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Tuberculosis in South West Centre: Annual review (2014 data)

Data from 2000 to 2014

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Public Health England
Wellington House
133-155 Waterloo Road
London
SE1 8UG
Tel: 020 7654 8000
http://www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

Prepared by: Field Epidemiology Services (South West).
For queries relating to this document, please contact: fes.southwest@phe.gov.uk

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Authors

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Executive summary

In 2014 there were 321 cases of tuberculosis notified among residents of the South West, a rate of 5.9 (95% confidence interval [CI] 5.29 to 6.60) per 100,000 population. The following local authorities (LA) had the highest notification rates: the city of Bristol (22.4/100,000), Bath and North East Somerset (10.4/100,000), and Swindon (8.34/100,000).

The notification rates for males and females were 7.17 and 4.71 per 100,000 cases respectively. The highest rates were observed in the following age groups: 30-39 (10.9/100,000), 20-29 (8.3/100,000), and 40-49 (7.9/100,000) years.

The rate for children under 15 (an indicator for ongoing local transmission) was 0.35/100,000 population, the second lowest rate in this age group for ten years (2005 to 2014).

The non-UK born case rate was 38.2/100,000 and the UK born case rate was 2.8/100,000. The largest proportion of non-UK born cases were born in India (21.3%) followed by Somalia (18.9%) and Pakistan (7.7%). The majority of persons were of white ethnicity (148 cases, 47.1%) followed by black African (64 cases, 20.4%) and Indian (38 cases, 12.1%) ethnicities.

The majority of cases were diagnosed with pulmonary disease (197 cases, 62.0%). One hundred and seventy seven (55.1%) cases were culture confirmed and 32 (37.2%) pulmonary cases were sputum smear positive. The median delay between symptom onset and diagnosis was 82 days (inter-quartile range [IQR] 44 to 151 days).

The majority (87.6%) of cases were either offered HIV tests (184) or their HIV status was already known (21). .

Over the five year period (2010 to 2014) there were 222 molecularly clustered notifications in the South West and these were associated with 62 different clusters. The remaining 506 cases represent unique cases to the South West.

Over the 12 months of 2013, 71.3% of cases successfully completed treatment, 10.4% of cases were not evaluated (data missing or not complete), 7.9% were still on treatment, 5.7% died, and 3.9% were lost to follow up. In 2014, 6.8% of notifications were found to have resistance to at least one first line drug, which was lower than in 2013 (8.3%), 2012 (7.4%) and 2011 (9.8%), although higher than in 2010 (5.9%).

There were two cases of multi-drug resistant (MDR) TB.

There were five (2.8%) cases found to have resistance to second line TB drugs, the largest number reported in the last ten years.

The first extensively resistant case was identified and reported in the South West.

Introduction

The South West PHE centre (PHEC) covers Bath and North East Somerset, Bournemouth, the City of Bristol, Cornwall, Devon, Dorset, Gloucestershire, Isles of Scilly, North Somerset, Plymouth, Poole, Somerset, South Gloucestershire, Swindon, Torbay and Wiltshire. The South West is traditionally a low incidence area for TB when compared to the rest of UK. This reflects the socio-demographic characteristics of the population (low level of non-UK born migrants and the rural environment). There is only one local authority, the City of Bristol, with an annual incidence which is greater than the national rate. See Appendix A for a description of data sources and definitions.

Enhanced Surveillance in England and Wales was launched on 1 January 1999 with the aim of providing detailed comparable information on the epidemiology of TB following the global resurgence of the disease, which prompted the World Health Organisation (WHO) to declare a 'global emergency' in 1993.The minimum dataset includes notification details, and demographic, clinical and microbiological information on all cases of TB reported by clinicians at local level. At the end of 2008 the Enhanced Tuberculosis Surveillance (ETS) System was rolled out across the UK, replacing the old Microsoft Access 2000 databases. The ETS System is a secure website, enabling users to: submit cases, denotify cases, add treatment outcome monitoring (TOM) information, generate reports and export case or laboratory information. The ETS System was implemented in the South West in November 2008. The system is real-time; once information is entered onto the website it is immediately accessible at clinic, regional and national level.

As part of the Collaborative TB Strategy for England 2015-2020, a suite of TB Strategy Monitoring Indicators have been developed (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf) [1]. Where data for these indicators is presented in this report, the indicator name is shown, and a summary table of national-level indicators is presented in Appendix B. Data for indicators which are presented at upper tier local authorities can be found at http://fingertips.phe.org.uk/profile/tb-monitoring

Data for this report comes from three different years:

- case data is from notifications occurring in 2014
- outcome data for patients with drug sensitive infections is from 2013 notifications
- outcome data for patients with drug resistant infections is from 2012 notifications.

Objectives

1. Describe the overall epidemiology of TB in the South West.
2. Highlight recent trends in TB epidemiology.

3. Identify areas of high burden of disease.
4. Identify at-risk population groups.
5. Identify opportunities for interventions to prevent further cases.

Tuberculosis epidemiology

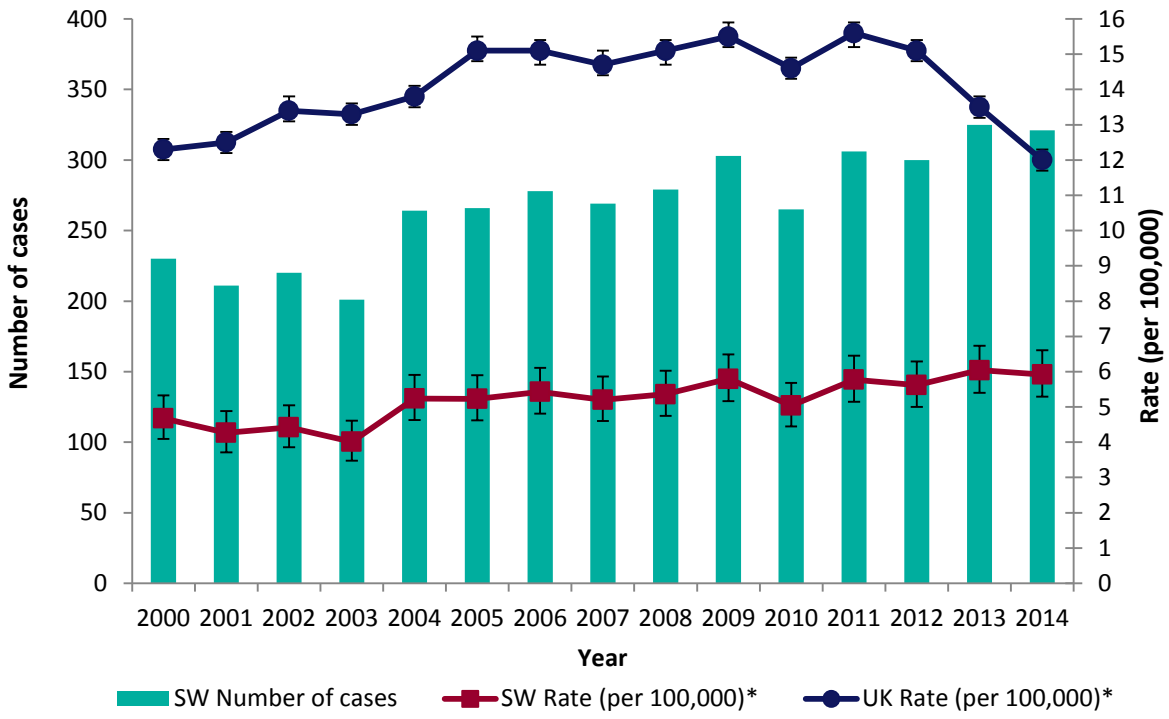
Overall numbers, rates and geographical distribution

In 2014 there were 321 cases of tuberculosis notified among residents of the South West PHEC, a rate of 5.9 (95% CI 5.29-6.60) per 100,000 population. The rate in 2014 was slightly lower than the rate in 2013 (6.0/100,000) and was considerably lower than the UK rate, which was 11.7/100,000 in 2014. The UK has experienced a fourth consecutive decrease in its annual TB incidence; however this trend has not been observed in the South West. The 2014 and 2013 rates were the second and first highest annual rates in the past ten years, see Figure 1.

The highest TB rates were observed in the following local authorities (LA): the City of Bristol (22.4/100,000), Bath and North East Somerset (10.4/100,000), Swindon (8.3/100,000), South Gloucestershire (8.1/100,000), and Weymouth and Portland (7.7/100,000). The TB rate for the City of Bristol is two times that of any other LA in the South West. The burden of TB disease in the City of Bristol has a significant weighting on the epidemiology in the South West and the rate has been increasing over the past five years.

The heat map in Figure 2 shows 2014 notification rates by upper tier local authority (UTLA). The majority of areas experienced an incidence rate of 2.9-3.8 /100,000. However Bristol experienced a substantially higher rate than any other UTLA. There were further ‘hot spots’ in Bath and North East Somerset, South Gloucestershire, and Swindon UTLA.

Figure 1: TB case reports and rates and 95% confidence intervals, South West and England, 2000-2014
*rate calculated using ONS mid-year population estimates



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

Demographic characteristics

Age and sex

In the South West during 2014 data on sex was available for 100.0% of notifications; there were 191 male (59.5%) and 130 female (40.5%) cases of TB. This equated to rates of 7.17 (95% CI 6.19 to 8.26) and 4.71 (95% CI 3.94 to 5.59) cases per 100,000 population for males and females respectively. These rates have remained relatively stable over the past four years. The age of cases ranged from three to 93 years and the median age was 41 (IQR 29 to 57). The age distribution was similar for males and females with median ages of 41 (IQR 30-58) and 40 (IQR 27-57) respectively. The highest rates in 2014 were observed in the following age groups: 30-39 (10.9/100,000), 20-29 (8.3/100,000) and 40-49 (7.9/100,000) years. When stratifying the 2014 rates by age and sex the highest rates were found in males aged 30-39 years (12.5/100,000) and males aged 40-49 years (10.9/100,000). The highest rates for females were in those aged 30-39 years (9.4/100,000), see Figures 3 and 4.

There were 16 notifications of TB in children under 16 years old with a rate of 1.6/100,000 (95% CI 0.96 to 2.74). The majority of these notifications occurred in the

City of Bristol (75.0%), but also Bath and North East Somerset (18.8%) and South Gloucestershire (6.3%). The rate in children under five years of age was 0.33 cases per 100,000 populations.

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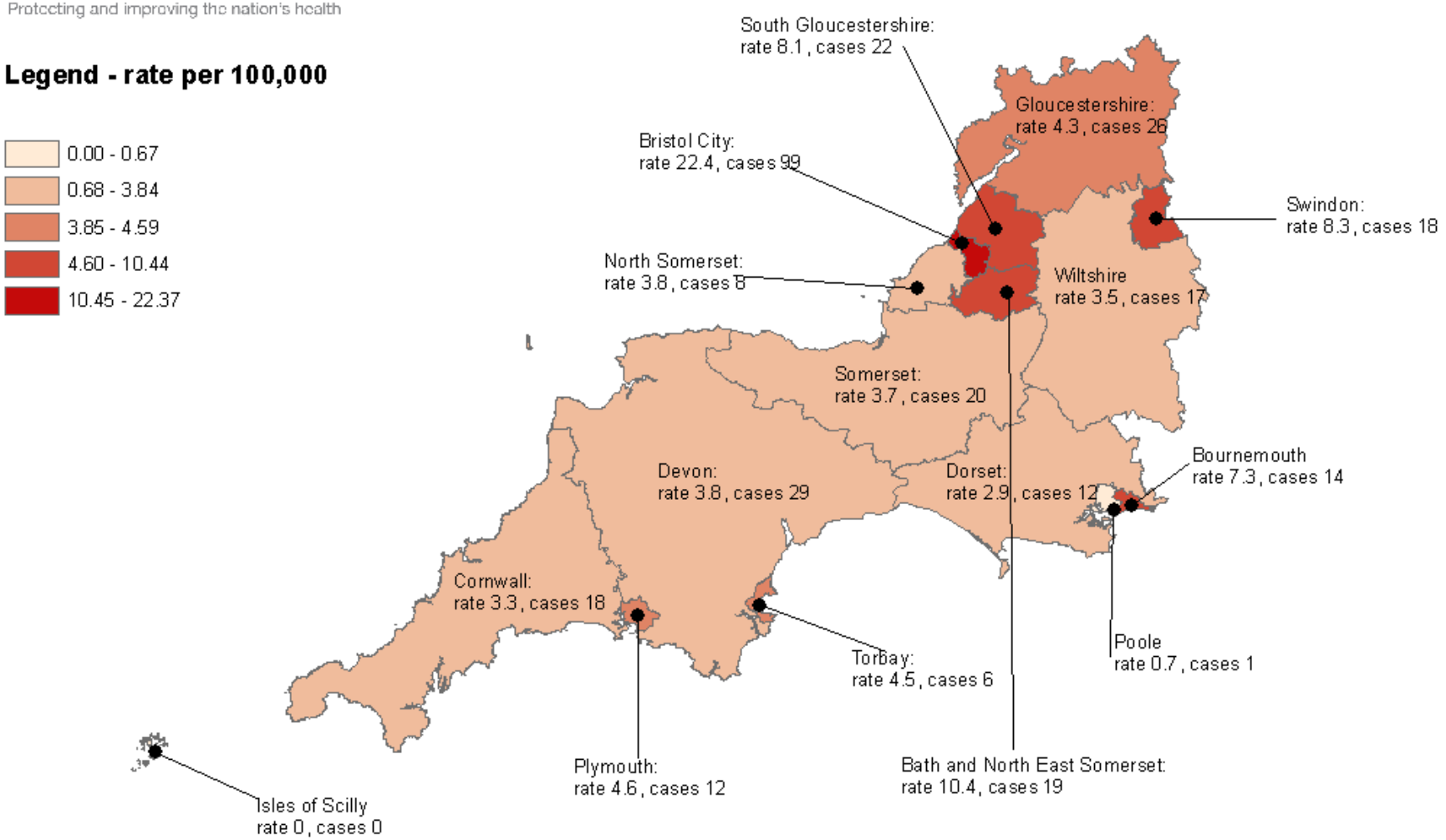
Figure 2: TB rate per 100,000 populations by upper tier local authority of residence, South West, 2014



