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Tuberculosis in the South East: Annual review (2017 data)

Data from 2000 to 2017

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Executive summary

The rate of tuberculosis (TB) in the South East continues to decline. In 2017, 539 people with TB were notified, a rate of 6.1 per 100,000 population. This was a small but continuous year-on-year decline from the peak of 9.7 per 100,000 in 2011, which followed a decade of increasing case numbers and rates. Out of the 9 PHE centres, the South East had the third lowest TB notification rate (below the England average of 10.2 per 100,000 population) and accounted for 10% of the 5,664 notifications in England. Most of the South East has very low rates of TB. In all but 4 upper-tier or unitary authorities (Slough, Reading, Southampton, and Windsor and Maidenhead), TB notification rates were below the national average.

The decrease was driven by a reduction in TB among people born outside the UK, which in 2017 was half the rate in 2011, although the majority of notifications are still among this group (71%). This reflected a decrease in the numbers and proportions of people born abroad in Hampshire and Isle of Wight, Kent, and Thames Valley. In Surrey and Sussex, although the number of people with TB who were born abroad decreased, the proportion increased slightly.

Similar to previous years, in the highest incidence areas of Slough and Reading in Thames Valley, more than 85% of people with TB were born outside the UK. India, Pakistan and Nepal were the most common countries of birth among those born outside the UK, together accounting for almost half of those born abroad. The median time since entry was 8 years, although longest among those from Pakistan and shortest among those from Nepal. The most common ethnicity of people with TB born abroad was Indian (29%) followed by mixed/other (25%).

In 2017 there was a small increase in TB among people born in the UK, although the rate in this group remains below the England average. Almost all UK-born people with TB were of white ethnicity (82%). The most common ethnicity overall was white, a third of all people with TB. Almost 75% of people with TB of white ethnicity that were born outside the UK were from Central or Eastern Europe, most commonly Romania or Poland.

Similar to recent years, just over half of people notified in 2017 had pulmonary disease. Pulmonary TB was more common among people born in the UK (73% vs. 49% in those born abroad). In 2017 63% of people with TB had their diagnosis confirmed by culture, similar to the proportion seen nationally. This was 75% among those with pulmonary TB. Only 56% of people with pulmonary TB had a sputum smear result. Results were missing on half of the people with pulmonary TB in Surrey and Sussex and Thames Valley and around a third of those in Hampshire and Isle of Wight and Kent.

Information on key co-morbidities (diabetes, hepatitis B, hepatitis C, chronic renal disease, chronic liver disease and immunosuppression) has been collected as part of surveillance on people with TB since 2016. Almost 1 in 5 people had a key co-morbidity (18%), most commonly diabetes.

People with TB in the South East had a median time from first having symptoms to starting treatment of 80 days, shorter than the previous year and similar to the national average. Delays became shorter in each Health Protection Team area except for Kent which increased nearly 50% to a median of 122 days – reasons for why half of people with TB in Kent experienced delays of greater than 4 months were unclear.

Of those people with TB notified in 2016 that would be expected to receive 6 months standard treatment (excluding those with rifampicin resistant, CNS, spinal, miliary or cryptic disseminated disease) 84% had completed at 12 months. Treatment completion was lowest among people in Surrey and Sussex (78%) and Kent (81%) and much higher in Hampshire and Isle of Wight (88%) and Thames Valley (88%).

As in recent years, treatment completion was lower among people born in the UK (79%). This was entirely due to low treatment completion among people of white ethnicity with all UK born people of other ethnic groups completing treatment. People who had at least 1 social risk factor were also less likely to complete treatment (77%). While white UK born people with a social risk factor had particularly low treatment completion (72%), it was still low among white UK born people without social risk factors (78%). Of those with CNS, spinal, miliary or cryptic disseminated TB who were notified in 2016, 71% had completed treatment by the last recorded outcome. Overall, 6% of people with rifampicin sensitive TB notified in 2016 died before completing treatment and TB was known to have contributed to 42% of these deaths.

One in 10 people with TB experienced a social risk factor, and almost half of these had more than 1. In Kent, this was nearer 1 in 5 people with TB. Consistent with recent years, social risk factors were more common in people with TB who were born in the UK and of white ethnicity. People with social risk factors were more likely to have infectious TB and less likely to complete treatment.

Information on HIV testing was available for 98%, a promising increase from 92% in 2016. Only 90%, however, were offered and received testing, below the national average. The latest estimates for 2017 suggested that 4.4% of people with TB in the South East were co-infected with HIV, and this was the PHE centre with the highest proportion of people with TB that was co-infected with HIV in 2017 in England.

In conclusion, TB rates remain very low across most of the South East, and continue to decline. However there are still areas that need focus, including the increased delays experienced by people with TB in Kent, and reasons for the lower than average coverage of HIV testing in the centre with the highest co-infection estimates. People with TB in the South East frequently have complex needs both medically and socially,

and integrated health and social strategies are needed to support them through treatment.

Recommendations

South TB control board should continue to prioritise work with wider stakeholders to develop strategies to improve outcomes for under-served populations.

Cohort review and MDR cohort review continue to play a vital role in quality assurance of TB case and contact management with identification and escalation of issues to TB control board.

PHE and local services should work together to use whole genome sequencing data to identify opportunities for prevention.

Areas where delays increased should investigate reasons, building on previous work across the South East. The review into the delays experienced by South East residents should be reviewed by the South TB Control Board and TB networks for opportunities to reduce these among local communities affected by TB.

Reasons for the low number of people with pulmonary TB who had sputum smear results reported should be explored.

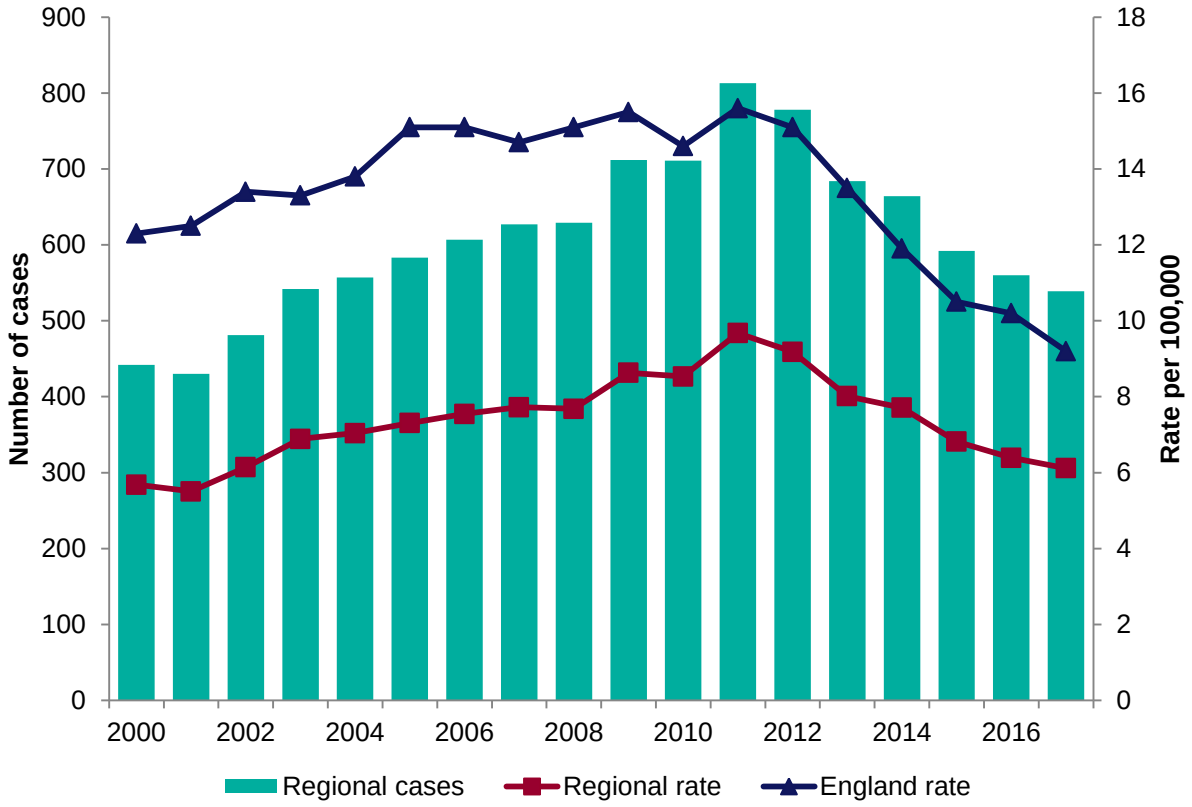
1. TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2017, 539 cases of tuberculosis (TB) were notified among residents in the South East, a rate of 6.1 per 100,000 population. This was a small but continuous year-on-year decline from the peak of 9.7 per 100,000 in 2011, which followed a decade of increasing case numbers and rates (Figure 1).

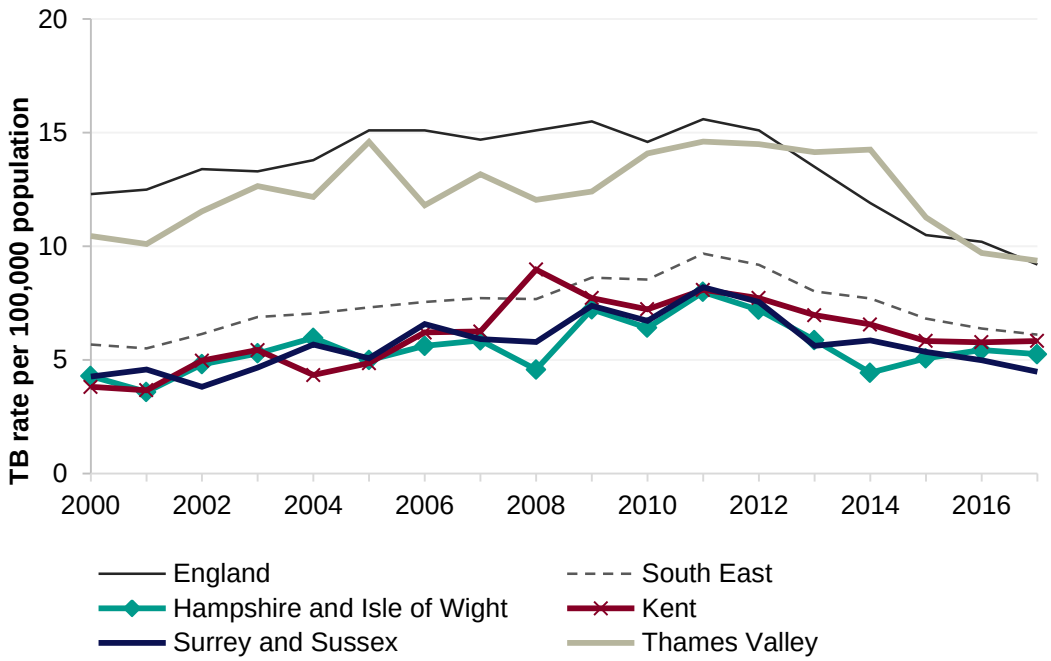
Out of the 9 PHE centres, the South East had the third lowest TB notification rate (below the England average of 10.2 per 100,000 population) and accounted for 10% of the 5,664 TB cases in England.

