	92	92
PHE Region/Centre												
North of England	97	99	93	100	92	95	96	41	46	99	94	95
North East	95	96	90	99	93	99	97	45	48	100	95	96
Cumbria and Lancashire	92	96	93	99	73	75	92	26	29	98	75	78
Yorkshire and the Humber	98	100	90	100	96	98	95	48	51	100	97	98
Greater Manchester	97	98	98	100	94	97	98	39	46	99	98	98
Cheshire and Merseyside	100	100	97	100	94	99	99	40	46	100	95	99
Midlands and East of England	98	99	96	100	93	98	96	50	53	99	99	100
East Midlands	100	100	97	100	93	99	98	51	54	100	99	100
West Midlands	98	99	96	100	92	98	95	50	53	98	99	100
Anglia and Essex	93	95	96	99	95	99	96	58	59	100	98	99
South Midlands and Hertfordshire	98	99	96	100	91	96	96	37	40	98	99	100
London	99	100	98	99	97	99	95	76	79	100	99	100
South of England	96	98	95	98	94	98	94	57	59	98	94	94
Sussex, Surrey and Kent	93	98	93	99	89	97	92	48	51	96	95	96
Thames Valley	100	100	100	100	99	100	98	62	64	100	100	100
Wessex	98	99	97	98	97	99	96	74	80	100	97	99
Devon, Cornwall and Somerset	91	93	92	94	93	100	98	48	56	100	96	98
Avon, Gloucestershire and Wiltshire	95	99	91	92	90	94	86	55	57	99	75	76
England, Wales and Northern Ireland	98	99	96	99	94	98	95	61	63	99	97	98
UK	97	99	96	99	94	98	95	60	66	99	97	98
Target for completeness	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**	**95**

* Data is reported and has a known value ** Data is reported but may be reported as unknown [$] Excluding cases diagnosed post mortem
[‡] Pulmonary cases only [§] Site reported as unknown site of disease only. Mandatory field so cannot be missing [#] For cases reported in 2011

Conclusions

Following the increase in the incidence of TB in the UK from 1990 to 2005, rates have stabilised over the past seven years. However, despite considerable efforts to improve TB prevention, treatment and control, the incidence of TB in the UK remains high compared to most other Western European countries [8].

The overall TB incidence of 13.9/100,000 obscures substantial differences in the rates of TB in different parts of the country and between different population subgroups. The vast majority of cases of TB continue to be concentrated in large metropolitan areas, such as London, where the rates are more than three times higher than the national average.

The incidence of TB is particularly high among people born in countries with a high TB burden, with some non UK-born ethnic minority groups experiencing TB rates 17 times higher than the national average. Analysis of strain typing data suggests that only around a third of cases in the non UK-born population are likely to be due to recent transmission, indicating that the majority are due to reactivation of latent infection acquired abroad. This means that even optimal services to reduce TB transmission in the UK could only prevent a minority of TB cases in those born outside the UK. To reduce the risk of reactivation of latent TB infection (LTBI) in new migrants, National Institute of Health and Care Excellence (NICE) recommendations to screen and treat migrants from high incidence countries for LTBI [9] should be implemented in a coordinated manner across the country. As almost half of TB cases in migrants occur within five years of entering the country, LTBI screening efforts should be concentrated on new migrants who have arrived in the UK in the past five years. To ensure that new migrants are identified for LTBI screening, and are rapidly diagnosed if they develop active disease, there must be no barriers to accessing primary health-care services.

In the UK-born population, the incidence of TB has not declined in the past decade in contrast to many other western countries [10, 11], with rates remaining stable at 4.1/100,000 per year. Within this population, those most at risk continue to be individuals from ethnic minority groups, those with social risk factors and the elderly. Although the overall proportion of cases with social risk factors remains low, such cases are more likely to have pulmonary TB, and are frequently part of strain typing clusters, which suggests they are particularly likely to have been involved in recent transmission events. Such cases are also more likely to have a higher level of drug resistance and poor treatment outcomes, including death. It is of concern that less than half of those with social risk factors were reported to have been put on DOT at the start of treatment. The particular vulnerability of these cases highlights the importance of targeting active case finding at those with complex social risk factors, and of addressing their underlying needs to support them to successfully complete treatment. In addition to the individual-level benefit, such interventions are likely to help reduce transmission within the UK-born population.