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Note: data presented at upper tier local authority (utla) level, rates per 100,000 and case numbers are presented

1:1,788,747
0 20 40 80 km

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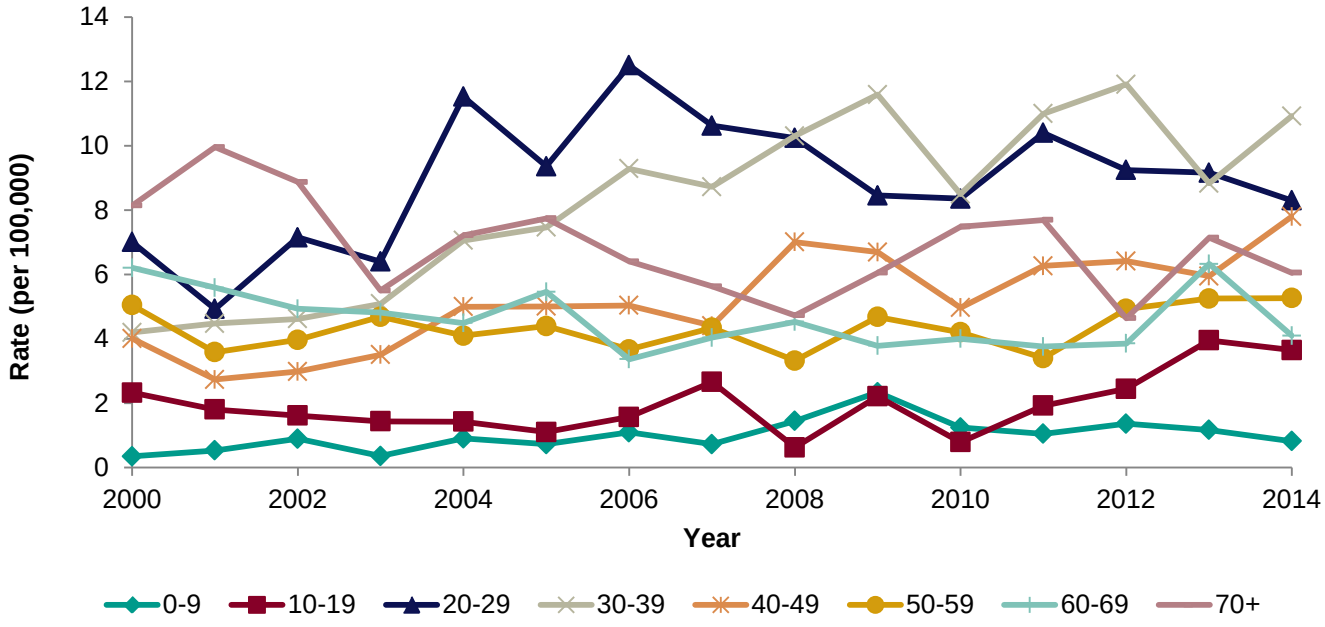
Wellington House
133 - 155 Waterloo Road
London, SE1 8UG

Figure 3: TB case reports and rate by age and sex, South West, 2014

Figure 4: TB case rates by age group, South West, 2000-2014

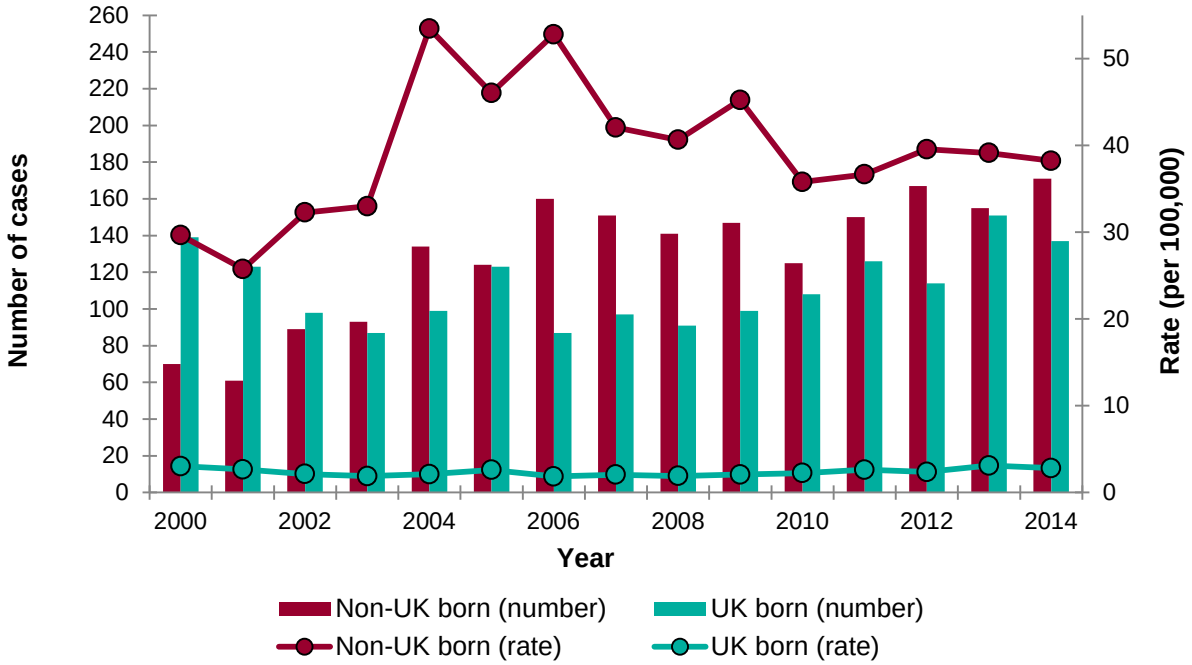


Place of birth and time since entry

In 2014 data was available on whether a case was born in the UK for 96.0% of cases; of these the majority, 55.5% (171), were born outside the UK, resulting in a rate of 38.2 cases per 100,000 population. This was substantially higher than the rate observed in the UK born population during 2014, 2.8/100,000, see Figure 5a. The rate in the UK born population ranged from 1.8/100,000 in 2006 to a high of 3.1/100,000 in 2013. A general decline in the rate of TB

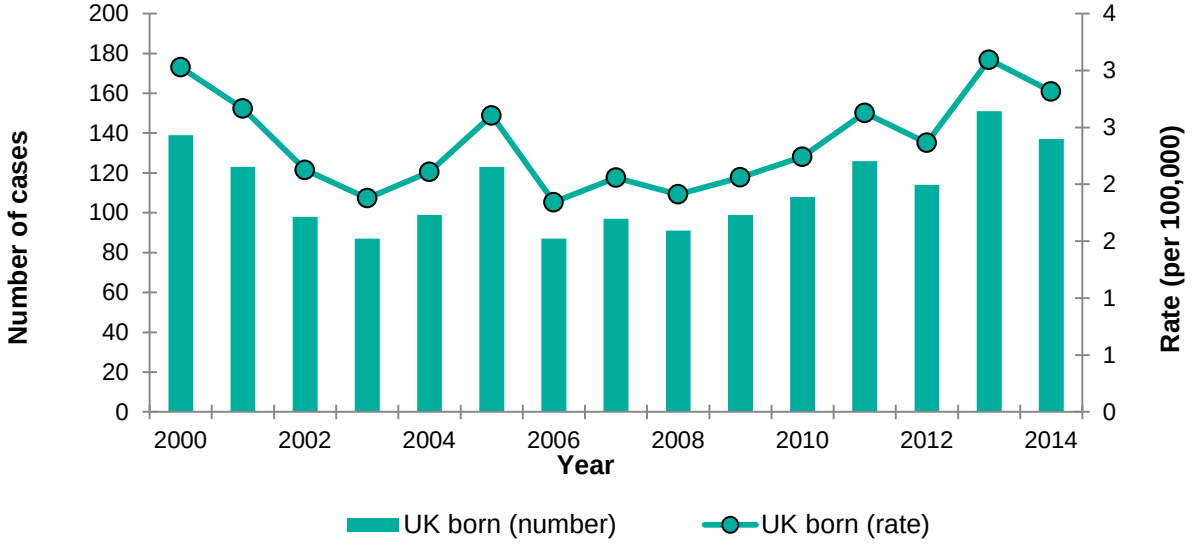
cases in the UK born population was observed from 2000 to 2006, however this did not continue with rates increasing over the past eight years. In the past two years UK-born rates have returned to high levels previously seen in 2000, see Figure 5b. In contrast in the non-UK born population a decrease in the rate of TB was observed from 2006 to 2010 and rates have remained stable over the past five years (range 35.8/100,000 in 2010 and 39.6/100,000 in 2012), see Figure 5a.

Figure 5a: TB case reports and rate by place of birth, South West, 2000-2014



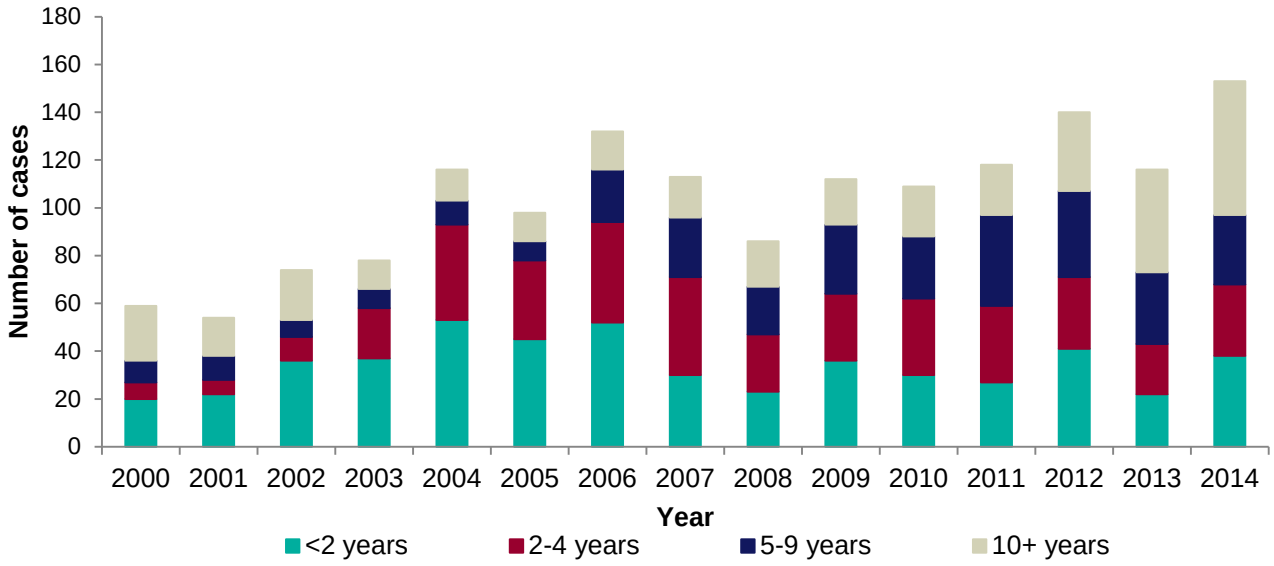
TB Monitoring Indicator 2: TB incidence in UK born and non-UK born populations (England)

Figure 5b: TB case reports and rate for the UK born population, South West, 2000-2014



In 2014 data was available on time since entry to the UK and TB diagnosis for 89.5% of non-UK born cases. This data showed that 36.6% of cases diagnosed in 2014 had resided in the UK for over 10 years, 24.8% entered the UK within one year, and the remaining cases entered between two and nine years prior to diagnosis. Over the past five years there has been an increase in the median time between entry and diagnosis, from two years in 2010 to three years in 2014 and 2013. This is reflected in Figure 6a, where a greater number of cases were found to be developing TB 10+ years after entering the UK.