Figure 1: TB case reports and rates, South East, 2000 to 2017



Overall, rates have decreased in all Health Protection Team areas since the peak in the South East in 2011(Figure 2). As in previous years, numbers and rates were highest among residents of Thames Valley. Relative to 2016, there was a 10% decrease in the TB rate in Surrey and Sussex. There were further small decreases in rates in Hampshire and Isle of Wight and in Thames Valley. The rate in Kent remained stable. Other than Thames Valley at 9.4 per 100,000, all Health Protection Team areas had lower incidence rates than England as a whole (9.2 per 100,000).

Figure 2: TB case rates, by Health Protection Team area of residence, South East, 2000 to 2017

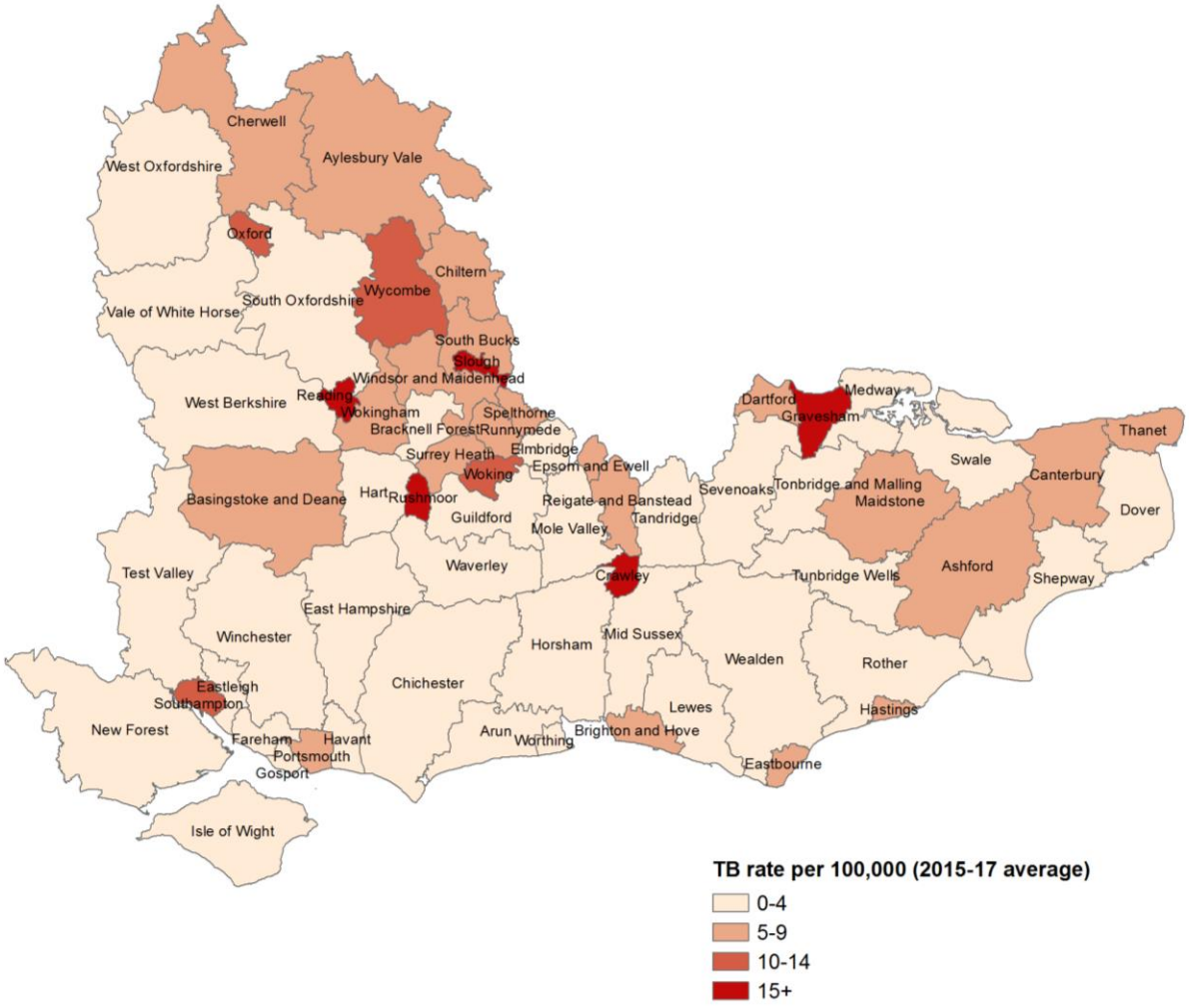


Most of the South East has very low rates of TB. In 2017, as in previous years, among residents of Slough in Thames Valley experienced the highest burden of TB disease (43 cases, 29 per 100,000) of all upper-tier or unitary authorities. However, this was a 19% decrease relative to 2016. At 23 per 100,000 population, the second highest rate of TB was among residents of Reading, also in Thames Valley. This was a 40% increase from the rate in 2016 but similar to the rate in 2015.

In all but 4 upper-tier or unitary authorities (Slough, Reading, Southampton 34 cases, 13.5 per 100,000 and Windsor and Maidenhead 14 cases, 9.3 per 100,000), TB notification rates were below the national average of 9.2 per 100,000 population in 2017.

Residents of Slough (38 per 100,000) also had the highest 3-year average TB rates among lower-tier local authorities, followed by Rushmoor in Hampshire (22 per 100,000), Reading (21 per 100,000), Gravesham in Kent (16 per 100,000), and Crawley in Sussex (16 per 100,000) (Figure 3).

Figure 3: Three-year average TB case rate by lower-tier local authority of residence, South East, 2015 to 2017

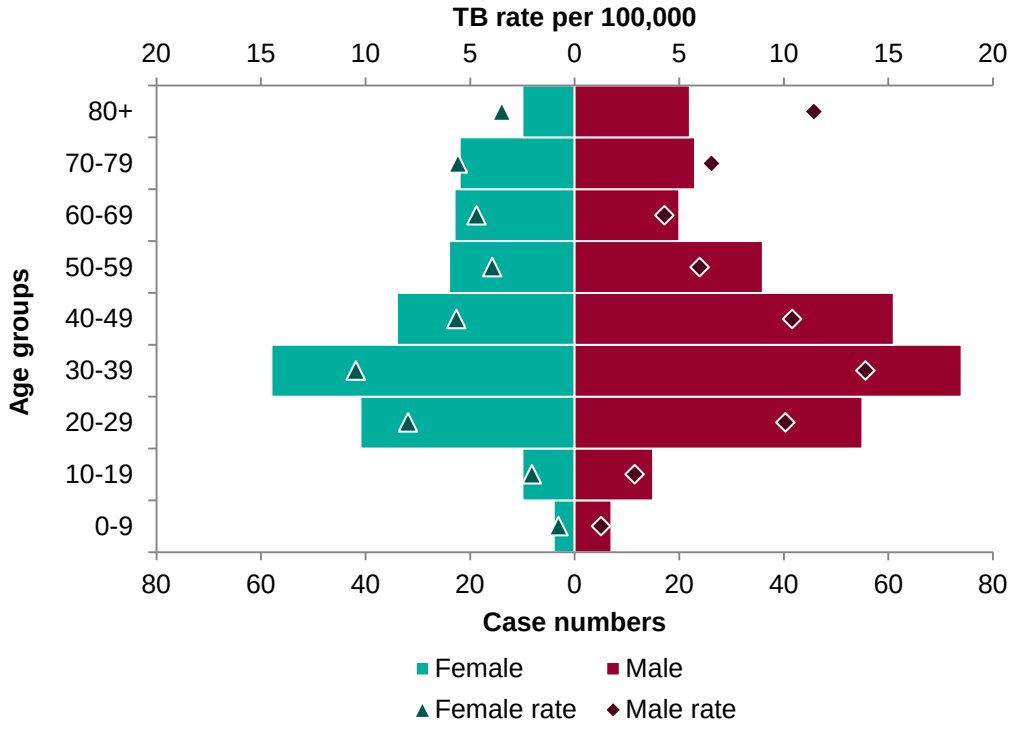


Demographic characteristics

Age and sex

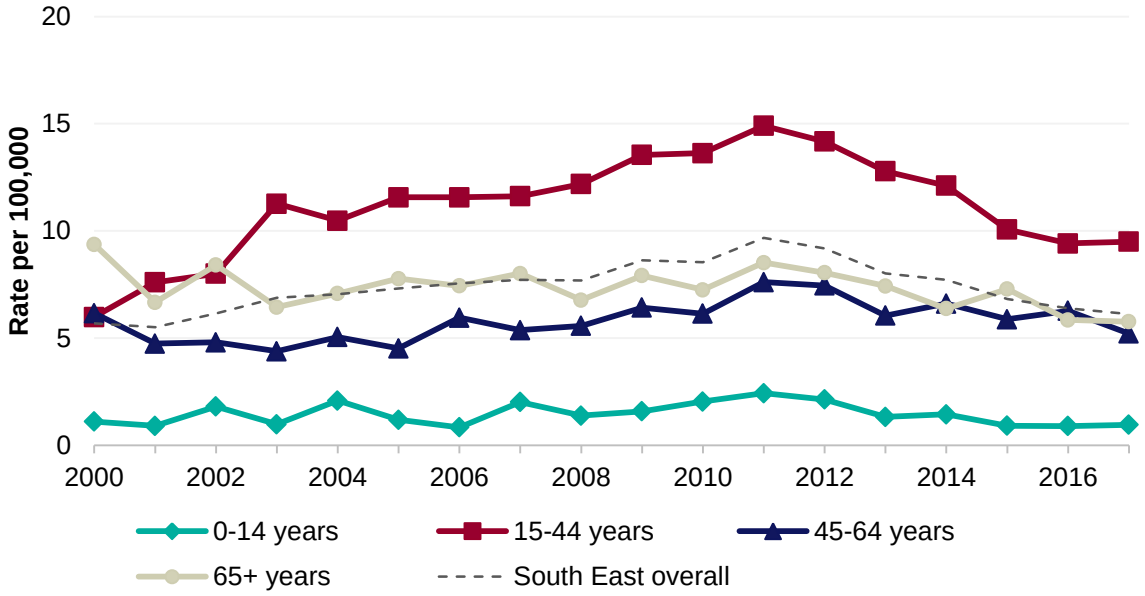
In 2017, 58% (313) of people with TB were male. Rates were higher among men than women (7 per 100,000 vs 5 per 100,000), as seen in previous years. Among both sexes, rates were highest in the 30 to 39 year age group (Figure 4).

Figure 4: TB case reports and rate by age and sex, South East, 2017



At a broader scale, the TB rate was highest among people aged 15 to 44 years, as in previous years (Figure 5). Compared to 2016, there was a 17% decrease in the rate among people aged 45 to 64 years, a 6% increase among people aged 15 to 44 years (although this age group had the greatest decline in rates from 2011-2016), and no clear change among children under 15 years or adults aged 65 and older.