Following the small but sustained increase in drug resistance in the past decade, the proportion of cases with first line drug resistance and MDR stabilised in 2012. The majority of cases with MDR continue to have been born outside the UK, and the proportion of TB cases with MDR was particularly high in patients from East Europe. Clinicians should be aware of this when making initial infection control and treatment decisions while awaiting the results of drug sensitivity testing.

The number and proportion of cases due to *M. bovis* continues to be very low, suggesting that the epidemic in bovine and non-bovine animals is not spilling significantly into the human population.

The quality of the national TB surveillance system continues to improve, with increased completion of almost all key data fields. This strengthened surveillance provides key information to direct local control efforts and inform national policy. An assessment of the performance of the national surveillance system will be conducted using the WHO Standards and Benchmarking Tool later this year to identify areas for further improvement.

Treatment completion rates, a widely accepted indicator of the quality of TB services, have shown a small but sustained improvement over the past five years. Some of this improvement may be a result of the adoption of Cohort Review by an increasing number of TB services across the country. However, a small but significant number of patients do not have a treatment outcome reported, or are reported as lost to follow up. Further efforts should be made to minimise the number of such cases, especially among those that are sputum smear positive or have drug resistance.

While there have been notable achievements in strengthening TB services in some areas including active case finding amongst groups that have difficulty accessing services [12], outreach services to support patients with treatment completion, and latent TB screening [13] the UK still lacks a national approach to TB and there is considerable variation in the delivery of some aspects of the service [14]. To further strengthen TB prevention, treatment and control throughout the country a coordinated national approach to TB is required, involving NHS commissioners and providers, local government and PHE, to support locally designed and implemented services, and monitor achievements against national standards.

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Appendix - Supplementary tables

Table 1.1: Tuberculosis case reports, rates and annual percentage change, UK, 2000-2012

Year	Total*		Annual change in case numbers (%)	Annual change in rate (%)	Place of birth			
					UK-born		Non UK-born	
	Number of cases	Rate per 100,000 (95% CI)			Number of cases	Rate per 100,000 (95% CI)	Number of cases	Rate per 100,000 (95% CI)
2000	6,691	11.4 (11.1 -11.6)	-	-	2,166	4.0 (3.9 - 4.2)	3,444	76.2 (73.6 - 78.8)
2001	6,833	11.6 (11.3 -11.8)	2.1%	1.7%	2,230	4.2 (4.0 - 4.3)	3,573	76.9 (74.4 - 79.5)
2002	7,317	12.3 (12.1 -12.6)	7.1%	6.7%	2,197	4.1 (3.9 - 4.3)	4,286	88.2 (85.6 - 90.9)
2003	7,244	12.2 (11.9 -12.4)	-1.0%	-1.4%	2,021	3.8 (3.6 - 3.9)	4,520	88.5 (86.0 - 91.2)
2004	7,617	12.7 (12.4 -13.0)	5.1%	4.6%	2,173	4.0 (3.9 - 4.2)	4,807	93.2 (90.5 - 95.8)
2005	8,330	13.8 (13.5 -14.1)	9.4%	8.6%	2,151	4.0 (3.8 - 4.2)	5,434	98.4 (95.8 - 101)
2006	8,335	13.8 (13.5 -14.1)	0.1%	-0.5%	2,053	3.8 (3.7 - 4.0)	5,440	91.3 (88.9 - 93.8)
2007	8,296	13.6 (13.3 -13.9)	-0.5%	-1.1%	2,122	4.0 (3.8 - 4.1)	5,465	84.7 (82.4 - 87)
2008	8,532	13.9 (13.6 -14.2)	2.8%	2.2%	2,181	4.1 (3.9 - 4.2)	5,770	85.9 (83.7 - 88.2)
2009	8,900	14.4 (14.1 -14.7)	4.3%	3.6%	2,284	4.2 (4.1 - 4.4)	5,997	85.8 (83.6 - 88)
2010	8,397	13.5 (13.2 -13.8)	-5.7%	-6.4%	2,113	3.9 (3.7 - 4.1)	5,827	81.7 (79.6 - 83.8)
2011	8,899	14.1 (13.8 -14.4)	6.0%	4.4%	2,220	4.1 (3.9 - 4.3)	6,316	84.0 (82.0 - 86.1)
2012	8,751	13.9 (13.6 -14.1)	-1.7%	-1.7%	2,257	4.1 (4.0 - 4.3)	6,125	79.9 (77.9 - 82.0)