Figure 6a: Time between entry to the UK and TB notification for non-UK born cases by year, South West, 2000-2014

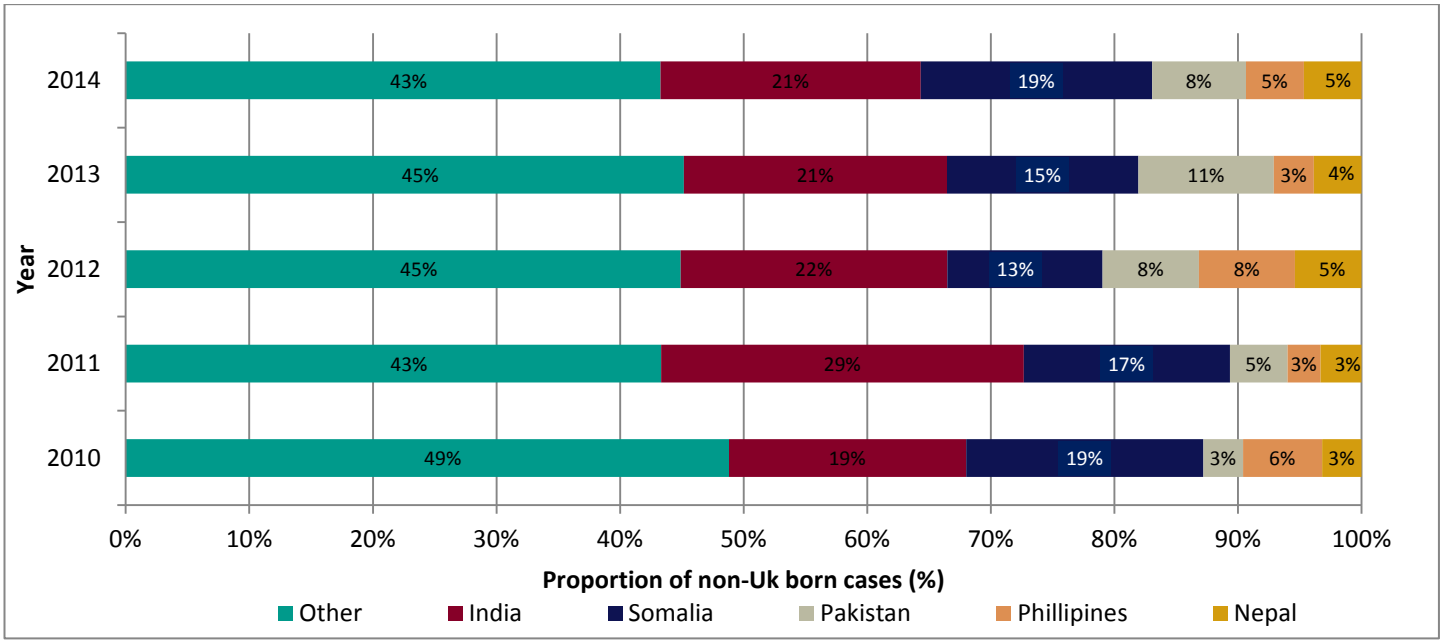


Data on country of birth was available for 98.8% of non-UK born cases. The largest proportion was born in India (21.3%) followed by Somalia (18.9%) and Pakistan (7.7%). Persons born in Pakistan and Bangladesh were found to have the highest median time between entry to the UK and TB diagnosis at 16 and 13 years respectively. Cases born in Kenya and Poland had the lowest median time at three and 3.5 years respectively. Over the past five years persons born in India have made up the highest proportion of non-UK born cases, a peak of 29.3% was observed in 2011 but the proportion has subsequently declined. Since 2011 persons born in Somalia have contributed to an increasing proportion of TB cases in the South West, see Table 1 and Figure 6b.

Table 1: Ten most common countries of birth of non-UK born TB patients, South West, 2014

Country of birth	Cases	Proportion of non-UK born patients (%)	Median time since UK entry (years)
India	36	21.3	6.0
Somalia	32	18.9	7.0
Pakistan	13	7.7	16.0
Nepal	8	4.7	10.0
Philippines	8	4.7	10.0
Bangladesh	7	4.1	13.0
Poland	7	4.1	3.5
Zimbabwe	6	3.6	10.5
Kenya	4	2.4	3.0
South Africa	4	2.4	4.0

Figure 6b: Five year trend in the percentage of non-UK born TB case in the five most common countries of birth, South West, 2010-2014



Ethnicity

Data on ethnic group was available for 97.8% of cases in 2014. The majority of these persons were white (148 cases, 47.1%) followed by Black-African (64 cases, 20.4%) and Indian (38 cases, 12.1%) ethnicities. Figure 7a shows that white ethnicity has consistently made up the majority of the TB cases in the South West since 2000. No clear trend over time emerges in the overall distribution of TB and ethnicity, which shows a reasonably consistent distribution over the past five years, see Figures 7b, 7c and 7d.

Figure 7a: TB case number by ethnic group by year, South West, 2000- 2014

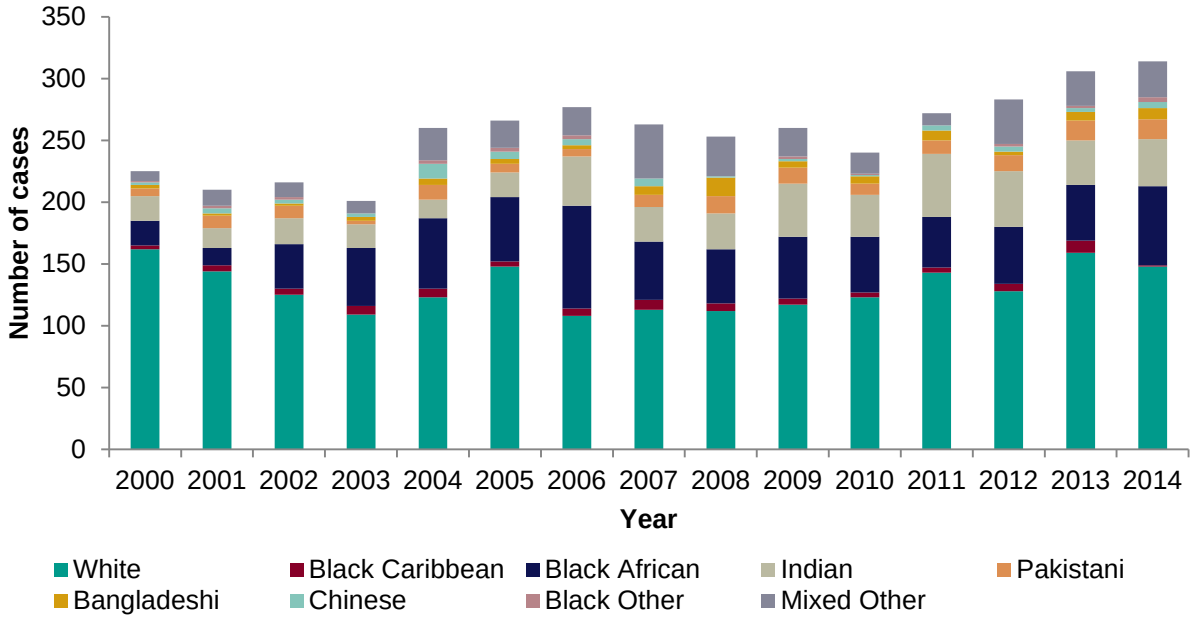


Figure 7b: Proportion of TB cases by ethnic group and year, South West, 2000-2014

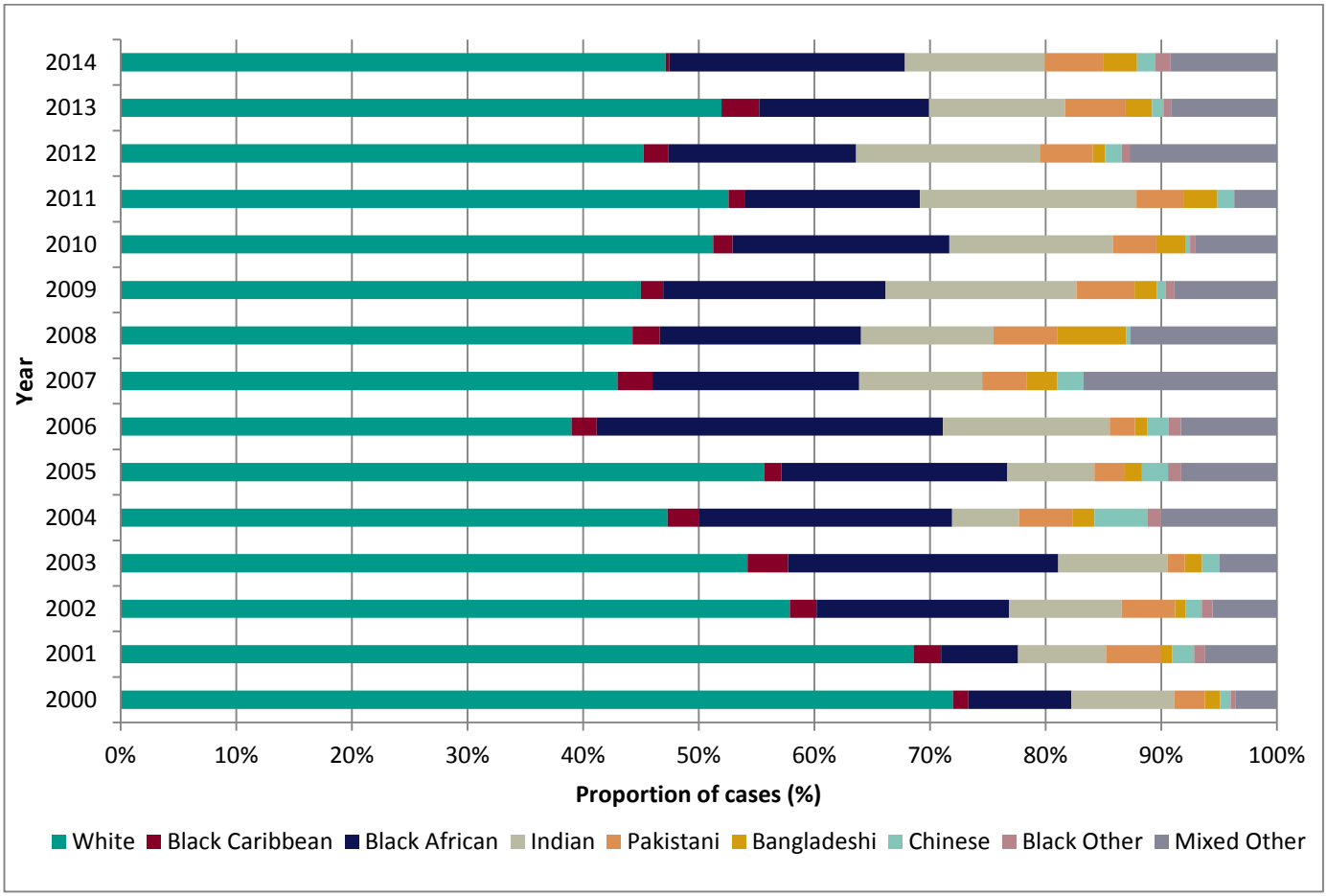


Figure 7c: TB case number by ethnic group and place of birth, South West, 2014

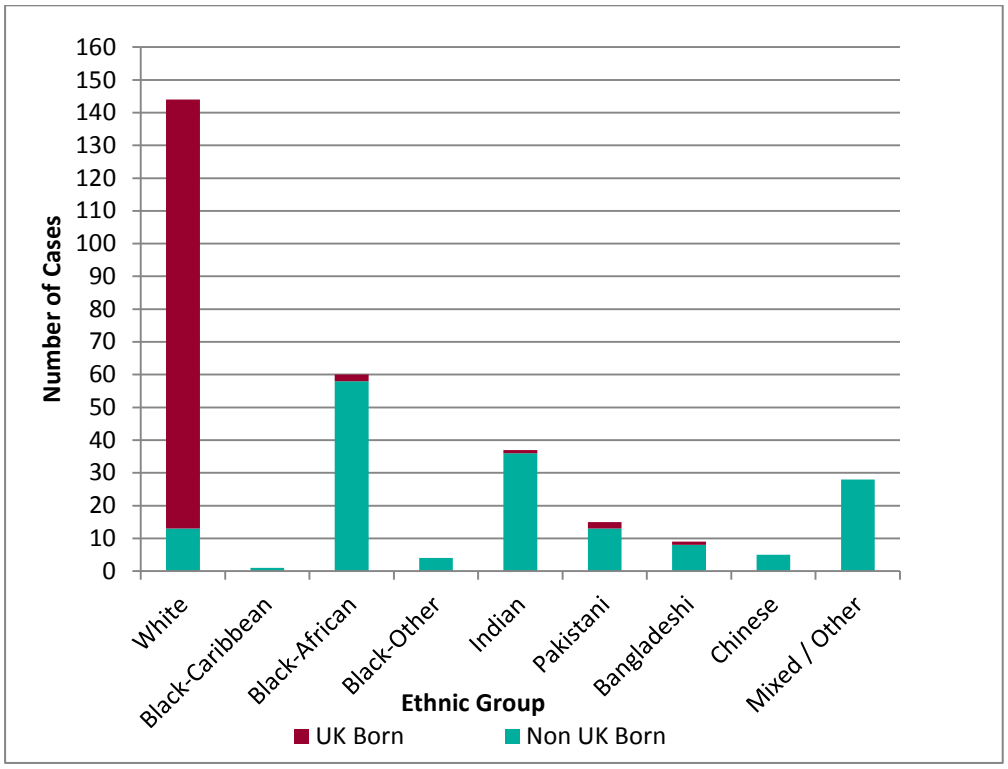
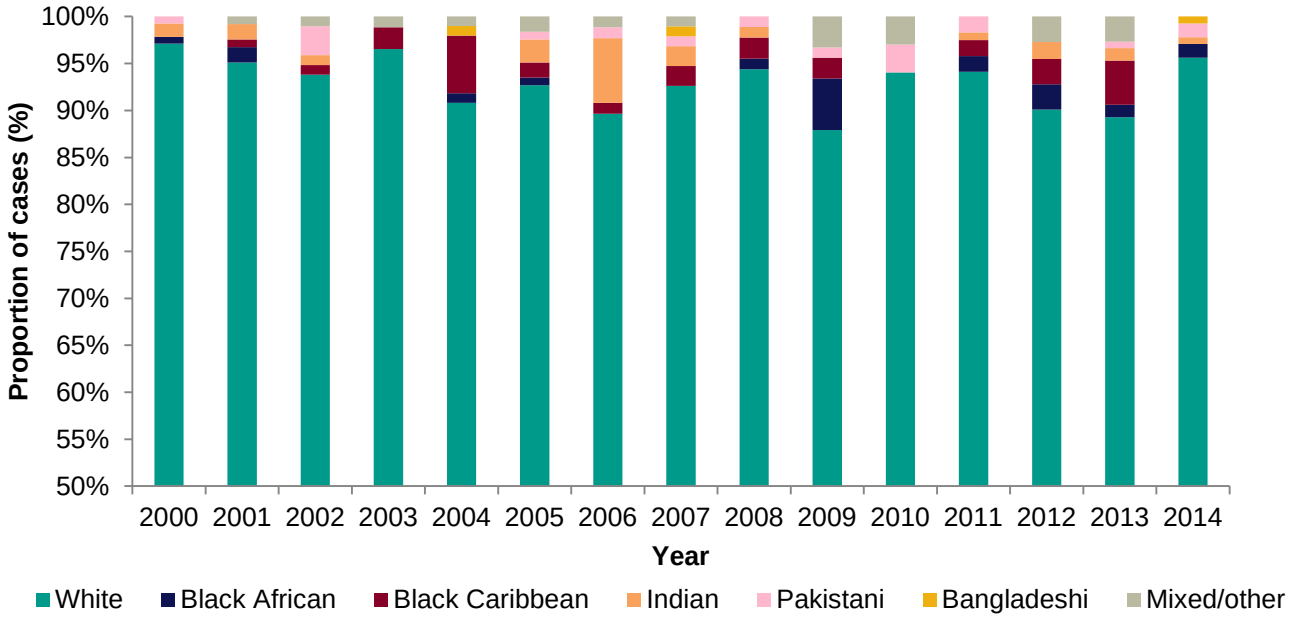