Figure 5: TB case rates by age group, South East, 2000 to 2017

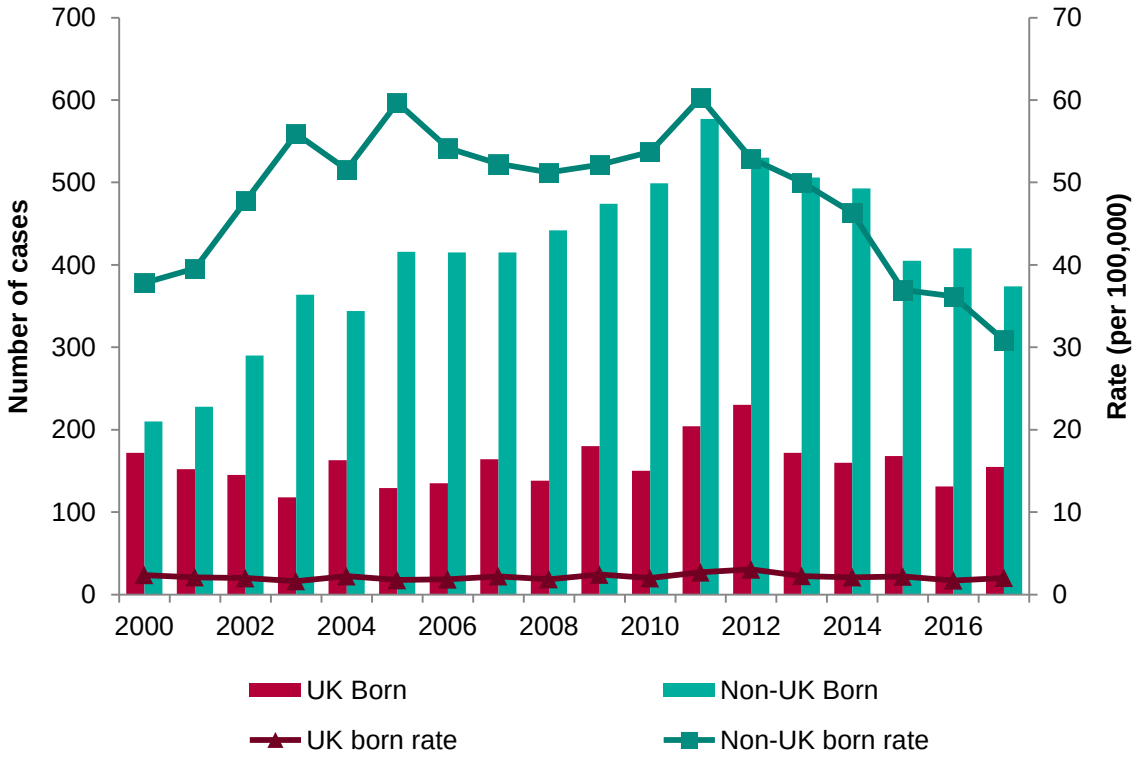


Place of birth and time since entry

In 2017, country of birth was known for 98% of people with TB (527/539). Of the 12 without known country of birth, 2 were known to be born outside of the UK. Overall, 71% (374/529) were born outside of the UK, which was smaller than the proportion observed in 2016 (76%).

This reflected a decrease in the numbers and proportions born abroad in Hampshire and Isle of Wight from 76% (79/104) to 70% (72/103), in Kent from 73% (74/102) to 60% (62/105), and in Thames Valley from 81% (164/203) to 75% (148/198). In Surrey and Sussex, although the number of people with TB who were born abroad decreased, the proportion increased slightly from 73% (103/142) to 75% (92/123). Similar to previous years, in the highest incidence areas of Slough and Reading, more than 85% of people with TB were born outside the UK.

Figure 6: TB case reports and rate by place of birth, South East, 2001 – 2017



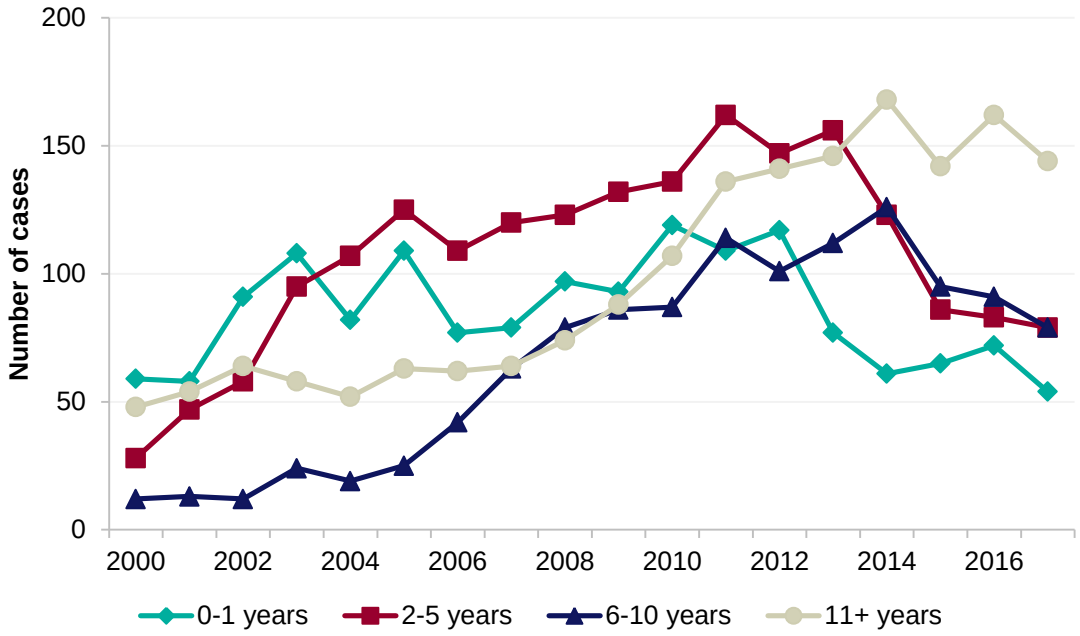
In 2017, the rate of TB among people born outside the UK was 31 per 100,000, the lowest rate observed since 2000 and a 49% decrease since the peak of 60 per 100,000 in 2011.

There were 155 people with TB born in the UK notified in 2017, a rate of 2.0 per 100,000 population, and an 18% increase compared to 2016 but still below the average for England of 3.2 per 100,000. The number among those born in the UK increased in all Health Protection Team areas other than Surrey and Sussex.

In 2017, information on the time between entry to the UK and TB notification was available for 95% (356/374) of those born abroad. After 2 years of increasing numbers, there was a continuation of the decrease among recent entrants to the UK (diagnosed within 2 years after entry) (54/356, 15% of those born abroad; Figure 7).

There were further small decreases in numbers of people diagnosed with TB 2-5 and 6-10 years after entry. These groups each accounted for 22% (79/356) of those born abroad. There was also a decrease in numbers of people notified more than 11 years since entry to the UK, although there has been no clear trend since 2013. As in recent years, this group accounted for the greatest proportion of those born abroad (40%, 144/356).

Figure 7: Time between entry to the UK and TB notification for people born outside the UK, South East, 2000 to 2017



For those born outside the UK, country of birth was known for 99.5% (372/374). As in previous years, India, Pakistan and Nepal were the most common (Table 1). Together, these countries were the place of origin of nearly half (47%, 176) of people born outside the UK and almost a third of all people with TB in the South East. This compares with the most common countries of birth in the non-UK born general population of South East England, which in 2017 were Poland, India, and Germany.[1] India was the most common country of birth in all Health Protection Team areas apart from Hampshire Isle of Wight, where it was Nepal.

[1] Office of National Statistics: www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/datasets/populationoftheunitedkingdombycountryofbirthandnationality

The median time since entry was 8 years (IQR 3-14 years), similar to 2016. Median time since entry was shortest in Hampshire and Isle of Wight (6.5 years, IQR 2-12) and longest in Thames Valley (10 years, IQR 5-16). Similarly, the proportion of recent entrants was highest in Hampshire and Isle of Wight (21%, 15/70), and Thames Valley had the highest proportion of long-term residents (46%, 65/142).

People with TB from Nepal and Romania were more likely to be recent entrants. Median time since entry to notification for people from India and Nepal decreased slightly since 2016 (from 9.5 years to 8 and from 5 to 4, respectively). For those born in Pakistan, the median time since entry increased from 13.5 to 16 years.

Table 1: Ten most common countries of birth for people with TB and time between entry to the UK and TB notification, South East, 2017

Country of birth	n	% of non-UK born patients	median years since entry (IQR)
India	103	27.5%	8 (3 to 14)
Pakistan	38	10.2%	16 (6 to 40)
Nepal	35	9.4%	4 (2 to 6.5)
Romania	24	6.4%	2 (1 to 6.5)
Philippines	13	3.5%	11 (5 to 13)
Poland	12	3.2%	10.5 (8.3 to 12)
Zimbabwe	12	3.2%	14.5 (13 to 16)
Nigeria	10	2.7%	5 (3.3 to 8.8)
Bangladesh	8	2.1%	19.5 (13 to 30)
Sudan	8	2.1%	2 (1.8 to 3.8)

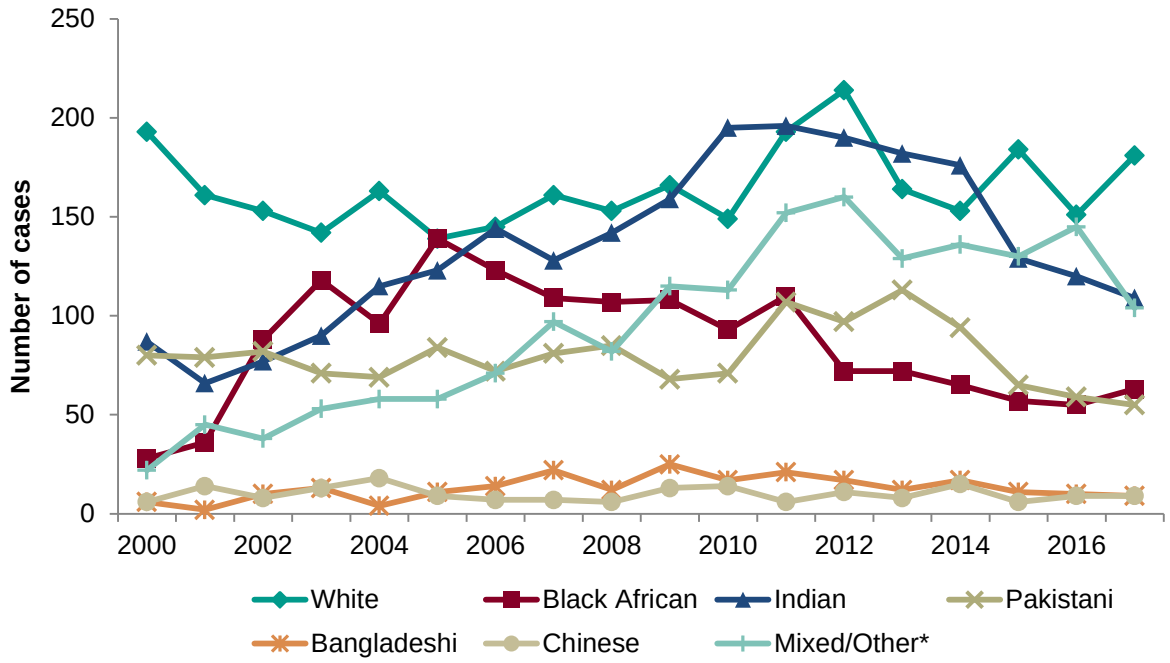
Ethnicity

Data on ethnicity was known for 98% (530/539) of people with TB in 2017. Since 2016, numbers decreased in all ethnic groups except for white and black African (Figure 8).

Similar to recent years, the most common ethnicity overall was white, a third of all people with TB (34%, 181/530), and an increase from 2016 (28%, 151/549). Most people with white ethnicity were UK born (71%, 127/178); of those born abroad, 73% were from Central or Eastern Europe (37/51), most commonly Romania or Poland. The second most common ethnic group was Indian (21%, 109/530), the majority of whom were born in India (92%, 99/108).