* Including where place of birth unknown
CI - confidence interval

Table 1.2: Tuberculosis case reports and rates by country, UK, 2012

Year	Country									
	England		Northern Ireland		Scotland		Wales		Total	
	Number of cases	Rate per 100,000 (95% CI)	Number of cases	Rate per 100,000 (95% CI)	Number of cases	Rate per 100,000 (95% CI)	Number of cases	Rate per 100,000 (95% CI)	Number of cases	Rate per 100,000 (95% CI)
2000	6,049	12.3 (12.0 -12.6)	57	3.4 (2.6 -4.4)	403	8.0 (7.2 -8.8)	182	6.3 (5.4 -7.2)	6,691	11.4 (11.1 -11.6)
2001	6,238	12.6 (12.3 -12.9)	57	3.4 (2.6 -4.4)	351	6.9 (6.2 -7.7)	187	6.4 (5.5 -7.4)	6,833	11.6 (11.3 -11.8)
2002	6,702	13.5 (13.2 -13.8)	67	3.9 (3.1 -5.0)	392	7.8 (7.0 -8.6)	156	5.3 (4.5 -6.3)	7,317	12.3 (12.1 -12.6)
2003	6,656	13.3 (13.0 -13.7)	57	3.3 (2.5 -4.3)	367	7.3 (6.5 -8.0)	164	5.6 (4.8 -6.5)	7,244	12.2 (11.9 -12.4)
2004	6,956	13.9 (13.6 -14.2)	81	4.7 (3.8 -5.9)	392	7.7 (7.0 -8.5)	188	6.4 (5.5 -7.4)	7,617	12.7 (12.4 -13.0)
2005	7,705	15.3 (14.9 -15.6)	75	4.3 (3.4 -5.5)	364	7.1 (6.4 -7.9)	186	6.3 (5.4 -7.3)	8,330	13.8 (13.5 -14.1)
2006	7,711	15.2 (14.9 -15.5)	61	3.5 (2.7 -4.5)	381	7.4 (6.7 -8.2)	182	6.1 (5.3 -7.1)	8,335	13.8 (13.5 -14.1)
2007	7,613	14.9 (14.6 -15.2)	69	3.9 (3.1 -5.0)	410	8.0 (7.2 -8.8)	204	6.9 (5.9 -7.9)	8,296	13.6 (13.3 -13.9)
2008	7,855	15.3 (14.9 -15.6)	66	3.7 (2.9 -4.7)	443	8.6 (7.8 -9.4)	168	5.6 (4.8 -6.5)	8,532	13.9 (13.6 -14.2)
2009	8,142	15.7 (15.4 -16.1)	59	3.3 (2.5 -4.3)	485	9.3 (8.5 -10.2)	214	7.1 (6.2 -8.2)	8,900	14.4 (14.1 -14.7)
2010	7,675	14.7 (14.4 -15.0)	66	3.7 (2.8 -4.7)	503	9.6 (8.8 -10.5)	153	5.1 (4.3 -6.0)	8,397	13.5 (13.2 -13.8)
2011	8,259	15.6 (15.2 -15.9)	62	3.4 (2.6 -4.4)	448	8.5 (7.7 -9.3)	130	4.2 (3.5 -5.0)	8,899	14.1 (13.8 -14.4)
2012	8,130	15.2 (14.9 -15.5)	87	4.8 (3.8 -5.9)	398	7.5 (6.8 -8.3)	136	4.4 (3.7 -5.2)	8,751	13.9 (13.6 -14.1)

CI - confidence interval

Table 1.3: Tuberculosis case reports and rates by PHE Region and Centre, England, 2012

PHE region/centre	Number of cases	Rate per 100,000 (95% CI)
North of England	1.565	10.5 (10.0 -11.0)
Cheshire and Merseyside	113	4.7 (3.9 -5.6)
Cumbria and Lancashire	216	11.0 (9.6 -12.6)
Greater Manchester	465	17.3 (15.8 -19.0)
North East	166	6.4 (5.5 -7.4)
Yorkshire and Humber	605	11.4 (10.5 -12.4)
Midlands and East of England	2,075	12.8 (12.2 -13.3)
Anglia and Essex	259	6.3 (5.5 -7.1)
East Midlands	412	10.7 (9.7 -11.8)
South Midlands and Hertfordshire	319	11.9 (10.6 -13.3)
West Midlands	1,085	19.3 (18.2 -20.5)
London	3,426	41.8 (40.4 -43.2)
South of England	1,064	7.8 (7.3 -8.2)
Avon, Gloucestershire and Wiltshire	184	7.8 (6.7 -9.0)
Devon, Cornwall and Somerset	85	3.9 (3.1 -4.8)
Sussex, Surrey and Kent	330	7.4 (6.6 -8.2)
Thames Valley	294	14.5 (12.9 -16.3)
Wessex	171	6.5 (5.5 -7.5)