Figure 7d: Proportion of UK born TB patients by ethnic group, South West, 2000-2014



Occupation

Information on occupation was available for 87.5% of working age (16-64 years) cases in 2014. The majority of persons (102 cases, 42.3%) were recorded as occupation 'other' followed by 'none' (57 cases, 23.7%) and 'education' categories (25, 10.4%), see Table 2.

Table 2: Occupational category of TB patients aged 18 to 65 years, South West, 2014

Occupation	Cases	Proportion (%)	Total
Agricultural/animal care worker	3	1.4	211
Education	25	11.9	211
Health care worker	23	10.9	211
Social service/prison worker	1	0.5	211
Other	102	48.3	211
None	57	27.0	211
Total	211	100.0	211

Clinical characteristics

Site of disease

Site of disease was known for 99.1% of cases in 2014. The majority of these cases were diagnosed with pulmonary disease (197 cases, 62.0%) with the remaining persons (121, 38.1%) experiencing extra-pulmonary disease. This distribution in site of disease has remained relatively stable over the past ten years (pulmonary disease range 72.2-62.0%). Extra-pulmonary sites of disease were most common in the extra thoracic lymph nodes (66 cases, 20.6%), plural cavity (34 cases, 10.6%) and intrathoracic lymph nodes (30 cases, 9.3%).

There was a higher proportion of UK born persons with pulmonary disease (69.1%) than non-UK born persons (56.8%). Site of disease varied by ethnicity with White, Black Caribbean, Black African, Black Other, Pakistani, Chinese and Mixed other ethnicities experiencing >50% cases of pulmonary infections (range Pakistani 56.3% to black Caribbean / other 100%), whereas Indian and Bangladeshi ethnicities had a greater proportion of extra-pulmonary infections, 64.9% and 77.8% respectively, see Table 3.

Previous diagnosis of tuberculosis

Data on whether a case had been previously diagnosed with TB was available for 94.4% of cases in 2014. There were 25 (8.3%) cases that had a previous diagnosis of TB recorded and this is the second highest proportion in the past five years (range 6.47% 2013 and 12.4% in 2010). Persons who were UK born had a higher proportion (UK born 11.0% and non-UK born 7.4%) of cases with a previous TB diagnosis recorded.

Table 3: Site of disease of TB patients, South West, 2014

*patients may have disease at more than one site, so the total % will not equal 100%

Site of disease*	Cases	Proportion (%)
Pulmonary	197	61.4
Lymph node (extra-thoracic)	66	20.6
Lymph nodes (intrathoracic)	30	9.3
Other	21	6.5
Pleural	34	10.6
Gastrointestinal/Peritoneal	14	4.4
Bone/Joint (spine)	9	2.8
Bone/Joint (other - not spine)	7	2.2
Miliary	10	3.1
CNS (meningitis)	3	0.9
Genitourinary	10	3.1
CNS (Other - not meningitis)	4	1.2
Cryptic disseminated	0	0.0
Laryngeal	1	0.3

BCG vaccination

BCG status was available for 59.5% of cases in 2014. Where data were available 50.8% of cases had received the BCG vaccination, this was an increase of 9.9% from 2013 but was similar to the values in 2011 and 2012. In 2014 there was only one case under five years old and they were recorded as receiving the BCG vaccine. There were 12 cases under the age of 16 with data available and 66.7% of these persons had been vaccinated. When place of birth was recorded nearly double the proportion of non-UK born had received a BCG compared with UK born cases and this was reflected in the sample as a whole, see Table 4.

Table 4: Number and proportion of TB patients with BCG vaccination, South West, 2014

*including person with missing UK born but with BCG status recorded

	<5 years old BCG vaccination			<16 years old BCG vaccination			All ages BCG vaccination		
	n	%	N	n	%	N	n	%	N
Non-UK born	0	0.0	0	3	60.0	5	63	60.6	104
UK born	0	0.0	0	1	33.3	3	29	35.8	81
All cases*	1	100.0	1	8	66.7	12	97	50.8	191

Microbiological information

Culture confirmation and speciation

Data on culture confirmation was available for 100.0% of cases. There were 177 (55.1%) culture confirmed cases of TB. This is a similar proportion to 2010 however it is lower than the proportion of culture-confirmed cases over the past three years (2011-2013). When stratified by site of disease 114 (57.9%) pulmonary and 63 (52.1%) extra-pulmonary cases were found to be culture confirmed. There were no important differences in culture confirmation between UK and non-UK born cases. Information on mycobacterial species was available for all culture confirmed cases; it was found that 166 (93.8%) were *Mycobacterium tuberculosis*, 10 (5.7%) were *Mycobacterium bovis* and one was (0.6%) *Mycobacterium africanum*.

Sputum smear

Data on sputum smear status was available for 43.7% of the pulmonary cases in 2014 and of these cases 37.2% (32 cases) were found to be positive. This is the lowest proportion of positive cases identified for the past 15 years and does not appear to reflect a differential bias due to the distribution of missing data. From 2010 to 2013 positivity values ranged from 58.3% to 61.3% (four year average = 60.0%) consequently the 2014 value represents a 22.8% drop in sputum smear positive pulmonary cases when compared to the previous four year average.

TB transmission

Rate of TB in UK born children

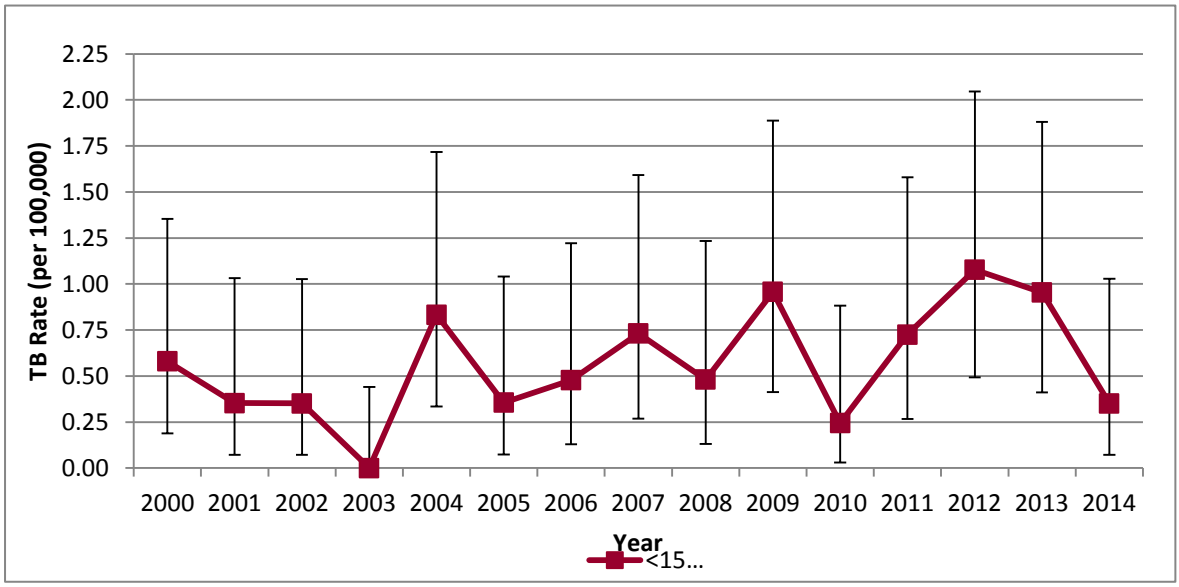
In the South West the rate of TB notification in the UK born population has typically been low and only in 2000 and 2013 has the rate exceeded 3.0/100,000 per population. An indicator for ongoing local transmission is the rate of TB in UK born children under the age of 15. In 2014 the rate was 0.35 / 100,000 population. This is the second lowest rate for ten years (2005 to 2014) and represents a second consecutive annual decrease. The rate in the UK-born under five population was 0.0/100,000 cases per

population. This is joint lowest value in ten years and represents a second annual decrease, see Table 5. However it should be noted that the 95% confidence limits around these values are wide and frequently overlap (see figure 8) and therefore represent imprecise annual estimates of the rate in the under 15 age group.

Table 5: Number and rate per 100,000 of UK born TB cases by age, South West, 2000-2014

UK Born	<5 years			<15 years			All ages		
Year	Cases	Rate per 100,000	Trend	Cases	Rate per 100,000	Trend	Cases	Rate per 100,000	Trend
2000	1	0.37		5	0.58		139	3.03	
2001	2	0.76	↑	3	0.35	↓	123	2.67	↓
2002	2	0.77	→	3	0.35	→	98	2.13	↓
2003	0	0.00	↓	0	0.00	↓	87	1.88	↓
2004	4	1.57	↑	7	0.83	↑	99	2.11	↑
2005	2	0.79	↓	3	0.36	↓	123	2.61	↑
2006	2	0.78	→	4	0.48	↑	87	1.84	↓
2007	0	0.00	↓	6	0.73	↑	97	2.06	↑
2008	2	0.74	↑	4	0.48	↓	91	1.91	↓
2009	6	2.17	↑	8	0.96	↑	99	2.06	↑
2010	1	0.35	↓	2	0.24	↓	108	2.24	↑
2011	3	1.02	↑	6	0.73	↑	126	2.63	↑
2012	4	1.36	↑	9	1.08	↑	114	2.37	↓
2013	3	1.01	↓	8	0.95	↓	151	3.09	↑
2014	0	0.00	↓	3	0.35	↓	137	2.82	↓

Figure 8: Rate of TB and 95% confidence intervals in UK born persons under the age of 15, South West, 2000-2014



TB Monitoring Indicator 5: Incidence of TB in UK born children aged less than 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 different strain types, 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.

Proportion of cases clustered and geographical distribution

In order to identify molecularly clustered cases the MIRU-VNTR profiles of isolates need to be matched by ≥23 typed loci. In 2014 there were 177 culture confirmed cases;168 (94.9%) of these cases had at least one loci out of 24 typed and 90.5% had at least 23 loci typed. Over the past five years (2010 to 2014) 895 cases were culture confirmed; 95.6% of these were typed to at least one loci and 81.3% were typed to at least 23 loci, see Table 6a.

Table 6a: Number and proportion of culture confirmed cases typed, or with 23 or 24 loci typed, South West, 2010-2014

* % typed is the proportion of culture confirmed cases which have had 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 have had all 24 loci typed

Year	Notified cases	Culture confirmed cases		Typed cases*		≥23 loci typed cases **		24 loci typed cases #	
	n	n	%	n	%	n	%	n	%
2010	265	142	53.58	135	95.07	79	55.63	54	38.03
2011	306	200	65.36	199	99.50	169	84.50	99	49.50
2012	300	190	63.33	189	99.47	180	94.74	131	68.95
2013	325	186	57.23	165	88.71	148	79.57	91	48.92
2014	321	177	55.14	168	94.92	152	85.88	113	63.84
Total	1,517	895	59.00	856	95.64	728	81.34	488	54.53

From the cases that had at least 23 loci typed over the five year period (2010-2014) there were 222 molecularly clustered cases in the South West and these were associated with 62 different clusters. The remaining 506 cases represent unique (unclustered) cases in the South West. However when looking nationally, South West cases were associated with 239 different UK wide clusters, see Table 6b.