As in the South East as a whole, white was the most common ethnic group in each Health Protection Team area. Indian was also the second most common ethnicity in Thames Valley and Kent, while mixed/other was more common in Hampshire and Isle of Wight and in Surrey and Sussex. The most common country of birth for people of mixed/other ethnicity was Nepal in all Health Protection Team areas except Thames Valley, where it was Timor-Leste.

Figure 8: TB case numbers by ethnic group, South East, 2000 to 2017



* Cases with mixed/other, black Caribbean and black other ethnic groups were grouped as 'Mixed/Other'

Occupation

In 2017, occupation was known for 97% (511/496) of people with TB aged 18 years or older (Table 2). Of these, 181 (37%) were not working, of whom half were retired. The majority of healthcare workers diagnosed with TB were born abroad (81%, 35/43), as were the majority of those working or engaged in education (72%, 23/32).

Table 2: Occupational category of people with TB aged 18 to 65 years, South East, 2017

Occupation	n	%
Healthcare worker	44	8.9
Education	32	6.5
Agricultural/animal care worker	3	<1
Social service/prison worker	3	<1
Laboratory/pathology	3	<1
Other	229	46.2
None	181	36.5
Total	**496**	

Clinical characteristics

Site of disease

Similar to recent years, just over half (53%, 288/539) of people notified with TB in 2017 had pulmonary disease (Table 3). Pulmonary TB was more common among people born in the UK (73%, 111/153 vs. 49%, 181/373 among people born abroad).

Table 3: Number of people with TB by site of disease, South East, 2017

Site of Disease	n	%
Pulmonary	288	53
Lymph Nodes (extra thoracic)	128	24
Lymph Nodes (intra thoracic)	49	9
Pleural	43	8
Other	42	8
Bone/Joint (spine)	21	4
Gastrointestinal/Peritoneal	17	3
Miliary	17	3
Genitourinary	15	3
CNS (meningitis)	11	2
(Bone/Join (other - not spine)	11	2
CNS (Other - not meningitis)	11	2
Cryptic Disseminated	6	1
Laryngeal	2	0.4
Total patients	**539**	

*patients may have disease at more than 1 site, so the total % will not equal 100%
†CNS: Central nervous system

Previous history of tuberculosis

In 2017, data on previous diagnosis was available for 95% (514/539) of people with TB. As in recent years, a small number (4%, 23/514) were previously diagnosed with TB. This proportion was slightly smaller than the proportion for England as a whole (6%, 289/4,887). The median time between diagnoses was 3 years (IQR 2 to 25).

Hospital inpatient and directly observed therapy

Almost a quarter of people diagnosed with TB (24%, 120/506) were hospital inpatients at the time of diagnosis in 2017. The proportion was higher among adults aged 65 years and older (28%, 25/88), and lower among children under the age of 15 (7%, 1/14), although numbers in this group remain small. As seen previously, being an inpatient was almost twice as common among those with social risk factors (45%, 20/44 vs. 20%, 83/409 among those without any risk factors). It was also more common for people with 1 of the key co-morbidities (39%, 35/90 vs. 20%, 85/416 without). Overall, 13% (63/500) of people notified with TB in 2017 were recorded as having received directly observed

therapy (DOT) at some point during treatment. Numbers and proportions have remained similar since 2011 (between 63 and 81 individuals per year).

Almost half of children under the age of 15 (40%, 6/15) and people with social risk factors (45%, 18/40) received DOT. DOT was not more common among those with resistance to at least 1 first-line drug (11%, 2/19), and was not used for the 4 people with multidrug-resistant TB (MDR-TB).

Co-morbidities

Data on selected key co-morbidities, diabetes, hepatitis B and C, chronic liver disease, chronic renal disease, and immunosuppression, has been routinely collected in the South East since 2015. In 2017, 18% (97/539) had at least 1 co-morbidity. The most common was diabetes, reported for 10% (51/497) of people with TB (Table 4). The prevalence of co-morbidities increased with age, with none reported for children under 15 years, up to 42% (33/79) for people aged 65 years and older. People with social risk factors were slightly more likely to have a co-morbidity (22%, 11/50 vs 17%, 73/420). There were no clear differences in prevalence of co-morbidities based on sex, place of birth, ethnicity, or Health Protection Team area of residence.

Table 4: Co-morbidities among people with TB, South East, 2017

Co-morbidity	n	%	Total
Diabetes	51	10%	497
Hepatitis B	5	1%	443
Hepatitis C	5	1%	442
Chronic liver disease	11	2%	486
Chronic renal disease	16	3%	493
Immunosuppression	29	6%	481

Travel and visitor risk factors

Information on travel to, and visitors received from a country[2] outside the UK, in the 2 years prior to TB diagnosis was known for 81% (435/539) and 74% (397/539) of people notified in 2017, respectively. A quarter (26%, 115/435) had travelled outside the UK and 10% (40/397) had received a visitor from outside the UK. More than a third of people born outside the UK had travelled abroad (36%, 108/300). For people born outside the UK where the country of travel or origin of their visitor was known, 78% (88/112) had travelled to their own country of birth, and 70% (28/40) had received a visitor from their own country of birth.

[2] Excludes countries in Western Europe, US, Canada, New Zealand and Australia

2. Laboratory confirmation of TB

Laboratory tests data collection

Laboratory data on culture confirmed TB isolates from the National Mycobacterium Reference Service was matched to TB case notifications, and the results were used to report culture confirmation. Results for microscopy, PCR and histology were also collected in ETS.

Culture confirmation and speciation

In 2017 in the South East, 63% of people with TB had their diagnosis confirmed by culture (340/539), similar to the proportion seen nationally of 62% (3,153/5,102). This was higher among those with pulmonary TB (75%, 222/298 vs. 49%, 117/238 of people with exclusively extra-pulmonary TB).

Of those people with TB who had a positive culture diagnosis, the vast majority had *Mycobacterium tuberculosis* (98%, 333/340), 4 had *M. africanum*, and 3 had *M. bovis*.

Of the 189 who did not have their diagnosis confirmed by culture, 22 had positive histology, 15 had positive microscopy and 6 had a positive PCR result. Of these 1 had both a positive histology and microscopy result and 1 had both a positive microscopy and PCR result. In total, 29% (158) of the 539 people who had TB in 2017, had no recorded laboratory evidence of TB. The proportion without a recorded laboratory result was highest in those under 15 years old (67%, 10/15) and in those with extra-pulmonary TB (40%, 95/238) but this proportion did not vary by any other demographics factors or by area.

Sputum smear

In 2017, sputum-smear results were known for just 56% (166/298) of people with pulmonary TB; even lower than in previous years (60% in 2016, 175/292). Results were missing on half of the people with pulmonary TB in Surrey and Sussex and Thames Valley and around a third of those in Hampshire and Isle of Wight and Kent.

Where known, 58% (97/166) of people with pulmonary TB had sputum smear positive disease, slightly lower than in previous years.

3. TB transmission

Rate of TB in UK born children

TB in UK born children is used as an indirect indicator for recent TB transmission, since it is likely to be caused by recent exposure. In 2017, the rate of TB in UK born children under 15 years of age in the South East was 0.7 per 100,000 population (95% CI 0.4 to 1.3, 11 cases). Small numbers mean year-on-year changes should be interpreted with caution (Figure 9).

Figure 9: Rate of TB in UK born children under 15 years of age, South East, 2000 to 2017

Strain typing and clustering

In 2017, strain typing in London continued to be by MIRU-VNTR, and 18% (96) of all 539 people with TB notified in the South East were identified as clustered with 1 or more South East residents in the period 2010 to 2017 (Table 5). Identification of clustering requires specimens to be cultured and typed to at least 23 loci. Between 60-68% were culture-confirmed each year, and around 90% of these had isolates that were strain typed to at least 23 loci between 2011 and 2017. The proportion of people with strain-typed TB that clustered with at least 1 other person in South East remained between 32-41%. The number of new clusters that formed each year fell from 50 in 2011 to 21 in 2017.

Of the 303 clusters between 2010 and 2017, the median cluster size was 2 people (range 2 to 40). The majority (83%; 250/303) were small in size (less than 5), with 55% (167) having only 2 people in the cluster. Fourteen clusters (5%) had 10 or more people (Figure 10). The most common lineage of clusters was Euro American, which accounted for 41% (114/278) of clusters between 2010 and 2017 (Table 6). Cluster size was similar across lineages (median size 2 to 3).

Table 5: Number and proportion of people with TB clustered using MIRU-VNTR and new clusters by year, South East, 2010 to 2017

Year	Total	Culture-confirmed		Strain-typed (≥ 23 loci)		Clustered[a]		New clusters[b]
	N	n	%	n	%	n	%	n
2010	711	437	61%	293	67%	106	36%	17
2011	813	490	60%	428	87%	160	37%	50
2012	778	488	63%	446	91%	154	35%	46
2013	684	440	64%	392	89%	147	38%	47
2014	664	429	65%	394	92%	149	38%	42
2015	592	366	62%	341	93%	136	40%	39
2016	560	379	68%	361	95%	147	41%	41
2017	539	340	63%	298	88%	96	32%	21
Total	**5,341**	**3,369**	**63%**	**2,953**	**88%**	**1,095**	**37%**	**303**

[a] South East TB cases clustered with at least 1 other case in a South East resident between 2010 and 2017
[b] New clusters identified that included at least 1 South East resident. A new cluster is identified at the point when a second case is notified with the same MIRU-VNTR strain type as an existing case within South East

Figure 10: Proportion of clusters by size, South East, 2010 to 2017

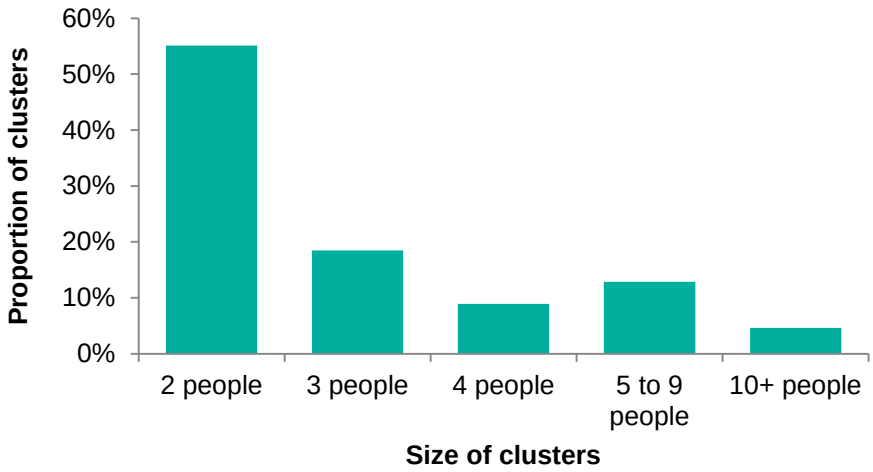


Table 6: Cluster lineage and size, South East 2010 to 2017

Cluster size	Number of clusters	Euro American		Central Asian		East African Indian		Beijing		Other*	
	n	n	%	n	%	n	%	n	%	n	%
2	159	69	61	47	60	16	55	10	37	17	31
3	50	20	18	15	19	4	14	7	26	4	7
4	24	9	8	4	5	4	14	4	15	3	5
5 to 9	35	14	12	9	12	4	14	3	11	5	9
≥10	10	2	2	3	4	1	3	3	11	1	2
Total	**278**	**114**	**100**	**78**	**100**	**29**	**100**	**27**	**100**	**55**	**55**

*includes people with M.bovis, M.africanum, and cases where no lineage has been identified

4. Delay from onset of symptoms to start of treatment

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

Overall delay includes time from symptom onset to the patient presenting to healthcare, and from the initial presentation to diagnosis and start of TB treatment. Information on delay was available for 93% (278/298) of people with pulmonary TB in 2017. One person was diagnosed post-mortem. The median time from symptom onset to start of treatment was 80 days (IQR 39-154). This was 4 days shorter than in 2016 and 1 day longer than the median of 79 (IQR 39-143) for England in 2017.