CI - confidence interval

Table 1.4: Most frequent countries of birth for non UK-born tuberculosis cases and time since entry to the UK to tuberculosis diagnosis, UK, 2012

Country of birth	Number of cases	Percentage of cases*	Median time since entry UK (IQR)**
India	1,858	30.7	4 (2 - 13)
Pakistan	1,091	18.0	7 (2-21)
Somalia	380	6.3	8 (3 - 12)
Bangladesh	276	4.6	7 (2 - 23)
Nepal	216	3.6	2 (1 - 5)
Nigeria	184	3.0	5 (1 - 10)
Philippines	136	2.3	5 (2 - 9)
Zimbabwe	132	2.2	9 (7 - 11)
Kenya	98	1.6	13 (6 - 40)
Sri Lanka	98	1.6	7 (2 - 15)
Eritrea	87	1.4	4 (2 - 5)
Romania	78	1.3	2 (0 - 4)
Afghanistan	75	1.2	5 (2 - 10)
Poland	71	1.2	5 (2 - 7)
Others (each <1%)	1,265	21.1	5 (1 - 13)
Total*	**6,045**	**100**	6 (2 -13)

*Where country of birth was known
**Years

Figure 1.1: Tuberculosis case reports and rates by age group and place of birth, UK, 2012

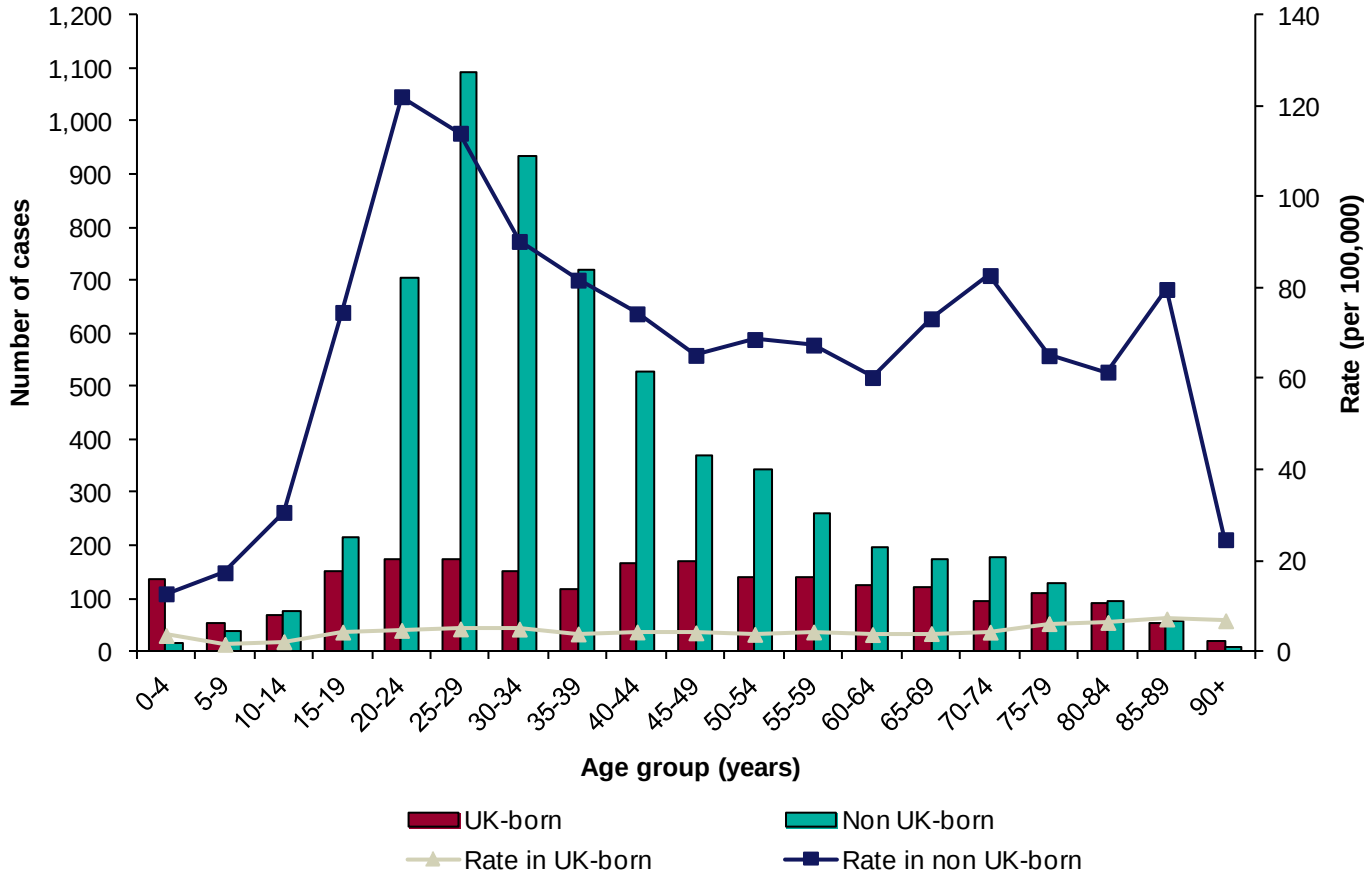

Table 2.1: Number and proportion of culture confirmed tuberculosis cases with first line drug resistance, UK, 2000-2012

Year	Isoniazid resistant		Rifampicin resistant		Ethambutol resistant		Pyrazinamide resistant*		Resistant to any first line drug**		Multi-drug resistant		Total[#]
	n	%	n	%	n	%	n	%	n	%	n	%	
2000	191	5.9	41	1.3	10	0.3	14	0.4	206	6.4	28	0.9	3,217
2001	223	6.3	38	1.1	15	0.4	18	0.5	247	7.0	25	0.7	3,529
2002	272	6.8	45	1.1	20	0.5	28	0.7	297	7.4	34	0.9	3,991
2003	292	7.0	72	1.7	22	0.5	22	0.5	321	7.7	52	1.3	4,149