Table 6b: Number and proportion of unique cases, clustered cases and new clusters by year, South West, 2010-2014

* Clustered in time period (2010-2014), clustered cases notified in year

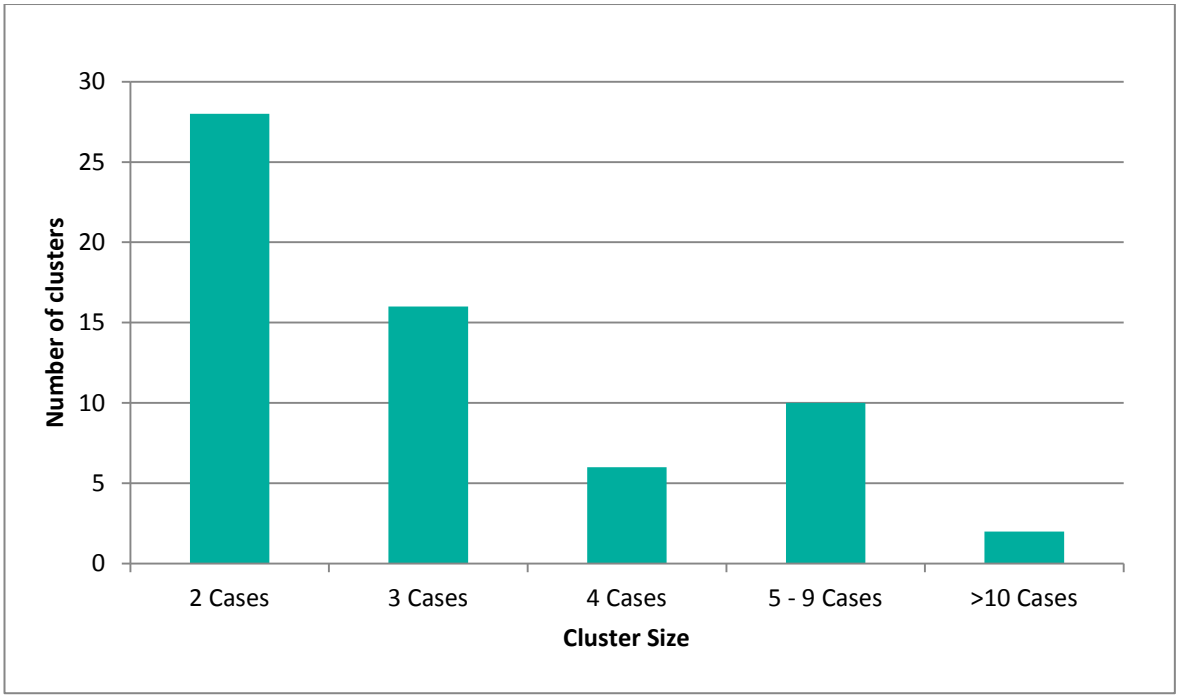
** A new cluster forms at the point when a second case is notified with the same MIRU-VNTR strain type as an existing case

Year	Notified cases	Culture confirmed cases		≥23 loci typed cases **		Unique cases		Clustered Cases PHEC *		Number of new clusters (per year) **
	n	n	%	n	%	n	%	n	%	n
2010	265	142	53.58	79	55.63	47	59.49	32	40.51	7
2011	306	200	65.36	169	84.50	118	69.82	51	30.18	1
2012	300	190	63.33	180	94.74	124	68.89	56	31.11	19
2013	325	186	57.23	148	79.57	105	70.95	43	29.05	13
2014	321	177	55.14	152	85.88	112	73.68	40	26.32	8
Total	1,517	895	59.00	728	81.34	506	69.51	222	30.49	62

Size of clusters

In the five years from 2010 to 2014 there were 62 different molecular clusters identified. These varied in size and the majority of clusters involved two cases (28, 45.2%) followed by three cases (16, 25.8%). There were two clusters (3.2%) that had over ten cases with matching MIRU-VNTR profiles, see figure 9.

Figure 9: Proportion of clusters by size, South West, 2010-2014



Cluster lineage

In 2014 lineage was available for 90.5% of cases and the predominant strain was Euro-American accounting for 44.1% of typed cases. This was followed by Central Asian Strain (CAS) and East African Indian (EAI) lineages, which made up 13.8% and 17.1% respectively, see table 7.

Table 7 – Shows lineage of strains MIRU-VNTR typed 2010 to 2014

Lineage	Cases	Proportion (%)
Euro-American	67	44.08
Central Asian Strain	21	13.82
East African Indian	26	17.11
Beijing	7	4.61
M.africanum	1	0.66
M.bovis	9	5.92
Multiple	5	3.29
None	16	10.53
Total	152	100

Characteristics of cases in clusters

The majority of clustered cases were male (62.3%), aged 15-44 (56.3%), UK born (61.8%) and ethnically white (61.9%). Almost one quarter of clustered cases (24.2%) reported a social risk factor; the most prevalent being alcohol misuse (9.7%) and problem drug use (9.7%). The majority of cases had pulmonary disease (81.0%); of those tested 72.3% were sputum smear positive. There were 5.8% of cases with a previous TB diagnosis, and 6.0% of clustered cases were found to have notifications resistant to at least one first line drug. One case was classified as being multidrug resistant.

Whole genome sequencing

Whole genome sequencing (WGS) of Mycobacterium tuberculosis complex (MTBC) isolates provides information on single nucleotide polymorphism (SNP) differences between isolates, which provides more information than the currently deployed method (MIRU-VNTR strain typing) on how isolates are related to each other. WGS may therefore provide greater understanding of whether isolates are likely to be part of the same transmission chain, and may also help determine the timing and direction of transmission [2, 3, 4]. PHE is close to deploying the use of whole genome sequencing for TB for the NHS throughout England. It is hoped that this new technology will

continue to add to the learning of TB transmission by providing robust genomic information to be used in conjunction with epidemiological and surveillance information.

Delay from onset of symptoms to start of treatment

Time symptomatic

Data on the delay between symptom onset and start of treatment was available for 88.5% of cases in 2014. The median delay for all patients, with available data, was 82 days (IQR 44-151 days), the minimum was two and the maximum was 2222 days. This is the third lowest median delay for five years; the highest was in 2013 at 86 days.

Persons with extrapulmonary TB had a higher median delay (91, IQR 43-173 days) than pulmonary TB cases (70, IQR 44-135 days). Pulmonary cases experienced the lowest median delay for five years in 2014; the highest delay was 85.5 days in 2013. Extrapulmonary cases experienced the second highest delay in five years; the highest was 93 days in 2012. Pulmonary cases with either a positive or negative smear positive test had a median delay of 63 days. However pulmonary cases with missing sputum smear status had a higher median delay at 74 (IQR: 52-145) days.

A total of 70.4% of pulmonary cases were started on treatment within four months of symptom onset and of these 52.1% were started within two months, see Table 8. This is the highest proportion of cases that started treatment within four months for five years. However a lower proportion of these cases started treatment within two months of diagnosis.

Table 8: Time between symptom onset and treatment start date*, South West, 2014

*excluding asymptomatic cases, and those with missing onset dates

	Median days (IQR)	0-2 months		2-4 months		>4 months		
		n	%	n	%	n	%	N
Extra-pulmonary	**91 (43-173)**	39	34.51	34	30.09	40	35.4	113
Pulmonary	**70 (44-135)**	62	36.69	57	33.73	50	29.59	169
Pulmonary smear positive	**63 (35-102)**	12	42.86	11	39.29	5	17.86	28
All cases	**82 (44-151)**	102	35.92	91	32.04	91	32.04	284

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)

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

The demographic characteristics of pulmonary TB cases experiencing treatment delays greater than four months in 2014 were analysed. Female cases were found to have a higher proportion of notifications with a greater than four months delay (34.9%) compared to males (26.2%). This was reflected by a higher median delay of 77 days (IQR 45-160) compared to males 64 (IQR 42-123). UK born persons had a higher proportion of cases with a greater than four months delay (34.5%) compared to non-UK born cases (24.4%) and a higher median delay of 82 days (IQR 48-174) compared to the non-UK born delay of 63 days (IQR 41 to 114). Persons reporting at least one social risk factor experienced a higher proportion of cases with a greater than four month delay (38.9%) compared to persons not reporting a risk factor (29.7%) and a slight increase in median diagnostic delay was identified at 78.5 (IQR 58-309) days compared to 72 (IQR 44.5-130.5).

Persons aged less than 16 years had a lower median delay from symptom onset to treatment than persons aged over 16 years, at 27 days (IQR 22-32 days) compared to 71 days (IQR 44-137 days). The ethnicities with the highest median delay were Bangladeshi at 111.5 days (IQR 109-114, 2 cases) followed by Indian at 92 days (IQR 61-120, 13 cases). The lowest median delay of 29 days was found for black Caribbean cases, although only one case was notified from this ethnic group.

TB outcomes in drug sensitive cohort (2013 data)

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 [5]. Treatment outcomes for the drug sensitive cohort are reported separately and differently for the following groups:

- for cases with an expected duration of treatment less than 12 months, TB outcomes at 12 months are reported. This group excludes cases with CNS disease who have an expected duration of treatment of 12 months. In addition, those with spinal, cryptic disseminated or miliary disease are excluded from this group, as CNS involvement cannot be reliably ruled out for the purposes of reporting.
- for cases with CNS, spinal, cryptic disseminated or miliary disease, the last recorded treatment outcome is reported.

1: Outcomes: patients with expected duration of treatment less than 12 months

Over the 12 months of 2013, 71.3% of cases were recorded as successfully completing treatment, 10.4% of cases were not evaluated (data missing/ not completed) for treatment completion, 7.9% were still on treatment, 5.7% died, and 3.9% were lost to follow-up, see Table 9a. These proportions are comparable to 2012; however, in 2013 a greater proportion were not evaluated, whereas in 2012 a greater proportion were either recorded as dying during treatment or were lost to follow-up after 12 months.

Table 9a: TB outcome at 12 months, South West, cases diagnosed in 2013*

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

Outcome at 12 months	Cases	Proportion (%)
Completed	199	71.3
Died	16	5.7
Lost to follow up	11	3.9
Still on treatment	22	7.9
Treatment stopped	2	0.7
Not evaluated	29	10.4
Total	279	100.0

Treatment data was available for 100.0% of the drug sensitive cases (including CNS cases) notified during 2013. During this time period, 298 cases were classified as drug sensitive and of these 19 (6.6%) had CNS disseminated disease. When looking at treatment outcomes for cases without CNS disseminated disease (n=279), 199 (71.3%) were recorded as successfully completing treatment at 12 months. This treatment completion rate is comparable to the completion rate in 2012 and has remained relatively stable since 2007 (range 67.0%-74.4%), see Table 9b and Figure 10.

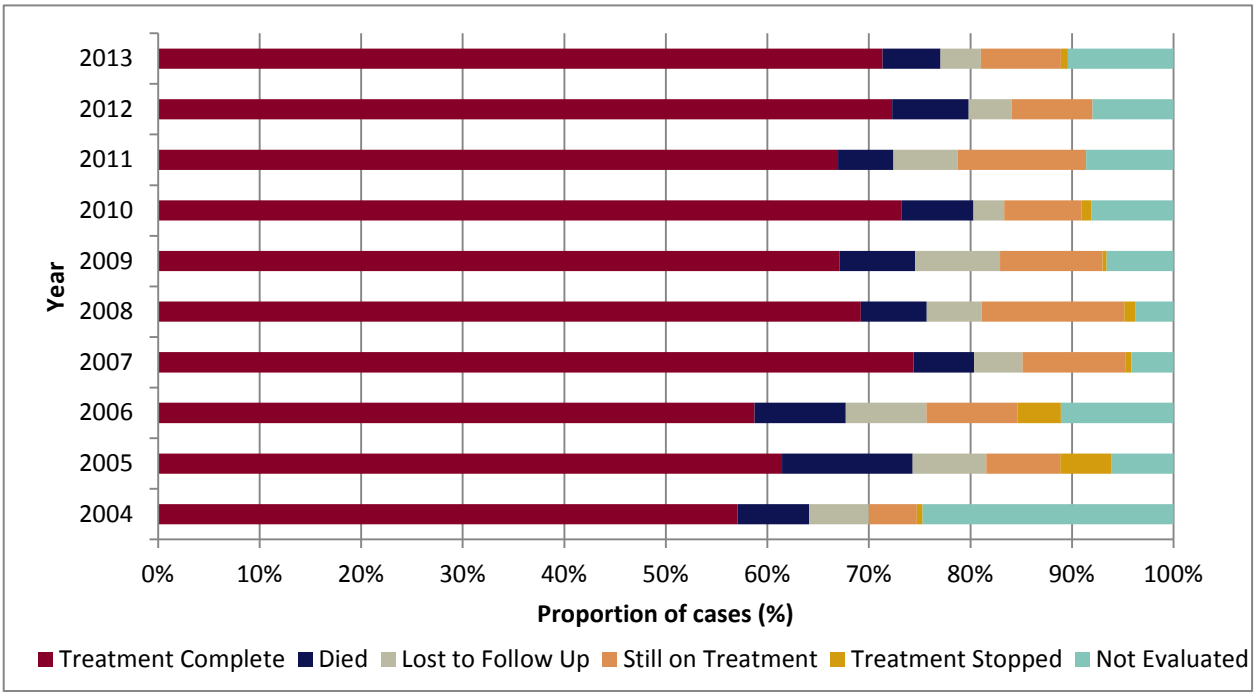
Table 9b: Number and proportion completing treatment at 12 months, South West, 2002-2012*

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

Year	Cases	Proportion (%)	Total
2003	92	68.15	135
2004	97	57.06	170
2005	110	61.45	179
2006	111	58.73	189
2007	125	74.40	168
2008	128	69.19	185
2009	153	67.11	228
2010	145	73.23	198
2011	148	66.97	221
2012	154	72.30	213
2013	199	71.33	279

Figure 10: The proportional distribution of treatment outcomes at 12 months from 2004-2013*

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



TB Monitoring Indicator 10: Number and proportion of drug sensitive TB cases who had completed a full course of treatment by 12 months (England, PHEC and UTLA data shown on Fingertips).