Table 5: Time between symptom onset and treatment start in people with pulmonary TB*, South East, 2013 to 2017

	0-2 months		2-4 months		>4 months				Total
Year	n	%	n	%	n	%	Median days (IQR)		N
2013	119	38	92	29	101	32	74	(38 - 155)	312
2014	98	31	103	33	113	36	87	(52 - 160)	314
2015	103	35	83	28	108	37	91	(45 - 165)	294
2016	103	36	84	30	96	34	84	(44 - 157)	283
2017	112	40	74	27	92	33	80	(39 - 154)	278

*excluding asymptomatic individuals, and those with missing onset dates

The median delay was longest in Kent (122 days, IQR 60-188), based on 69 people with pulmonary TB, which saw an increase of nearly 50% from 85 days (IQR 49-175) in 2016. This was followed by Hampshire and Isle of Wight (83 days, IQR 36-141) then Thames Valley (70 days, IQR 41-116). Delays were shortest in Surrey and Sussex (55 days, IQR 31-107). The median delay decreased in these areas compared to 2016.

Characteristics of people with pulmonary TB with a delay from onset of symptoms to treatment of more than 4 months

One in 3 residents in the South East had a delay of more than 4 months. As in recent years, adults over the age of 65 were more likely to experience delays (38%, 18/48) as were people born in the UK (39%, 39/101 vs 30%, 52/173 of those born outside the UK). Similarly delays were more common among those of white ethnicity (37%, 47/128). People who had at least 1 social risk factor were slightly more likely to have a delay (35%, 14/40) compared to those who had none (32%, 65/204).

Table 6 shows the proportion of people with pulmonary TB who experienced delays of over 4 months by PHE Health Protection Team area. This ranged from 24% in Surrey and Sussex and Thames Valley to just over half of all people with TB in Kent. There was no clear distinction in characteristics in those experiencing delays in Kent compared to elsewhere.

A higher proportion of females experienced delays in Kent and in Surrey and Sussex whereas males were more often delayed in Hampshire and Isle of Wight and Thames Valley. Surrey and Sussex was the only region where delays were more common among in people born outside the UK. In Kent a higher proportion of those who had no social risk factors experienced delays compared to those who had at least 1. This was the opposite in Surrey and Sussex but both groups had similar proportions elsewhere.

Table 6: Proportion of people with pulmonary TB with a delay from onset of symptoms to treatment of more than 4 months, by PHE Health Protection Team area, sex, place of birth, and social risk factor, South East, 2017

		Kent n=69		Surrey & Sussex n=71		Hampshire & Isle of Wight n=56		Thames Valley n=82		Total n=278	
		n	%	n	%	n	%	n	%	n	%
Sex	Male	17	45	9	20	16	41	13	27	55	32
	Female	19	61	8	32	3	18	7	21	37	35
Place of birth	UK born	20	59	4	19	7	37	8	30	39	39
	Non-UK born	16	46	12	26	12	32	12	22	52	30
Any social risk factor	Yes	7	44	2	33	3	30	2	25	14	35
	No	24	52	11	23	13	33	17	24	65	32
Overall delayed		**36**	**52**	**17**	**24**	**19**	**34**	**20**	**24**	**92**	**33**

5. TB outcomes in drug sensitive cohort

Drug sensitive cohort

For the purposes of reporting outcomes for people with TB, the drug sensitive cohort is defined as all people notified with TB excluding those in the drug resistant cohort (see Chapter 6). Under this definition, people with TB resistant to isoniazid, ethambutol and/or pyrazinamide but without resistance to rifampicin are included in the drug sensitive cohort. Outcomes are reported according to year of notification up to and including 2016.

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

- people with TB with an expected duration of treatment less than 12 months, outcomes at 12 months are reported − this group excludes individuals with central nervous system (CNS) disease, who would be treated for 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)
- people with CNS, spinal, cryptic disseminated or miliary disease, the last recorded treatment outcome is reported

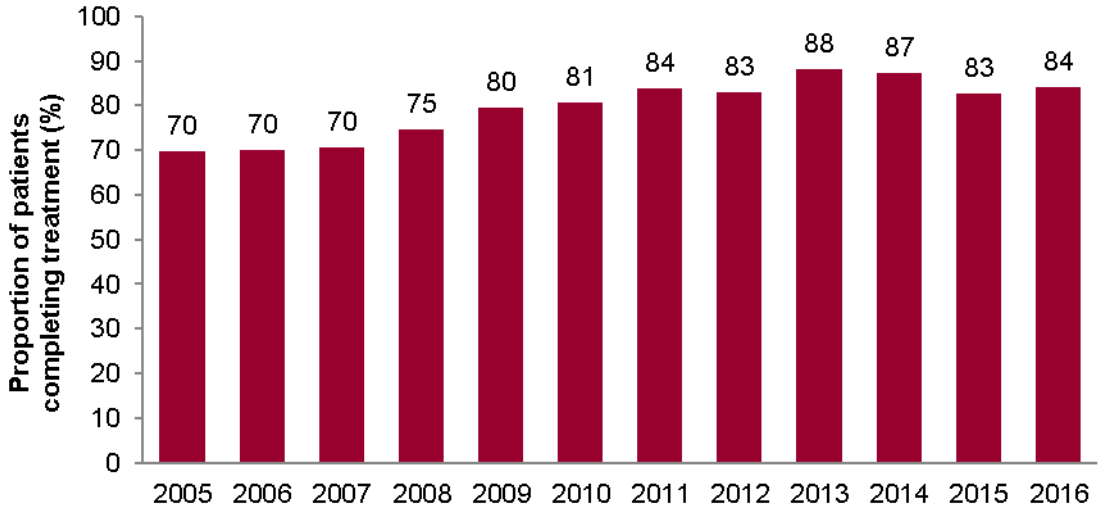
Detailed data on deaths and people lost to follow-up at last recorded outcome is presented for the entire drug sensitive cohort.

1: Outcomes for people with TB with expected treatment duration of less than 12 months

The majority (91%, 502/553) of those notified with rifampicin-sensitive TB in 2016 did not have CNS, spinal, miliary or cryptic disseminated disease. Of these, 84% had completed treatment at 12 months, similar to those diagnosed in 2015 (83%, 433/523) and nationally in 2016 (84%, 4,201/4,975). Among the 430 people for whom duration of treatment was known, the median treatment time was 183 days (IQR 176-207).

The overall trend in treatment completion in the South East has improved from just 70% in 2005 to 2007, but was lower than a peak of 88% in 2013 (Figure 11). Treatment completion was lowest in Surrey and Sussex (78%, 102/131) and Kent (81%, 76/94) and higher in Hampshire and Isle of Wight (88%, 79/90) and Thames Valley (88%, 165/187). Surrey and Sussex was the only area where treatment completion has decreased since 2015 when it was 83% (105/126).

Figure 11: Proportion completing treatment at 12 months, South East, 2005 to 2016*



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

The most common reasons for not completing treatment were death (5%) and still being on treatment (5%); see table 7. These were also the primary reasons for not completing across England. Of those still on treatment at 12 months information on why they were still on treatment was available for 24 people. Out of these 10 were on a planned treatment regime that exceeded 12 months (4 of these were due to initial drug resistance). A further 11 had their treatment changed (3 due to intolerance/ side effects) and 3 were still on treatment due to treatment interruptions.

Table 7: TB outcome at 12 months for people diagnosed in South East in 2016*

Outcome at 12 months	n	%
Completed	422	84.1
Died	27	5.4
Lost to follow up	13	2.6
Still on treatment	25	5.0
Treatment stopped	2	0.4
Not evaluated	13	2.6
Total	**502**	

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

Similar to previous years, treatment completion was lower among men (81%, 232/287 vs. 88% for women, 190/215) with the most common reason for not completing recorded as still being on treatment for men (33%, 18/55) and death for women (40%, 10/25). Treatment completion decreased with age with only 66% (57/87) of people over 64 years old completing treatment. By far the most common reason for not completing in this group was death (67%, 20/30).

Treatment completion was lower among those born in the UK (79%, 94/119 vs. 86%, 323/375 among those born abroad), but this difference has narrowed since 2015 (72%, 108/150 vs. 88%, 316/358). This was entirely driven by low treatment completion amongst people of white ethnicity (72%, 62/86) with 100% completion amongst all other UK born ethnic groups (32/32). The primary reason for not completing treatment by 12 months amongst UK born people of white ethnicity was still being on treatment (54%, 13/24).

Treatment completion was also lower among people who had at least 1 social risk factor in 2016 (77%, 37/48 vs. 87%, 340/390 among those with no social risk factors). This difference has narrowed since 2015 (70%, 38/54 vs. 87%, 367/422). In addition, people with 1 of the key co-morbidities were less likely to complete (80%n 66/82 vs. 85%, 356/420) and more likely to die (15%, 12 vs. 4%, 15).

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

Of the 51 people with CNS, spinal, miliary, or cryptic disseminated TB notified in 2016, 59% had completed treatment at 12 months (Table 10). The proportion increased to 71% (36) by the last recorded outcome, just below that seen nationally (73%, 416/573). By the last recorded outcome only 10% of people (5) were still on treatment. For those who completed treatment, the median treatment time was 364 days (IQR 282-365).

Table 10: TB outcome at 12 months for people with rifampicin sensitive, CNS, spinal, miliary, or cryptic disseminated diagnosed in South East in 2016*

Outcome at 12 months	n	%
Completed	30	58.8
Died	6	11.8
Lost to follow up	2	3.9
Still on treatment	11	21.6
Treatment stopped	0	0.0
Not evaluated	2	3.9
Total	**51**	

*Excludes rifampicin resistant TB

3: Deaths and loss to follow up in the drug sensitive cohort

Of all patients with rifampicin sensitive disease diagnosed in 2016, 6.0% (33/553) died before completing treatment, slightly above the national proportion (5.5%, 304/5,548). This proportion was highest in Kent (8.7%, 9/103) and lowest in Hampshire and Isle of Wight (1.9%, 2/105), although all regions were below the South East average for the previous year (8.9%, 52/587). TB was reported to have caused/contributed to 42% of

these deaths (14/33); 9 deaths were not related to TB (27%) and information on whether TB was part of the reason for death was not known for the remaining 10 individuals (30%). Five people were diagnosed with TB post-mortem and for all of them the influence that TB had on death was unknown.

Among people with TB and at least 1 of the key co-morbidities, 15% died before completing treatment (12/82).

The median age at death was 76 years (IQR 65 – 86) but TB contributed to the death of 4 individuals under the age of 65; all of these people were born outside the UK and 2 were of Indian ethnicity. 79% (11/14) of deaths with TB as a contributing factor were in people born outside the UK and half (7/14) were in people born outside the UK of Indian ethnicity. Overall deaths were more common among those born outside the UK compared to those born in the UK (7.6%, 10/131 vs. 4.6%, 19/413), a similar trend to previous years.