2004	316	7.1	62	1.4	18	0.4	30	0.7	349	7.8	47	1.1	4,448
2005	321	6.7	55	1.1	17	0.4	14	0.3	345	7.2	40	0.8	4,815
2006	341	6.9	74	1.5	29	0.6	27	0.6	377	7.7	54	1.1	4,920
2007	324	6.9	72	1.5	30	0.6	34	0.7	353	7.5	59	1.3	4,709
2008	284	6.0	71	1.5	36	0.8	35	0.7	322	6.8	54	1.1	4,769
2009	344	6.9	73	1.5	33	0.7	53	1.1	389	7.9	62	1.3	4,950
2010	312	6.3	76	1.5	37	0.8	42	0.9	341	6.9	66	1.3	4,915
2011	400	7.5	92	1.7	62	1.2	59	1.1	448	8.4	84	1.6	5,325
2012	351	6.8	91	1.8	51	1.0	45	0.9	379	7.4	81	1.6	5,151

* Excludes *M. bovis* cases
** First line drugs - isoniazid, rifampicin, ethambutol and pyrazinamide
[#] Culture confirmed cases with drug susceptibility results for at least isoniazid and rifampicin

Table 4.1: Trends in tuberculosis treatment outcomes at 12 months, UK

Treatment Outcome	2007		2008		2009		2010		2011	
	n	%	n	%	n	%	n	%	n	%
Completed	6,517	79.2	6,778	80.1	7,294	82.6	6,856	82.4	7,302	82.9
Died	484	5.9	491	5.8	483	5.5	441	5.3	434	4.9
Lost to follow-up	378	4.6	387	4.6	362	4.1	312	3.7	435	4.9
Still on treatment	349	4.2	346	4.1	287	3.3	322	3.9	289	3.3
Stopped	88	1.1	79	0.9	98	1.1	86	1.0	88	1.0
Not completed, reason unknown	23	0.3	15	0.2	12	0.1	0	0.0	0	0.0
Not evaluated	385	4.7	365	4.3	291	3.3	302	3.6	257	2.9
Total	**8,224**	**100**	**8,461**	**100**	**8,827**	**100**	**8,319**	**100**	**8,805**	**100**

Table 4.2: Number and proportion of tuberculosis cases completing treatment by Country, PHE Region and PHE Centre, UK, 2011*