TB Monitoring Indicator 11: Number and proportion of drug sensitive TB cases that were lost to follow up at last reported outcome (England, PHEC and UTLA data shown on Fingertips).

TB Monitoring Indicator 12: Number and proportion of drug sensitive TB cases that had died at last reported outcome (England, PHEC and UTLA data shown on Fingertips).

In 2013 the majority of persons who were lost to follow up left the UK (70.0%, 7 cases), the remaining persons were recorded as having other reasons for disengagement with the TB service. Of the cases who died during treatment, 50.0% (8 cases) were recorded as having an unknown relationship between their death and TB infection, TB caused or contributed to the death of six persons (37.5%; 3 cases each) and there were two cases where TB infection was found to be incidental to death. Three of the cases with an unknown relationship between infection and death had their infection diagnosed post mortem. People who died had a median age of 71.5 years (range 33 to 87 years). One of the cases where TB was recorded as causing death was aged 25 to 34 years and the other two were over 65 years old.

The majority of patients recorded as still on treatment at 12 months had their treatment extended (73.3%, 11 cases); the remaining cases either had their treatment changed or

interrupted (26.6%, 4 cases). When treatment was changed or interrupted this was due to intolerance and/or side effects.

Treatment completion rates were analysed by patient characteristics and the highest proportion of treatment completion was found for those aged 0-14 years (90.0%, 9 cases). This value decreased with age and persons 65+ years had the lowest rate (66.2%, 47 cases). Persons reporting at least one social risk factor had a lower proportion completing treatment (69.0%) than persons reporting no social risk factors (73.0%). In 2013 upper tier local authorities with greater than or equal to five cases were Bournemouth, Bristol, Cornwall, Devon, Gloucestershire, North Somerset, Plymouth, Poole, South Gloucestershire, Torbay and Wiltshire; all had a treatment completion rate above 70.0% however only Plymouth and Poole had a completion rate above 80.0%.

It was found that a greater proportion of male (8.0%, 13 cases) cases died during treatment than female cases (2.6%, 3 cases), and a higher proportion of UK born cases died (9.6%, 13 cases) compared to non-UK born cases (1.6%, 2 cases). Persons reporting at least one social risk factor had a higher proportion of deaths (no risk factor 3.9% and risk factor 13.8%). A higher proportion of non-UK born cases was lost to follow-up compared to UK born cases (6.3% and 8 cases vs 2.2% and 3 cases). Persons reporting at least one social risk factor were found to have a higher proportion recorded as lost to follow up (no risk factor 2.5% and risk factor 6.9%).

2: Outcomes: patients with CNS, spinal, miliary or cryptic disseminated disease

There were 19 cases of TB with CNS dissemination that were sensitive to rifampicin. All the cases were evaluated for treatment completion and of these 57.9% had successfully completed treatment at 12 months, three (15.8%) were still on treatment, two (10.5%) were lost to follow up, two died and one (5.3%) stopped treatment. The year 2013 had the highest completion rate of CNS disseminated cases since 2002. This was in part due to a low proportion of cases being either still on treatment or dying within 12 months, see Table 10.

Table 10: TB outcome at 12 months for patients with rifampicin sensitive, CNS, spinal, miliary or cryptic disseminated disease, South West, cases diagnosed in 2012*

*excludes rifampicin resistant TB

Outcome at 12 months	Cases	Proportion (%)
Completed	11	57.89
Died	2	10.53
Lost to follow up	2	10.53
Still on treatment	3	15.79
Treatment stopped	1	5.26
Not evaluated	0	0.00
Total	19	100.00

In 2013 there were two deaths, one of these a causal relationship between death and TB was identified and the second case was listed as incidental. These cases had a median age of 80 years (range 75 to 85). There were no post mortem diagnoses of TB recorded.

Three cases were still on treatment at 12 months, two of these cases had their treatment extended and one had their treatment interrupted due to poor compliance. The two cases that were lost to follow up either left the UK or had ‘other’ reasons listed.

Treatment outcomes were analysed by patient characteristics and it was found that a higher proportion of females (71.4%, 5 cases) with CNS disseminated TB completed treatment than males (50.0%, 6 cases). A higher proportion of cases completed treatment from lower age bands and both deaths occurred in the over 65 year age group. Non-UK born persons had a higher proportion (66.7%, 8 cases) of cases completing treatment at 12 months compared to UK born cases (40.0%, 2 cases). Persons reporting social risk factors had a higher proportion of persons completing treatment (66.7%, 2 cases) compared to those who did not (53.9%, 7 cases). When looking at mortality both of the cases that died were male, over the age of 65, UK born and one was recorded as having no social risk factors. Of the two cases that were lost to follow up one was male and the other female, both were between the ages of 15 and 44 years, one was non-UK born, and neither had social risk factors recorded.

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

Drug resistance

Overall drug resistance and geographical distribution

In 2014 there were 177 culture confirmed cases of TB and these were preserved in the following analysis. There were 12 (6.8%) cases that were found to have resistance to at least one first line drug. This was a lower proportion than in 2013 (8.3%), 2012 (7.4%) and 2011 (9.8%), however it was higher than in 2010 (5.9%). There were 11 cases (6.2%) with isoniazid resistance, two (1.1%) with ethambutol resistance, two (1.1%) with rifampicin resistance, and none with pyrazinamide resistance (excluding *M.bovis*). There were two cases of multi-drug resistant (MDR) TB in 2014; this was similar to the range over the past five years, of one to two cases, see Figure 11.

TB Monitoring Indicator 9: Number and proportion of culture confirmed TB cases with drug susceptibility testing reported for the four first line agents (England, PHEC and UTLA data shown on Fingertips).

TB Monitoring Indicator 18: Number and proportion of culture confirmed TB cases with any first line drug resistance (England, PHEC and UTLA data shown on Fingertips).

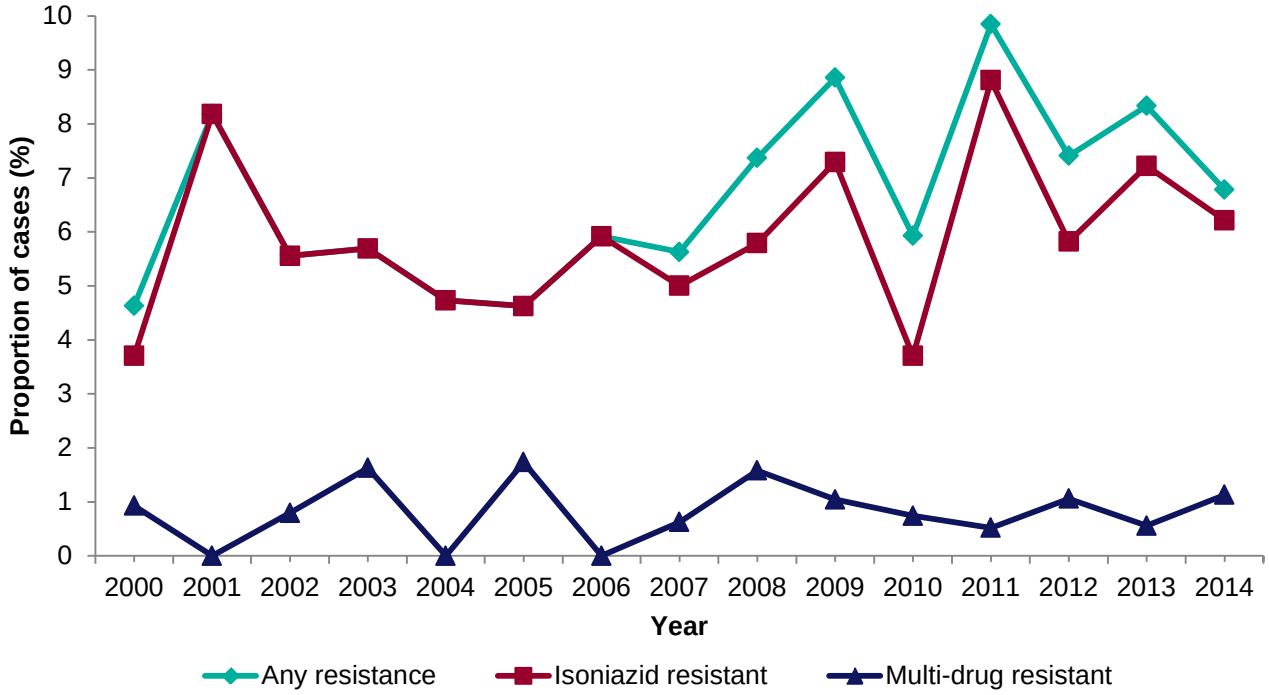
TB Monitoring Indicator 19: Annual number and proportion of culture confirmed TB cases with MDR-TB (England, PHEC and UTLA data shown on Fingertips).

Characteristics of patients with drug resistant TB

It was found that non-UK born persons had a higher proportion (10.5%, 10 cases) of notifications with resistance to any first line drug compared to UK born persons (2.7%, 2 cases). The non-UK born resistant cases were mostly of black-African ethnicity (60.0%, 6 cases), followed by Indian (20.0%, 2 cases) and mixed / other (20.0%, 2 cases) ethnicities, and the two UK born cases were of white and Black-African ethnicities respectively. None of the cases with infections that were resistant to any first line drug, reported a previous TB infection. There was a higher proportion of males (8.0%, 9 cases) suffering from resistant infections than females (4.6%, 3 cases). Extra-pulmonary cases had a higher proportion of resistant infections (9.5%, 6 cases) than pulmonary notifications (5.3%, 6 cases). The proportion of resistance in people reporting social risk factors (6.7%, 1 case) was similar to that in people not reporting these factors (6.2%, 8 cases). The two multi-drug resistant cases were of Indian (non-

UK born) and black-African (UK born) ethnicities, both male, one case reported no social risk factors the other case had no risk factor information recorded, and both were suffering from extra-pulmonary disease.

Figure 11: Proportion of TB cases with first line drug resistance, South West, 2000-2014



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

There were five (2.8%) cases that were found to have resistance to second line TB drugs. This is the largest number reported in ten years with the previous highest being two cases (1.0%) in 2008, 2009 and 2011. These cases were male, non-UK born, and three with pulmonary disease. There was one extensively resistant case reported in 2014 and this was the first case to be identified in the South West. This case was in a non-UK born male of Indian ethnicity who had extra-pulmonary disease and had not been previously diagnosed.

Outcomes: 24 months for patients with rifampicin resistant disease

In 2012 there were two cases in the drug resistant treatment cohort. Of these cases one was recorded as completing treatment and the other had had their treatment extended beyond 24 months. The two cases presented with pulmonary disease, no social risk factors, one male and one female, both aged between 15 and 44 years, non-UK born and were either black-African or mixed / other ethnicity, and one case reported a previous diagnosis of TB, see Table 11.

Table 11: TB outcome at 24 months for patients with rifampicin resistant disease, South West, cases diagnosed in 2012

Outcome at 24 months	Cases	Proportion (%)
Completed	1	50.00
Died	0	0.00
Lost to follow up	0	0.00
Still on treatment	1	50.00
Treatment stopped	0	0.00
Not evaluated	0	0.00
Total	2	100.00

TB Monitoring Indicator 13: Number and proportion of drug resistant TB cases who had completed treatment at 24 months (England, PHEC and UTLA data shown on Fingertips).

TB Monitoring Indicator 14: Number and proportion of drug resistant TB cases who were lost to follow up at last reported outcome (England, PHEC and UTLA data shown on Fingertips).

TB Monitoring Indicator 15: Number and proportion of drug resistant TB cases who had died at last reported outcome (England, PHEC and UTLA data shown on Fingertips).

TB in people with associated social risk factors and health inequalities

Social risk factors

In 2014 data on social risk factors was available for 83.8% of notifications. Of these 9.3% (25 cases) reported at least one social risk factor. This is the lowest proportion of cases reporting a risk factor in the past five years. A higher proportion of persons with pulmonary (76.0%) than extra-pulmonary (61.8%) disease report at least one social risk factor compared to persons who reported none, see table 12a.

A higher proportion of UK born persons reported a social risk factor (12.7%) compared to non-UK born persons (6.8%). Non-UK born persons with risk factors were from nine different countries, with the largest proportion from Somalia (2 cases, 20.0%).