There was little difference in deaths amongst males and females and those with or without social risk factors. The proportion of people with TB who died was highest among those with delays between symptom onset to treatment start of between 2 and 4 months (6.5%, 10/153), compared to those with delays of less than 2 months (4.3%, 7/162) and more than 4 months (4.0%, 9/224).

Similar to previous years, 2.7% (15/553) of people with rifampicin sensitive TB notified in 2016 were lost to follow up within 12 months; lower than the proportion seen nationally of 3.9% (219/5,548). All those lost to follow up were born abroad. Where known, the majority of those lost to follow up had left the UK (79%, 11/14). No great variation in proportion lost to follow up was seen across sexes, Health Protection Team area, or people who did/ did not have at least 1 social risk factor. In addition, treatment was reported as stopped for 2 individuals. Both were 71 years old and neither had any recorded co-morbidities or social risk factors, comments indicate that the medical team agreed to stop due to side effects of the medication.

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

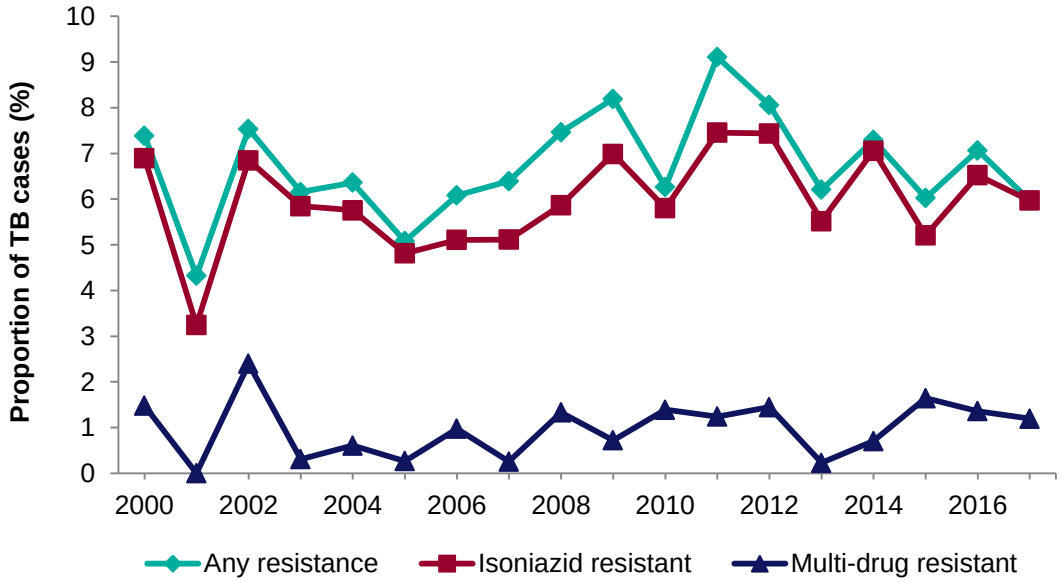
Drug resistance

Anti-TB antibiotic drugs are a large family and resistance may occur to 1 or more of these antibiotics and may be in complex combinations. A distinction is made between first, second and third-line TB antibiotic drugs depending upon their clinical effectiveness. First-line drugs include isoniazid, rifampicin, pyrazinamide and ethambutol. Second-line drugs are injectable agents (for example amikacin, capreomycin, kanamycin), fluoroquinolones (for example moxifloxacin, ofloxacin, ciprofloxacin) and other oral bacteriostatic agents. MDR-TB cases are initially resistant to at least isoniazid and rifampicin. Extensively drug-resistant TB cases (XDR-TB) are initially MDR and resistant to at least 1 injectable agent and at least 1 fluoroquinolone.

Overall initial drug resistance and geographical distribution

In 2017, resistance profiles were available for 99% (335/340) of culture-confirmed TB cases. The proportion of cases resistant to at least 1 first-line drug among people with culture-confirmed TB was 6% (20/335), similar to recent years (Figure 12).

Figure 12: Proportion of TB cases with initial first-line drug resistance, South East, 2000 to 2017



All people with resistance to a first-line drug had resistance to isoniazid. As in recent years. a small number of people additionally had resistance to other first-line drugs (fewer than 5 each for rifampicin, ethambutol, and pyrazinamide). The pattern of drug resistance varied across the South East. Resistance to any first-line drug was most common in Thames Valley (9%, 12/128) and least common in Surrey and Sussex (1%, 1/85). There was no clear pattern in resistance over time within Health Protection Team areas.

Characteristics of patients with drug resistant TB

Any first-line drug resistance

In 2017, similar proportions of men (6%, 14/202) and women (5%, 6/133) with had TB that was resistant to at least 1 first-line drug. Resistance was slightly more common among people aged 15 to 44 (8%, 15/197) than among other age groups (4%, 5/138).

A higher proportion of people born outside the UK had drug resistant disease (7%, 17/238 vs 3%, 3/91 of those born in the UK). Among common countries of birth, resistance occurred most frequently among people from Romania (11%, 2/18) and India (11%, 6/57).

Drug resistance occurred at similar proportions for people with pulmonary TB (6%, 12/218) and those with extra-pulmonary TB only (7%, 8/116). It was also similar for people with a social risk factor (6%, 2/36) and those without (6%, 16/251).

Multidrug-resistance (MDR) and extensively drug resistant (XDR) TB

Small numbers mean the following information should be interpreted with caution. In 2017 there were 4 people with resistance to isoniazid and rifampicin, 1% of culture-confirmed cases of TB among South East residents. Ages ranged from 22 to 86 years, 3 were male and 3 born abroad. All lived in Thames Valley. None were reported as having any social risk factor.

There were no cases of XDR-TB in 2017.

TB outcome at 24 months for patients with rifampicin resistant disease

Of the 6 people in the rifampicin-resistant TB cohort notified in 2015, 3 had completed treatment at 24 months, while the other 3 were still on treatment. The most recent information indicates that all 6 completed treatment.

7. TB in under-served populations

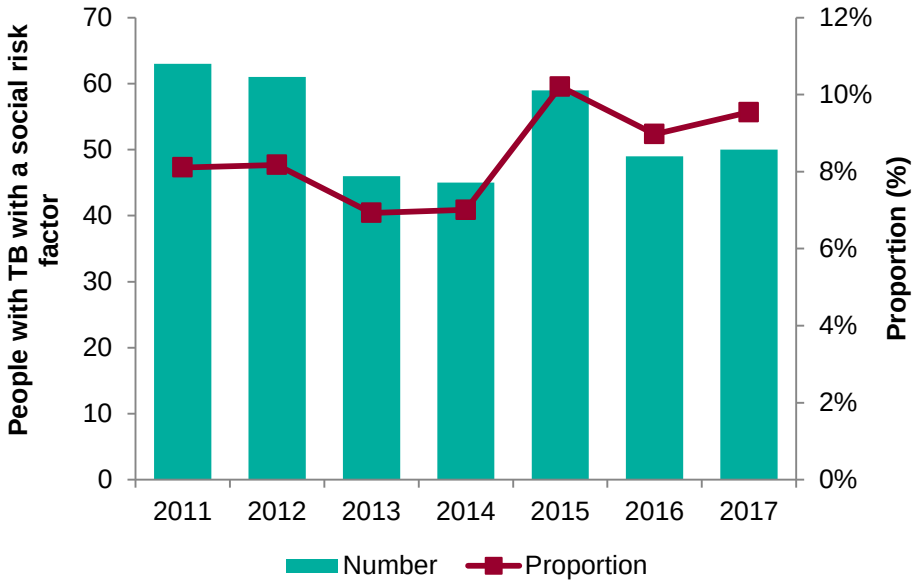
Social risk factors

In this chapter, social risk factors (defined as current or previous history of homelessness, drug use or imprisonment, or current alcohol misuse) are described for people with TB aged 15 years or over.

In 2017, 10% (50/524) of people with TB resident in the South East who were aged over 15 years old had at least 1 social risk factor. Of those with at least 1 social risk factor, 46% (23/50) experienced multiple.

The most common social risk factors experienced by people with TB in the South East in 2017 were homelessness (5%, 24/483) and imprisonment (5%, 23/474). This was closely followed by drug use (4%, 20/483) and current alcohol misuse (3%, 15/487).

Figure 13: Social risk factors among people with TB, South East, 2011 to 2017



As in previous years, Kent had the highest prevalence of social risk factors among people with TB, almost 1 in 5 (18%, 18/101). Half of these reported drug use, but all social risk factors were common. In Hampshire and Isle of Wight, the number and proportion increased from 5% (5/103) in 2016 to 12% (12/104) in 2017, although numbers remain very small. The most common social risk factor in this area was imprisonment (7 people). Seven per cent of people with TB in Surrey and Sussex had a social risk factor (9/123), similar to 2016 (8%, 11/140). In Thames Valley, the proportion of people with TB and at least 1 social risk factor decreased slightly from 2016 (7%, 14/203) to 2017 (6%, 11/197).

Table 11: Social risk factors by characteristic of people with TB, South East, 2017

	Any social risk factors		
	n	%	Total
UK born	27	21	129
Non-UK born	23	7	325
Black African	8	16	57
White	29	19	149
Male	41	16	257
Female	9	5	199
Pulmonary	43	17	253
Extra-pulmonary only	7	3	214
Sputum smear positive	20	23	86

Consistent with recent years, social risk factors were more common in people born in the UK, of white ethnicity and men. Imprisonment was the most common factor for men (20/41), whereas for women it was homelessness (89%, 8/9). Over half of those of white ethnicity with a social risk factor had more than 1 risk factor. An increase was seen in the proportion of people of black African ethnicity with at least 1 social risk factor in 2017 (16% vs. 8%, 4/48 in 2016) although numbers were small.

People with TB who experienced social risk factors were more likely to have infectious disease (defined as having sputum-smear positive pulmonary TB - 40%, 20/50) compared to those with no social risk factors (16%, 66/406).

Of those with drug sensitive TB and least social risk factor, who were notified in 2016, just 77% completed treatment within 12 months (Table 12). Although 8% were still on treatment, the remaining 15% had either died, were lost to follow up or had no further information on what happened to them.