	Completed		Died		Lost to follow-up		Still on treatment		Stopped		Not evaluated		Total
Country	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**
England	6,831	83.6	377	4.6	408	5.0	263	3.2	78	1.0	216	2.6	8,173
Wales	97	75.8	8	6.3	8	6.3	4	3.1	6	4.7	5	3.9	128
Northern Ireland	44	73.3	8	13.3	2	3.3	4	6.7	0	0.0	2	3.3	60
Scotland	331	74.2	41	9.2	17	3.8	18	4.0	5	1.1	34	7.6	446
Total	7,303	82.9	434	4.9	435	4.9	289	3.3	89	1.0	257	2.9	8,807
PHE Region/Centre													
North of England	1,227	76.9	106	6.6	94	5.9	54	3.4	18	1.1	96	6.0	1,595
North East	96	74.4	14	10.9	8	6.2	4	3.1	1	0.8	6	4.7	129
Cumbria and Lancashire	134	63.2	10	4.7	7	3.3	6	2.8	1	0.5	54	25.5	212
Yorkshire and the Humber	499	76.3	46	7.0	51	7.8	34	5.2	4	0.6	20	3.1	654
Greater Manchester	427	84.2	30	5.9	25	4.9	7	1.4	7	1.4	11	2.2	507
Cheshire and Merseyside	71	76.3	6	6.5	3	3.2	3	3.2	5	5.4	5	5.4	93
Midlands and East of England	1,717	84.4	121	5.9	89	4.4	65	3.2	19	0.9	24	1.2	2,035
East Midlands	361	84.7	34	8.0	16	3.8	9	2.1	2	0.5	4	0.9	426
West Midlands	835	83.8	58	5.8	46	4.6	37	3.7	9	0.9	12	1.2	997
Anglia and Essex	225	84.0	14	5.2	10	3.7	9	3.4	4	1.5	6	2.2	268
South Midlands and Hertfordshire	296	86.3	15	4.4	17	5.0	10	2.9	3	0.9	2	0.6	343
London	2,989	86.8	97	2.8	182	5.3	122	3.5	30	0.9	25	0.7	3,445
South of England	897	81.8	53	4.8	43	3.9	22	2.0	11	1.0	71	6.5	1,097
Sussex, Surrey and Kent	288	83.0	19	5.5	11	3.2	9	2.6	3	0.9	17	4.9	347
Thames Valley	260	89.7	15	5.2	6	2.1	5	1.7	4	1.4	0	0.0	290
Wessex	162	86.2	7	3.7	9	4.8	2	1.1	3	1.6	5	2.7	188
Devon, Cornwall and Somerset	72	79.1	8	8.8	5	5.5	2	2.2	0	0.0	4	4.4	91
Avon, Gloucestershire and Wiltshire	115	63.5	4	2.2	12	6.6	4	2.2	1	0.6	45	24.9	181

***** Excludes MDR-TB and RMP-resistant TB cases. Not evaluated includes missing, unknown and transferred out.

Glossary

BCG
Bacillus Calmette-Guérin

Cluster
Clusters in this document refer to molecular clusters only. These are defined as a group of 2 or more patients who are infected with a strain of *Mycobacterium tuberculosis* 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.

Multi-drug resistance (MDR)
MDR is defined as resistance to at least isoniazid and rifampicin, with or without resistance to other drugs.

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

Extensively drug resistance (XDR)
XDR is defined as resistance to at least isonaizid and rifampicin (MDR), one injectable agent (capreomycin, kanamycin or amikacin) and one fluoroquinolone.

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 miliary TB is classified as pulmonary TB because it causes lesions in the lungs. This is in line with the WHO's recommendation and international reporting definitions.

Rates
Overall tuberculosis rates per 100,000 population, as well as rates by age, sex and PHE centre and region of reporting, have been calculated using mid-year estimates and 2011 Census data provided by the Office for National Statistics (ONS).
Rates by place of birth and ethnic group presented in this report have been calculated using population estimates from the Labour Force Survey.

World region
Information on country of birth of TB cases is collected. Countries were grouped into world regions based on the United Nations classifications, adjusted to take into account the global epidemiology of tuberculosis and migration patterns to the UK.

Data for Scotland in this report may differ slightly to data presented by Scotland in their own reports. In this UK report, cases that have transferred from England to Scotland are not counted in the Scottish figures to avoid duplication at the UK level.

Data presented in this report are correct as at end of April 2013.