The most prevalent risk factor reported in 2014, for people who had data on risk factors (n=269), was alcohol use (10, 3.7%), followed by homelessness (8, 2.97%), prison and problem drug use (both 6, 2.23%), see Table 12b.

Table 12a: Social risk factors among TB patients, South West, 2010-2014

	Any risk factor		
Year	Cases	Proportion (%)	Total
2010	21	11.86	177
2011	23	10.90	211
2012	32	13.45	238
2013	37	13.65	271
2014	25	9.29	269

Table 12b: Individual social risk factors among TB patients, South West, 2014

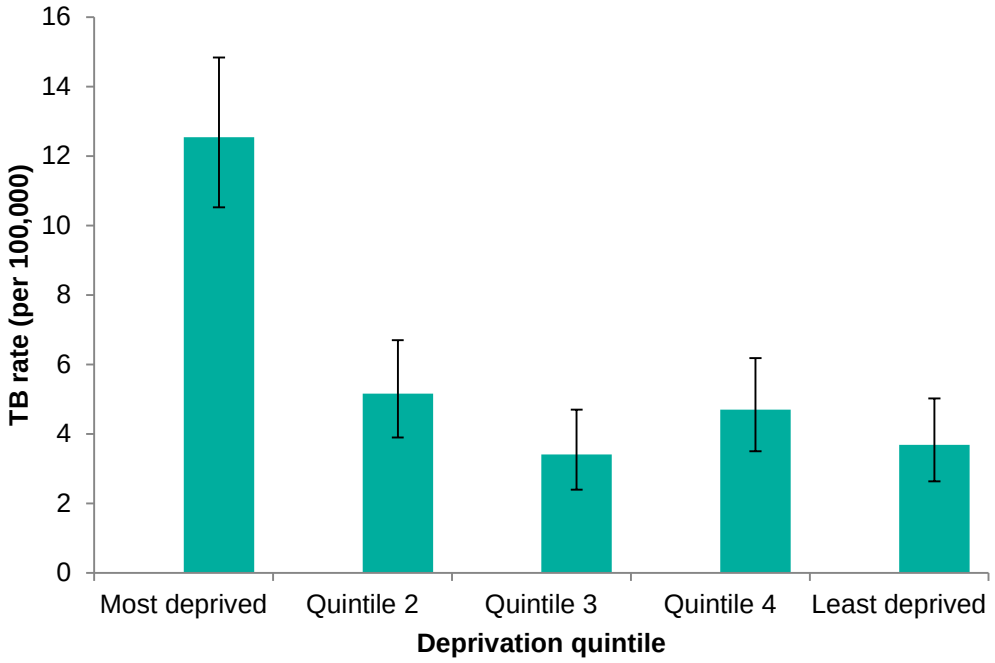
Social Risk Factor	Cases	Proportion (%)	Total
Homelessness	8	2.97	269
Imprisonment	6	2.23	269
Drug misuse	6	2.23	269
Alcohol misuse	10	3.72	269

Deprivation

The Index of Multiple Deprivation (IMD) 2010, part of the English Indices of Deprivation, is an overall measure of multiple deprivation experienced by people living in an area and is measured at lower super output (LSOA) level. This report uses IMD score categorised into five groups (deprivation quintiles) for each PHEC based on IMD score variable (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6871/1871208.pdf).

Data on social deprivation quintile was available for 99.7% of cases and of these the majority (42.5%) were from the most deprived quintile. The rates within each quintile can be seen in Figure 12.Tthe highest rate is observed in the most deprived quintile and the lowest in quintile three. The 95% confidence intervals for the rate of TB in persons by social deprivation quintile for quintiles two to five (least deprived) all overlap indicating potentially no difference between them. The rate for quintile one (most deprived) is more than double that for the other quintiles and the confidence intervals do not overlap indicating a significant difference in the point estimates across deprivation quintile, see figure 12.

Figure 12: TB case rate and 95% confidence intervals by IMD quintile, South West, 2014



HIV testing, DOT and hospital admissions

HIV testing

Data on HIV testing was available for 72.9% of cases in 2014. The majority of TB notifications (87.6%) either had an HIV test offered (184) or their status was already known (21). This is an increase on 2013 when 82.0% of cases were either offered an HIV test (171) or their status was already known (7). Of the 184 cases offered an HIV test in 2014, 96.2% had an HIV test carried out and the remaining 3.8% either refused or did not have the test performed for another reason. The proportion of HIV tests offered in 2013 that were performed was higher than the corresponding proportion in 2013 (94.7%), see Table 13.

Table 13: HIV testing, South West, 2014
*or result already known

	Cases	Proportion (%)
HIV test offered*	205	87.61
HIV test offered and done*	177	96.20
HIV test offered but refused or not done	7	2.99
All cases with data available	234	100.00

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

Hospital inpatient and directly observed therapy

Data on whether a patient was treated for TB as an inpatient was available for 90.7% of cases of which 21.0% were treated as an inpatient. This is an increase from 2013 when 16.6% of cases were treated for TB as an inpatient. Data on directly observed therapy was available for 82.6% of cases in 2014 of which 10.2% underwent treatment via DOT. This was a slight increase from 2013 when 9.9% of cases underwent treatment using DOT, see Table 14.

Table 14: Hospital inpatient and DOT use, South West, 2014
* At any time during treatment

	Cases	Proportion (%)	Total
Hospital inpatient*	61	20.96	291
DOT given*	27	10.19	265

Latent TB infection testing and treatment

In January 2015, the Collaborative Tuberculosis Strategy for England identified £10 million of funding to establish new migrant latent TB infection (LTBI) testing and treatment services in areas with high incidence (>20 per 100,000). The only CCG to meet this threshold in the South West was Bristol.

The Bristol LTBI testing and treatment service will be delivered through primary care and aims to prevent active TB by identifying and treating latent TB infection. Those eligible for the service are people registering with a GP practice in Bristol who:

- were born or spent >6 months in high TB incidence country (>150/100,000 or Sub-Saharan Africa)
- entered the UK within the last 5 years
- are aged 16−35 years
- have no history of TB, either treated or untreated
- have never been screened for TB in the UK

Data on GP patient registrations was analysed to estimate the number of patients who would be eligible for LTBI screening (defined above). Based on an average of the last three years of data, the expected screening cohort for a full year was estimated as:

- number of new migrants eligible for screening: 1025-1324
- number requiring treatment for latent TB (20% positivity): 205-265
- number requiring treatment for active TB (<1%): <10

Identification of eligible screening recipients will take place prospectively using current registration arrangements for each GP practice. All new patients registering with a GP practice (or identified through The Haven[1]) who meet the eligibility criteria will be offered a latent TB screening test, which comprises a single blood sample. A positive test will result in a referral to the TB secondary care providers for treatment and support.

The service will be delivered in two phases: phase one will begin in January 2016 and will see the service delivered across five GP practices located in high-risk areas and The Haven, which provides health assessments to asylum seekers; phase two will see the service delivered in the remaining GP practices in Bristol CCG.

[1] *The Haven offers* asylum seekers and refugees across Bristol a comprehensive health assessment

Discussion

This report aims to provide an epidemiological overview of TB in the South West. It uses notification data from 2014 and outcome data from 2013 and 2012. The South West PHEC remains a low incidence region and the rate of 5.9/100,000 population is the lowest reported for a region in England. The incidence within the area has remained stable for the past ten years. This is in contrast to the rate for England, which has seen a considerable decrease over the past four years. The decrease for the UK has been attributed to a reduction in the rate in the non-UK born population. This is not reflected in the South West and there has been no noteworthy decrease in the rate of notification in non-UK born persons. Furthermore the rate in the UK population has been slowly rising since 2008. These factors are thought to be responsible for the static annual rate in the South West.

The South West is a heterogeneous region and there are large differences in rates of TB notification by location. The highest TB rate was found in the City of Bristol which is the largest urban area in the region. This finding is in line with the national picture, where TB continues to be concentrated in urban centres. The City of Bristol's TB rate is nearly double that of any other local authority and public health action is required to reduce the incidence in this locality. It is therefore predicted to be a strong driver for TB incidence in the South West. Other areas with relative high incidence cluster in the northern part of the region.

The South West non-UK born population has a rate 14 times larger than that of the UK born population. These cases continue to arise in settled migrant populations and the majority of cases occur in persons who have lived in the UK for over 10 years prior to diagnosis. These cases could perhaps be attributed to re-activation of latent tuberculosis infection (LTBI) acquired prior to UK entry. The roll out of systematic LTBI testing in primary care aims to identify persons at risk of reactivation, who entered the UK within the last five years, and intervene with treatment to prevent it. It is predicted to play a crucial role in reducing the number of cases caused by reactivation by reducing the pool of LTBI positive persons for years to come.

The rate of TB in UK born persons under the age of 15 has seen a two year consecutive decrease which suggests there has been a reduction in recent transmission. There have been several rises in the past ten years and this could indicate transmission events were occurring. Improvements in early diagnoses, TB treatment completion and comprehensive contact tracing with a focus on vulnerable populations can help achieve further decreases in transmission.

Delay between symptom onset and starting treatment for TB is higher than the national value (median delay 74 days) and has continued to fluctuate over the past five years. The highest delays have been seen in extra-pulmonary TB cases. A positive finding is that pulmonary cases have experienced a shorter median delay than in previous years. To tackle this issue further a method needs to be developed to flag and investigate delays that exceed an agreed threshold.

Treatment completion rates are lower than the national level and have remained relatively stable over the past five years. This cannot be attributed to any one factor, however further

work is required to ensure that TB patients complete treatment and that further reductions are made in TB related deaths and those lost to follow-up.

Levels of resistance to first line drugs have remained relatively stable, bar a few fluctuations, over the past five years, and the level of isoniazid resistance mirrors this trend. This is reflected in the number of multidrug resistant cases which has remained between one and two per year. Resistance to second line drugs has shown an increase and in 2014 the largest proportion in the past ten years was observed. Furthermore, an XDR TB case occurred during 2014, which was the first in the South West. Drug resistant cases are more commonly identified in males and persons who are non-UK born. The outcomes in 2012 for resistant cases were positive with one case completing treatment at 24 months and the other still on treatment.

TB continues to affect the most vulnerable person in society. This is shown by the higher rate of TB in the most deprived social quintile, which is 2.4 times that of the next highest quintile. One in ten cases report at least one social risk factor, with the most prevalent being alcohol misuse (3.7%). This highlights the crucial importance of tackling TB in the most under-served populations through systematic joined-up care between health and social services, the third sector, public health and housing, in addition to tackling the social and economic risk factors associated with TB. An important intervention will be cohort review which is currently being rolled out across the South West. This aims to improve service delivery by monitoring patient care against pre-defined objectives, sharing learning and increasing accountability.

Following a successful pilot, PHE is finalising the accreditation for whole genome sequencing of TB, and is currently planning the full deployment of this new technology. This will enable routine typing of all TB isolates. This is expected to improve our understanding of the epidemiology of TB transmission in England, as well as leading to faster speciation and resistance prediction, which should have a direct impact on patient care.

In January 2015, PHE and NHS England published the Collaborative TB Strategy for England 2015-2020 [1], which sets out the actions required to achieve a year on year reduction in TB incidence and a reduction in the health inequalities associated with the disease. The Collaborative TB Strategy sets out the actions required to raise awareness of TB among communities and health professionals, and to ensure services are accessible to affected communities. This report of TB surveillance data for South West up until the end of 2014 provides a comprehensive overview of the epidemiology of TB in the region prior to the implementation of the strategy.

Conclusion

Tuberculosis remains an important issue in parts of the South West and requires further intervention to prevent future cases. Overall the rates of notification have remained stable for a long period of time; decreases in previous years were due to a reduction in cases that were non-UK born however recently the rate in this group has stabilised. Furthermore, the UK born population has seen an increase in rates of notification. Certain 'hot spots' exist within the South West and these require special attention. The introduction of latent tuberculosis screening in the City of Bristol is predicted to have a positive impact on rates in this area. Furthermore cohort review is currently being rolled out and has been shown elsewhere to improve clinical outcomes and reduce healthcare associated delays. This will be important in facilitating services to improve TB detection and treatment outcomes in their area. In order to support the development of the regional strategy this report will be shared with the TB control board for the South of England and priority actions will be decided upon.

References

1. Collaborative tuberculosis strategy for England: 2015-2020 https://www.gov.uk/government/publications/collaborative-tuberculosis-strategy-for-england

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Appendix A: Methods, description of data sources and definitions

Methods
For a full description of the methods used to collect, manage and clean the data see the national TB annual report:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/464914/TB_Annual_Report_2015.pdf

Data sources
Data on TB cases in the South West comes from the national enhanced TB surveillance (ETS) system. Data collected includes notification details, and demographic, clinical and microbiological information, including drug resistance and strain type, provided by the Reference Laboratory (Cardiff and NMRL).

Definitions

Amplified resistance
Amplified 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 amplified 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 a group of 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 amplified), including MDR-TB (initial or amplified), as well as those without culture confirmation treated for MDR-TB.

Drug sensitive cohort
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.

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.

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 classed as resistance identified within three months of the first specimen date.