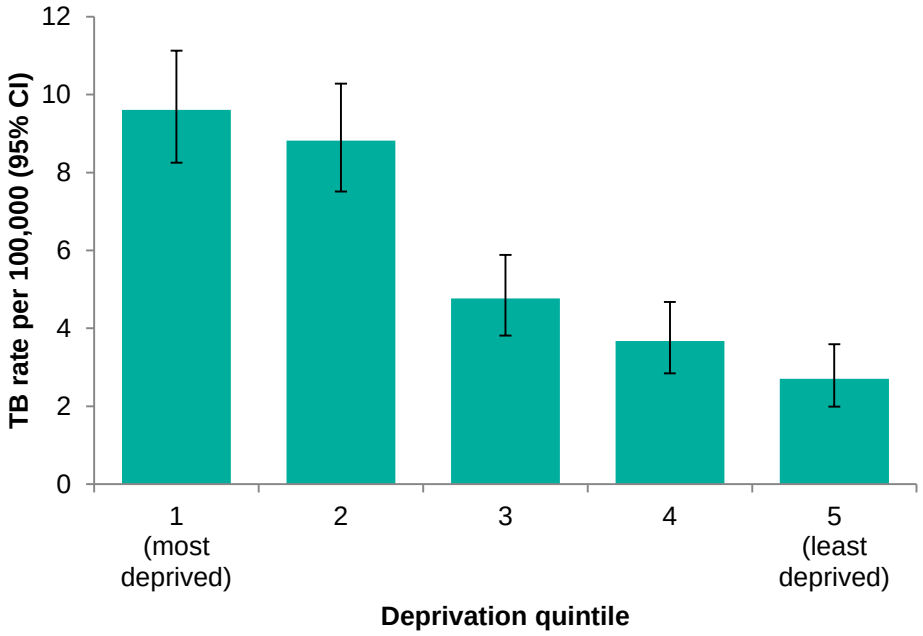
Table 12: Treatment outcome at 12 months for people with drug sensitive TB and at least 1 social risk factor, London, 2016

	n	%
Treatment completed	37	77.1
Died	2	4.2
Lost to follow up	2	4.2
Still on treatment	4	8.3
Not Evaluated/Missing	3	6.3
Total	**48**	**100**

Deprivation

Deprivation was assessed using the 2010 Index of Multiple Deprivation. In 2017, a third of all people with TB were resident in the most deprived quintile of the South East (33%, 178/539), and a further 30% (162) were resident in the second most deprived quintile (Figure 14). Rates were also highest in these 2 quintiles (9.6 and 8.8 per 100,000 of the population, respectively). The rate almost halved from the second most deprived to the 3rd quintile (from 8.8 to 4.8 per 100,000) and drops further from the 3rd to the least deprived quintile (2.7 per 100,000), where 9% of people with TB in the South East reside.

Figure 14: TB case rate by deprivation, South East, 2017



8. TB-HIV co-infection and HIV testing of people with TB

HIV testing

Of the 539 people with TB notified in 2017, HIV status was already known for 26 and a further 4 were diagnosed with TB post-mortem. Of the remaining 509, information on HIV testing was available for 98% (497/509), an improvement on 2016 when information was only available for 92%. Of these, 90% (449/497) were offered and received testing; lower than to the national figure of 93%. A further 1.0% (5) were offered but refused testing and 3.0% (15) were offered but did not receive testing. 5.6% (28) were not offered testing which is higher than the proportion nationally of 3.9%.

The lowest proportion offered and tested was in Surrey and Sussex (86%, 98/114), where 10.5% (12) of people with TB were not offered testing. There was no clear distinction in those not offered testing in Surrey and Sussex across sex, age, ethnic group, country of birth, or hospital.

TB-HIV co-infection rates

The latest available information on TB-HIV co-infection for notified adults 15 years and older, estimated that 4.4% (23) of people with TB in the South East in 2016 were co-infected with HIV.[3] This was higher than the proportion in 2016 to 2015, and similar to the proportion between 2011 and 2014, although remaining lower than the proportions reported from 2001 to 2010.

The South East was the PHE centre with the highest proportion of people with TB that was co-infected with HIV in 2017 in England. For England in 2017, only 2.8% of people with TB were co-infected with HIV, the lowest since the peak of 8.4% in 2004, with an increase in the median age of people with co-infection (from 34 in 2001 to 43 in 2017).

[3] Tuberculosis in England: 2018 (presenting data to end of 2017), Public Health England, prepared by: Tuberculosis Unit, National Infection Service https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742782/TB_Annual_Report_2018.pdf

9. BCG vaccination

BCG vaccination status of TB patients

Information on BCG vaccination was available for 70% (375/539) of people notified in 2017, of whom 72% (269) were vaccinated (Table 4). Consistent with previous years, a higher proportion of those born outside the UK had been vaccinated (79%, 206/261) than UK born (56%, 63/113).

Among children aged under 15 years, over half had not received the BCG vaccination. All 8 were UK born, and 7 were of white ethnicity. Of the 5 children aged under 5 with TB in the South East, all were born in the UK and none had been vaccinated. Four were of white ethnicity. None had received the BCG vaccination, and all had pulmonary TB.

Table 11: Number and proportion of TB patients with BCG vaccination, South East, 2017

	< 5 years old			< 15 years old			All ages		
	n	N	%	n	N	%	n	N	%
UK born	0	5	0%	3	11	27%	63	113	56%
Non-UK born	0	0	-	3	3	100%	206	261	79%
All cases*	**0**	**5**	**0%**	**6**	**14**	**43%**	**270**	**375**	**72%**

BCG vaccine coverage

BCG immunisation is recommended for people at higher risk of exposure to TB, particularly to protect against serious forms of disease in infants. Information on neonatal BCG is included as part of the Cover Of Vaccination Evaluated Rapidly (COVER) programme, with data derived from local Child Health Information Systems. Data on these is of variable quality, but included in the national PHE TB report.

10. Latent TB infection testing and treatment

A national programme for the screening and treatment of LTBI for new migrants was introduced by the Department of Health and PHE in April 2015. Information for this programme is currently collected separately to ETS, and more information on the LTBI screening programme is available in the national PHE report.

Discussion

The rate of TB in the South East in 2017 was again below the average for England. At 6.1 per 100,000, this was a small but continuous year-on-year decline from the peak of 9.7 per 100,000 in 2011, which followed a decade of increasing case numbers and rates. As in previous years, rates were highest among residents of Slough in Thames Valley. There was substantial geographic variation, with very low rates across most of the South East.

The decrease was driven by a reduction in TB among people born outside the UK, which in 2017 was half that in 2011. While the majority of cases still occur among people born outside the UK, among those from the most common countries of India and Pakistan, these are now more often in people who have been in the UK for many years. Conversely, people from other countries including Nepal and Romania were more likely to have entered the UK recently.

People with TB in the South East frequently had other medical concerns: almost 1 in 5 had 1 of the key co-morbidities collected in surveillance, with diabetes the most common. While culture confirmation rates were similar to national levels, sputum smear results were only known for approximately half of all people with pulmonary disease. Reasons for this should be explored further at a clinic level.

In addition, 1 in 10 people with TB had 1 or more social risk factor across the South East: this was higher in some areas such as Kent. As people with social risk factors were more likely to have infectious disease, and less likely to complete treatment, they remain a group of particular public health concern needing additional focus by TB control programmes.

The shorter delays leading to diagnosis experienced by most South East residents compared to previous years is encouraging, except for in Kent where about half of people with TB experienced delays of greater than 4 months. There was no clear demographic or other explanation associated with this increase and this should be investigated further.

The latest estimates for 2017 suggested that 4.4% of South East TB cases were co-infected with HIV, and the South East was the PHE centre with the highest proportion of people with TB that were co-infected with HIV in 2017 in England. Information on HIV testing was available for 98%, a promising increase from 92% in 2016. However of these, only 90% were offered and received testing, below the national average.

Conclusion and recommendations

In conclusion, TB rates remain very low across most of the South East and continue to decline. However there are still areas that need focus, including the lack of sputum smear results for many people with pulmonary TB, long delays experienced by residents in Kent, and reasons for the lower than average coverage of HIV testing in the centre with the highest co-infection estimates, which will require further exploration at a local level.

Social and clinical complexity were common, with 25% of people with TB having either a social risk factor or 1 of the selected co-morbidities. These complex needs are likely to impact on early diagnosis and prompt treatment of people with TB, and integrated health and social strategies are needed to support them through treatment.

Recommendations

South of England TB Control Board should continue and prioritise work with wider stakeholders to develop strategies to improve outcomes for under-served populations.

Cohort review and MDR cohort review continue to play a vital role in quality assurance of TB case and contact management with identification and escalation of issues to TB Control Board.

PHE and local services should work together to use whole genome sequencing data to identify opportunities for prevention.

Areas where delays increased should investigate reasons, building on previous work across the South East. Success in reducing delays elsewhere should be shared so that learning can benefit other areas.

Reasons for the low number of people with pulmonary TB who had sputum smear results reported should be explored.

Appendix A: Notes on the report

About the Field Service

The Field Service (FS) supports PHE centres and partner organisations through the application of epidemiological methods to inform public health action. It does this firstly by providing a flexible expert resource, available, as and when needed, to undertake epidemiological investigations for key health protection work and secondly through the expert analysis, interpretation and dissemination of surveillance information to PHE Centres, local health partners, service providers and commissioners of services. Within the FS network, excellence and innovation is encouraged, we foster academic collaborations and take active part and lead in research, development and training.

Intended audience

This report is for use by healthcare professionals who diagnose and/or care for people with TB, commissioners involved in planning and financing TB services, public health professionals working to improve TB control and the health of at-risk populations, researchers with an interest in TB, and government and non-governmental organisations working in the field of TB. In particular this report is for the use of the South TB Control Board and local TB networks and health protection forums.

Aim of report

This report describes the recent epidemiology of TB in the South East. It includes local trends, areas and population groups with a high burden of disease, and detail on the care of people with TB.

Further TB information

The national report of TB in England www.gov.uk/government/publications/tuberculosis-in-england-annual-report.

Official Statistic for TB www.gov.uk/government/collections/tuberculosis-and-other-mycobacterial-diseases-diagnosis-screening-management-and-data.

TB Strategy Monitoring Indicators Collaborative TB Strategy for England 2015-2020 www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf).

TB indicators at Upper Tier Local Authority and Clinical Commissioning Group level http://fingertips.phe.org.uk/profile/tb-monitoring

Appendix B: Description of data sources and definitions

Data sources

This report is based on TB case notifications made to the PHE Enhanced TB Surveillance system (ETS) in England to the end of 2017. This information is updated annually to take into account denotifications (if the patient was found not to have TB), late notifications and other updates. The data presented in this report supersedes data in previous reports.

Diagnostic laboratories serving acute hospitals are the first place in which TB infection-related samples are received and processed within the pathway of clinical diagnosis and management of suspected TB. Results for microscopy, polymerase chain reaction (PCR), histology and culture are collected in ETS. The National Mycobacterium Reference Service (NMRS) receives these diagnostic materials and undertake characterisation using culture and molecular diagnostic methods to define species of *Mycobacterium*, TB antibiotic (drug) susceptibility and organism relatedness.