Interquartile range
A measure of statistical dispersion, being equal to the difference between the upper and lower quartiles IQR = $Q_3 - Q_1$

Median
Denoting or relating to a value or quantity lying at the midpoint of a frequency distribution of observed values or quantities, such that there is an equal probability of falling above or below it.

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 post-mortem diagnosis is an unexpected diagnosis of TB made after death, usually during an autopsy examination.

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.

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 2015.

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

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

Population denominator

Tuberculosis rates by geographical area (Centre, local authority, MSOA and LSOA), age, sex and place of birth were calculated using ONS mid-year population estimates. http://www.ons.gov.uk/ons/about-ons/get-involved/taking-part-in-a-survey/information-for-households/a-to-z-of-household-and-individual-surveys/labour-force-survey/index.html Rates by place of birth and by ethnic group were calculated using population estimates from the Labour Force Survey (LFS) http://www.esds.ac.uk/findingData/qlfs.asp . The LFS is based on a population sample, so estimates are liable to sampling errors, particularly for small population subgroups, and should be interpreted with caution.

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 South West was carried out on cases that clustered in 2014 and notified between 2010 and 2014.

Appendix B: TB among South West residents

Table Bi: TB cases numbers by local authority of residence, South West, 2000- 2014

	Year														
Local Authority	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bath and North East Somerset	6	11	11	12	9	18	4	5	8	12	12	4	11	9	19
Bristol, City of	48	40	63	51	76	66	81	81	71	84	81	82	88	97	99
Cheltenham	8	7	10	6	8	6	14	8	13	8	5	7	5	13	7
Cotswold	2	3	0	0	1	1	2	1	2	2	1	3	5	3	1
Forest of Dean	3	3	2	2	1	2	3	3	1	1	0	1	1	0	1
Gloucester	7	1	7	7	8	6	12	13	11	8	7	13	11	21	8
North Somerset	3	7	4	3	5	10	6	5	10	13	10	6	9	7	8
South Gloucestershire	8	11	5	12	11	10	9	8	16	25	13	18	13	17	22
Stroud	6	3	0	6	3	4	4	3	7	4	2	2	5	7	5
Swindon	11	9	8	12	11	10	21	24	13	18	21	23	18	29	18
Tewkesbury	5	1	1	2	3	4	2	2	1	1	2	4	2	4	4
Wiltshire	6	11	11	14	12	9	12	9	16	13	15	15	14	12	17
Bournemouth	17	12	17	13	14	24	23	13	18	14	15	24	16	12	14
Christchurch	4	4	1	2	2	3	3	4	0	3	1	2	2	0	0
East Dorset	3	6	2	2	3	1	1	2	2	5	1	1	2	3	3
North Dorset	1	2	2	3	2	3	4	0	1	4	3	2	4	1	0
Poole	12	8	10	5	10	11	6	8	11	5	7	2	1	5	1
Purbeck	0	2	1	2	2	1	3	2	1	3	3	2	1	2	1
West Dorset	3	1	2	3	2	5	3	2	4	2	2	2	2	2	3
Weymouth and Portland	4	2	0	1	3	4	4	6	0	6	0	1	1	3	5
Cornwall & Isles of Scilly	13	10	13	12	20	13	10	21	11	13	7	23	18	13	18
East Devon	8	2	5	1	6	5	1	3	2	5	4	3	1	0	1
Exeter	3	6	2	1	7	7	6	8	7	9	1	8	14	7	5
Mendip	2	2	5	2	10	9	3	3	4	1	4	2	2	6	5
Mid Devon	2	0	0	1	0	2	1	0	4	0	2	2	3	1	3

North Devon	3	0	0	0	1	0	0	1	0	1	0	0	1	3	3
Plymouth	11	15	12	9	12	5	16	12	13	13	11	16	20	12	12
Sedgemoor	1	0	5	0	2	0	0	3	2	1	2	7	3	2	4
South Hams	2	6	0	0	1	1	2	2	2	1	6	3	1	2	4
South Somerset	2	2	4	2	2	9	5	5	2	3	5	2	5	5	9
Taunton Deane	4	2	4	1	3	2	0	1	4	2	1	6	6	3	2
Teignbridge	11	12	5	8	2	2	5	4	8	8	5	9	4	9	6
Torbay	9	8	6	3	8	12	10	4	11	14	12	11	5	10	6
Torridge	1	1	0	0	1	0	0	1	0	0	0	0	1	0	3
West Devon	1	1	1	2	3	0	2	1	2	1	2	0	5	5	4
West Somerset	0	0	1	1	0	1	0	1	1	0	2	0	0	0	0

Table Bii: TB rate* per 100,000 by local authority of residence, South West, 2000-2014

	Year														
Local Authority	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bath and North East Somerset	3.56	6.50	6.48	7.04	5.28	10.51	2.34	2.90	4.61	6.92	6.89	2.28	6.19	5.00	10.44
Bristol, City of	12.29	10.26	16.16	13.03	19.20	16.28	19.83	19.66	17.12	20.05	19.15	19.16	20.35	22.17	22.37
Cheltenham	7.31	6.36	9.11	5.49	7.29	5.41	12.54	7.11	11.51	7.02	4.35	6.05	4.31	11.22	6.01
Cotswold	2.47	3.73	0.00	0.00	1.22	1.22	2.42	1.20	2.41	2.42	1.21	3.61	5.98	3.57	1.18
Forest of Dean	3.76	3.75	2.50	2.48	1.23	2.45	3.67	3.66	1.22	1.22	0.00	1.22	1.21	0.00	1.20
Gloucester	6.35	0.91	6.33	6.28	7.11	5.27	10.41	11.09	9.29	6.70	5.80	10.66	8.91	16.86	6.37
North Somerset	1.60	3.71	2.11	1.57	2.59	5.13	3.05	2.51	4.98	6.44	4.93	2.95	4.40	3.40	3.84
South Gloucestershire	3.27	4.47	2.02	4.82	4.38	3.95	3.53	3.12	6.20	9.63	4.97	6.83	4.88	6.32	8.10
Stroud	5.56	2.78	0.00	5.51	2.74	3.63	3.62	2.70	6.29	3.58	1.78	1.77	4.41	6.14	4.34
Swindon	6.12	5.00	4.39	6.51	5.90	5.27	10.92	12.19	6.45	8.81	10.15	10.97	8.49	13.55	8.34
Tewkesbury	6.54	1.31	1.29	2.57	3.85	5.11	2.53	2.52	1.25	1.24	2.45	4.86	2.41	4.75	4.66
Wiltshire	1.40	2.54	2.51	3.16	2.69	2.01	2.65	1.96	3.45	2.79	3.19	3.16	2.94	2.50	3.52
Bournemouth	10.45	7.34	10.33	7.92	8.54	14.46	13.80	7.64	10.47	8.03	8.37	13.08	8.57	6.36	7.31
Christchurch	8.93	8.91	2.22	4.41	4.40	6.56	6.51	8.61	0.00	6.35	2.10	4.17	4.17	0.00	0.00
East Dorset	3.59	7.15	2.36	2.34	3.49	1.16	1.16	2.30	2.29	5.75	1.15	1.15	2.28	3.41	3.40
North Dorset	1.62	3.23	3.18	4.69	3.08	4.55	5.97	0.00	1.47	5.90	4.42	2.90	5.77	1.43	0.00

Poole	8.68	5.78	7.19	3.60	7.19	7.87	4.25	5.60	7.63	3.44	4.77	1.35	0.67	3.36	0.67
Purbeck	0.00	4.50	2.24	4.51	4.51	2.24	6.69	4.44	2.21	6.65	6.64	4.43	2.21	4.40	2.19
West Dorset	3.27	1.08	2.13	3.16	2.09	5.19	3.09	2.04	4.06	2.03	2.02	2.01	2.01	2.00	2.99
Weymouth and Portland	6.32	3.14	0.00	1.55	4.65	6.17	6.17	9.23	0.00	9.22	0.00	1.54	1.54	4.61	7.69
Cornwall & Isles of Scilly	2.61	1.99	2.57	2.35	3.89	2.51	1.92	4.01	2.09	2.46	1.32	4.29	3.33	2.39	3.29
East Devon	6.40	1.59	3.95	0.79	4.67	3.85	0.77	2.27	1.51	3.78	3.02	2.25	0.74	0.00	0.73
Exeter	2.71	5.40	1.81	0.90	6.32	6.20	5.30	7.01	6.13	7.87	0.86	6.83	11.73	5.75	4.02
Mendip	1.94	1.92	4.78	1.90	9.45	8.46	2.81	2.78	3.68	0.92	3.67	1.83	1.82	5.45	4.51
Mid Devon	2.89	0.00	0.00	1.40	0.00	2.73	1.35	0.00	5.24	0.00	2.58	2.57	3.83	1.27	3.79
North Devon	3.44	0.00	0.00	0.00	1.11	0.00	0.00	1.08	0.00	1.07	0.00	0.00	1.07	3.20	3.19
Plymouth	4.55	6.23	4.95	3.70	4.92	2.02	6.42	4.78	5.15	5.14	4.33	6.24	7.75	4.63	4.59
Sedgemoor	0.95	0.00	4.67	0.00	1.84	0.00	0.00	2.68	1.77	0.89	1.76	6.09	2.58	1.70	3.36
South Hams	2.44	7.32	0.00	0.00	1.22	1.21	2.41	2.40	2.39	1.20	7.18	3.59	1.20	2.39	4.76
South Somerset	1.33	1.32	2.63	1.30	1.29	5.75	3.18	3.15	1.25	1.87	3.11	1.23	3.07	3.05	5.47
Taunton Deane	3.99	1.95	3.84	0.95	2.83	1.87	0.00	0.92	3.68	1.83	0.91	5.43	5.39	2.68	1.77
Teignbridge	9.14	9.90	4.10	6.53	1.63	1.62	4.05	3.22	6.43	6.43	4.02	7.24	3.20	7.14	4.71
Torbay	7.01	6.16	4.60	2.29	6.06	9.08	7.58	3.03	8.33	10.63	9.13	8.38	3.80	7.57	4.51
Torridge	1.72	1.69	0.00	0.00	1.63	0.00	0.00	1.58	0.00	0.00	0.00	0.00	1.54	0.00	4.57
West Devon	2.05	2.05	2.00	4.02	5.99	0.00	3.93	1.93	3.80	1.89	3.75	0.00	9.28	9.27	7.37
West Somerset	0.00	0.00	2.84	2.84	0.00	2.86	0.00	2.85	2.84	0.00	5.71	0.00	0.00	0.00	0.00

*rates calculated using ONS mid-year population estimates

Table Biii: TB case numbers and rate by age and sex, South West, 2014

Age Group		Male	Female
Age 0 to 9	Count	5	0
	Rate	1.61	0.00
Age 10 to 19	Count	10	12
	Rate	3.25	4.08
Age 20 to 29	Count	31	24
	Rate	9.09	7.48
Age 30 to 39	Count	38	29
	Rate	12.46	9.41
Age 40 to 49	Count	40	18
	Rate	10.93	4.77
Age 50 to 59	Count	21	17
	Rate	5.93	4.64
Age 60 to 69	Count	18	10
	Rate	5.44	2.85
Age 70+	Count	28	20
	Rate	8.05	4.50

Table Biv: Drug resistance among TB patients with culture confirmed disease*, South West, 2000-2014

Year	Any resistance		Isoniazid resistant		Multi-drug resistant		Ethambutol		Rifampicin		Pyrazinamide		Total	Total excluding M. bovis
	n	%	n	%	n	%	n	%	n	%	n	%	n	n
2000	5	4.63	4	3.70	1	0.93	0	0.70	2	0.02	0	0.00	108	104
2001	9	8.18	9	8.18	0	0.00	0	0.30	0	0.00	0	0.00	110	108
2002	7	5.56	7	5.56	1	0.79	0	0.50	1	0.01	0	0.00	126	124
2003	7	5.69	7	5.69	2	1.63	0	0.60	2	0.02	0	0.00	123	121
2004	7	4.73	7	4.73	0	0.00	0	0.60	0	0.00	0	0.00	148	148
2005	8	4.62	8	4.62	3	1.73	1	0.60	3	0.02	0	0.00	173	171
2006	10	5.92	10	5.92	0	0.00	0	0.60	0	0.00	0	0.00	169	165
2007	9	5.63	8	5.00	1	0.63	1	0.70	1	0.01	2	1.29	160	155
2008	14	7.37	11	5.79	3	1.58	2	0.70	4	0.02	3	1.60	190	188
2009	17	8.85	14	7.29	2	1.04	2	0.60	3	0.02	4	2.12	192	189
2010	8	5.93	5	3.70	1	0.74	1	1.00	2	0.01	2	1.52	135	132
2011	19	9.84	17	8.81	1	0.52	2	1.10	1	0.01	1	0.52	193	191
2012	14	7.41	11	5.82	2	1.06	1	1.50	3	0.02	3	1.65	189	182
2013	15	8.33	13	7.22	1	0.56	1	0.56	1	0.01	2	1.13	180	177
2014	12	6.78	11	6.21	2	1.13	2	1.13	2	0.01	0	0.00	177	167

*culture confirmed cases, Pyrazinamide resistance excluding M.bovis cases

Appendix C: Local authority TB epidemiological summaries

Local authority TB epidemiological summaries will provide further information about TB cases among residents of South West upper tier local authorities with an average of at least 50 TB cases per year over the previous three years. These will be published online shortly by your local FES team.