Definitions

BCG	Bacillus Calmette-Guérin vaccination
CI	Confidence interval
CCG	Clinical Commissioning Group
Cluster	Two or more people notified within the time period of analysis caused by indistinguishable strains, with at least 23 complete MIRU-VNTR loci
CNS	Central nervous system
Cohort review	The systematic review of all people with TB notified by a TB service in a 3-4 month period, looking at standard outcomes in terms of care and contacts tracing
Cryptic disseminated TB	Systemic illness without localising features
DOT	Directly observed treatment
Drug	In the context of TB control, a drug is an anti-TB antibiotic
Drug resistant cohort	The drug resistant cohort includes any people with rifampicin resistant TB (initial or acquired), including MDR-TB (initial or acquired), as well as those without culture confirmation

	treated with an MDR-TB regimen
Drug sensitive cohort	The drug sensitive cohort excludes all people with rifampicin resistant TB (initial or acquired) including MDR-TB (initial or acquired), and non-culture confirmed treated with an MDR-TB regimen
DST	Drug sensitivity testing, based on phenotypic analysis of cultured TB isolates
ETS	Enhanced TB surveillance system
First-line drug resistance	First-line anti-TB antibiotic drug resistance is defined as resistance to at least 1 of the first line antibiotics (isoniazid, rifampicin, ethambutol, pyrazinamide)
HAART	Highly active antiretroviral therapy
IGRA	Interferon-gamma release assay – blood test for TB infection which does not differentiate between active disease and LTBI
IMD 2015	The Index of Multiple Deprivation 2010 rank for each LSOA, based on deprivation score assigned, relative to other LSOAs
IQR	Interquartile range
LSOA	Lower super output area (geographic definition)
LTBI	Latent TB infection
MDR	Multidrug-resistance: cases initially resistant to at least isoniazid and rifampicin
Miliary TB	TB infection spread via the bloodstream to all parts of the body
MIRU-VNTR	Mycobacterial Interspersed Repetitive Unit-Variable Number Tandem Repeats
PCR	Polymerase chain reaction
Post-mortem diagnosis	A post-mortem diagnosis is defined as where TB was not suspected before death, but a TB diagnosis was made at post-mortem, with pathological and/or microbiological findings consistent with active TB that would have warranted anti-TB treatment if discovered before death
Pulmonary TB	A pulmonary case is defined as involving the lungs and/or tracheobronchial 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

Second-line drugs	Second-line drugs include injectable agents (for example amikacin, capreomycin, kanamycin), fluoroquinolones (for example moxifloxacin, ofloxacin, ciprofloxacin) and other oral bacteriostatic agents.
SNP	Single nucleotide polymorphism – mutation of 1 base pair in the genome of an *M. tuberculosis complex* isolate
TB	Tuberculosis
UTLA	Upper tier local authority (geographic definition)
VOT	Video observed therapy
WGS	Whole genome sequencing
XDR	Extensive drug resistance: cases initially MDR and resistant to at least 1 injectable agent (amikacin, capreomycin or kanamycin) and at least 1 fluoroquinolone (moxifloxacin, ofloxacin or ciprofloxacin)

Treatment outcome

Information on outcomes was reported for all people notified in the previous year, excluding those with known rifampicin resistant disease: outcomes for these 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 2018.

Proportions

All proportions in this report are calculated among 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

TB rates by geographical area, age, sex and place of birth were calculated using ONS mid-year population estimates. TB rates by ethnic group were calculated using population estimates from the Labour Force Survey [www.esds.ac.uk/findingData/qlfs.asp]. This is based on a population sample, so estimates are liable to sampling errors, particularly for small population subgroups, and should be interpreted with caution.

Appendix C: TB among South East residents

Table Ci: TB case numbers by upper tier local authority of residence, South East 2000 to 2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hampshire	34	30	41	42	51	38	47	54	37	66	67	79	67	53	44	58	59	57
Isle of Wight	<5	7	<5	<5	<5	<5	<5	7	<5	<5	<5	6	7	<5	<5	<5	<5	<5
Portsmouth	24	12	15	16	23	20	23	23	23	30	24	16	23	19	10	17	11	12
Southampton	18	15	27	36	33	30	33	24	24	36	27	51	41	39	29	23	34	34
Hampshire & Isle of Wight	76	64	86	95	108	91	103	108	85	135	121	152	138	113	86	99	108	98
Kent	47	37	66	67	61	65	86	86	129	111	104	112	115	107	101	91	94	96
Medway	13	21	13	20	9	14	16	18	22	20	20	28	20	16	16	14	12	11
Kent & Medway	60	58	79	87	70	79	102	104	151	131	124	140	135	123	117	105	106	107
Brighton and Hove	17	24	6	<5	14	15	15	30	28	35	22	23	31	15	22	24	19	16
East Sussex	13	28	25	13	20	15	16	12	17	27	24	25	34	20	25	23	21	16
Surrey	42	31	28	60	61	64	79	57	72	88	86	100	98	57	77	67	62	62
West Sussex	37	34	39	44	52	38	63	58	38	49	51	77	46	64	41	38	45	35
Surrey & Sussex	109	117	98	120	147	132	173	157	155	199	183	225	209	156	165	152	147	129
Bracknell Forest	8	<5	<5	6	<5	10	<5	6	7	9	12	10	10	6	14	7	<5	<5
Buckinghamshire	42	38	51	47	32	40	41	37	34	30	48	52	54	45	39	42	52	44
Oxfordshire	36	33	26	43	64	60	52	75	53	56	60	71	70	64	74	51	38	40
Reading	29	30	41	39	34	59	44	55	60	57	59	52	43	66	64	37	27	38
Slough	56	64	68	73	71	75	62	54	59	61	72	85	84	78	58	71	54	43
West Berkshire	6	5	8	<5	9	11	<5	10	5	11	7	6	9	11	7	5	6	8
Windsor and Maidenhead	11	12	11	15	7	17	8	9	11	13	9	10	12	9	21	7	10	14
Wokingham	9	5	9	13	11	9	15	12	9	10	16	10	14	12	19	17	16	7
Thames Valley	197	191	218	240	232	281	229	258	238	247	283	296	296	291	296	237	206	194
South East	442	430	481	542	557	583	607	627	629	712	711	813	778	683	664	593	567	528

Table Cii: TB rate* per 100,000 by local authority of residence, South East, 2000 to 2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hampshire	2.7	2.4	3.3	3.4	4.1	3.0	3.7	4.2	2.9	5.1	5.1	6.0	5.0	4.0	3.3	4.3	4.3	4.2
Isle of Wight	0.0	5.3	2.2	0.7	0.7	2.2	0.0	5.1	0.7	2.2	2.2	4.3	5.0	1.4	2.2	0.7	2.1	0.7
Portsmouth	12.8	6.4	8.0	8.4	11.9	10.2	11.7	11.8	11.7	15.1	11.8	7.8	11.1	9.2	4.8	8.1	5.2	5.6
Southampton	8.3	6.8	12.2	16.2	14.8	13.2	14.6	10.6	10.5	15.7	11.6	21.6	17.2	16.3	12.0	9.3	13.6	13.5
Hampshire & Isle of Wight	4.3	3.6	4.8	5.3	6.0	5.0	5.6	5.9	4.6	7.2	6.4	8.0	7.2	5.9	4.4	5.1	5.4	5.3
Kent	3.5	2.8	4.9	5.0	4.5	4.7	6.2	6.1	9.1	7.7	7.2	7.6	7.8	7.2	6.7	6.0	6.0	6.2
Medway	5.2	8.4	5.2	8.0	3.6	5.6	6.3	7.0	8.5	7.7	7.6	10.6	7.5	5.9	5.9	5.1	4.3	4.0
Kent & Medway	3.8	3.7	5.0	5.4	4.3	4.9	6.2	6.3	9.0	7.7	7.2	8.1	7.7	7.0	6.6	5.8	5.8	5.8
Brighton and Hove	6.8	9.6	2.4	1.2	5.6	5.9	5.9	11.6	10.7	13.2	8.2	8.4	11.2	5.4	7.8	8.4	6.6	5.6
East Sussex	2.6	5.7	5.0	2.6	4.0	2.9	3.1	2.3	3.3	5.2	4.6	4.7	6.4	3.7	4.6	4.2	3.6	2.9
Surrey	4.0	2.9	2.6	5.6	5.7	6.0	7.3	5.2	6.5	7.9	7.6	8.8	8.6	4.9	6.6	5.7	5.2	5.2
West Sussex	4.9	4.5	5.2	5.8	6.8	4.9	8.1	7.4	4.8	6.2	6.3	9.5	5.6	7.9	4.9	4.5	5.0	4.1
Surrey & Sussex	4.3	4.6	3.8	4.7	5.7	5.1	6.6	5.9	5.8	7.4	6.7	8.2	7.6	5.6	5.9	5.4	5.0	4.5
Bracknell Forest	7.3	3.6	3.7	5.5	3.7	9.1	3.6	5.4	6.3	8.0	10.6	8.8	8.7	5.1	11.9	5.9	2.5	4.2
Buckinghamshire	8.8	7.9	10.7	9.8	6.6	8.2	8.4	7.5	6.8	6.0	9.5	10.3	10.6	8.7	7.5	8.0	9.8	8.2
Oxfordshire	5.9	5.4	4.3	7.0	10.3	9.6	8.2	11.8	8.3	8.7	9.2	10.8	10.6	9.6	11.1	7.4	5.6	5.9
Reading	20.2	20.7	28.5	27.1	23.5	40.2	29.7	36.7	39.6	37.4	38.2	33.5	27.4	41.6	39.9	22.9	16.6	23.3
Slough	46.8	53.1	56.2	60.4	58.8	61.0	49.5	42.2	44.9	45.3	52.2	60.4	59.2	54.7	40.2	48.6	35.9	28.9
West Berkshire	4.2	3.5	5.6	2.8	6.2	7.5	2.0	6.7	3.3	7.2	4.5	3.9	5.8	7.0	4.5	3.2	3.8	5.0
Windsor and Maidenhead	8.2	9.0	8.2	11.2	5.2	12.5	5.8	6.4	7.8	9.1	6.3	6.9	8.2	6.2	14.2	4.7	6.7	9.3
Wokingham	6.0	3.3	6.0	8.7	7.4	6.0	10.0	7.9	5.9	6.5	10.3	6.5	8.9	7.6	11.9	10.5	9.8	4.2
Thames Valley	10.5	10.1	11.5	12.6	12.2	14.6	11.8	13.2	12.0	12.4	14.1	14.6	14.5	14.1	14.3	11.3	9.7	9.4
South East	**5.7**	**5.5**	**6.1**	**6.9**	**7.0**	**7.3**	**7.5**	**7.7**	**7.7**	**8.6**	**8.5**	**9.7**	**9.2**	**8.0**	**7.7**	**6.8**	**6.4**	**6.1**

*rates calculated using ONS mid-year population estimates

Table Ciii: TB case numbers and rate* by age and sex, South East, 2017

Age Group	Female		Male	
	n	rate	n	rate
0-9	4	0.8	7	1.3
10-19	10	2.0	15	2.9
20-29	41	8.0	55	10.1
30-39	58	10.5	74	13.9
40-49	34	5.6	61	10.4
50-59	24	3.9	36	6.0
60-69	23	4.7	20	4.3
70-79	22	5.6	23	6.6
80+	10	3.5	22	11.5

*rates calculated using ONS mid-year population estimates

Table Civ: Drug resistance among people with culture confirmed TB*, South East, 2000 to 2017

Year	Any resistance		Isoniazid resistant		Multi-drug resistant		Total*
	n	%	n	%	n	%	
2000	15	7.4	14	6.9	3	1.5	203
2001	8	4.3	6	3.2	0	0	185
2002	22	7.5	20	6.8	7	2.4	292
2003	20	6.2	19	5.8	1	0.3	325
2004	21	6.4	19	5.8	2	0.6	330
2005	19	5.1	18	4.8	1	0.3	374
2006	25	6.1	21	5.1	4	1	411
2007	25	6.4	20	5.1	1	0.3	391
2008	28	7.5	22	5.9	5	1.3	375
2009	34	8.2	29	7	3	0.7	415
2010	27	6.3	25	5.8	6	1.4	431
2011	44	9.1	36	7.5	6	1.2	483
2012	39	8.1	36	7.4	7	1.4	484
2013	27	6.2	24	5.5	1	0.2	435
2014	31	7.3	30	7.1	3	0.7	425
2015	22	6.0	19	5.2	6	1.6	366
2016	26	6.6	23	6.3	5	1.4	379
2017	20	6.0	20	6.0	4	1.2	340

*culture confirmed cases with drug susceptibility testing results for at least isoniazid and rifampicin