Public Health England

Protecting and improving the nation's health

Tuberculosis in London
Annual review (2017 data)

Data from 2000 to 2017

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The data presented in this report are correct as at August 2018.

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Suggested citation

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Executive summary

The rate of TB in London continues to decline. The 1,919 people notified with TB in London in 2017 was the lowest number since 2000; a rate of 21.7 per 100,000 of the population. This represents a 12% decline in numbers from 2016, and a 45% decrease from the peak in 2011, but remains over twice the rate across all of England in 2017. The biggest decline was in the highest burden areas: rates more than halved in Newham and Brent, which were the only boroughs with rates above 40 per 100,000.

The majority (79%) of people with TB in London were born outside the UK, although many have been resident in the UK for many years before their illness: the median time since UK entry for people with TB who were born abroad was 10 years. Most of the decline in numbers has been in this group, with a 16% reduction in TB rates from 2016. Although the rate among London's UK born population was much lower, and also decreased slightly from 2016, this was also still more than twice the England average.

India remains the most common country of birth. People of Indian ethnicity had the highest rate of TB and continued to account for the highest proportion of cases overall. The next most common countries of birth of people with TB were Pakistan, Bangladesh, Somalia, and Romania.

Almost half of all people with TB had pulmonary disease, with extra-thoracic lymph node the next most common site. In 2017, 61% of people with TB had their TB culture confirmed; 77% among those with pulmonary TB. For the first time, information on key co-morbidities (diabetes, hepatitis B, hepatitis C, chronic renal disease, chronic liver disease and immunosuppression) was collected as part of surveillance on people with TB. More than 1 in 5 people had a key co-morbidity (22%), most commonly diabetes.

People with TB in London had shorter periods from becoming unwell to starting treatment that on average for England. The median time from symptom onset to start of treatment for people with pulmonary TB was 73 days, 6 days shorter than the median of 79 for England in 2017. Those of white ethnicity were more likely to have delays of more than 4 months. Healthcare delays were slightly longer at a median of 37 days than presentation delays at 24 days.

Contact tracing information collected through cohort reviews showed that a median of just 3 contacts were screened per person with pulmonary TB.

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) 87% had completed at 12 months. People who had at least 1 social risk factor were less likely to complete treatment (77%). In addition, only

73% of those with CNS, spinal, miliary, or cryptic disseminated TB had completed treatment by the last recorded outcome. Overall, 4% of people with rifampicin sensitive TB died before completing treatment and TB was reported to have caused or contributed to over half of these deaths 57%.

The proportion of people with TB resistant to 1 or more first line drug increased slightly, while the number and proportion with multi-drug resistant disease has remained around 1%. Treatment completion for people with rifampicin resistant disease was only 53% at 24 months, with a further 11% still on treatment at that point.

Overall 12% of people with TB had a social risk factor, defined as homelessness, prison history, drug or alcohol misuse. Experience of 1 or more social risk factor was twice as common among people born in the UK. People with TB with a social risk factor were more likely to be drug resistant, more likely to be infectious, and less likely to have completed treatment.

London remains the PHE Centre with the highest levels of HIV testing among people with TB with 99% of those whose HIV status was not already known being offered testing and 97% receiving testing. The estimates for 2017 suggested that 2.7% of London TB cases were co-infected with HIV. This was a decline from the previous 2 years.

In conclusion, it is encouraging that TB rates in London have declined to their lowest level since 2000, but focus remains necessary to ensure continued success in TB control. People with TB frequently have complex needs both medically and socially, and integrated health and social strategies are needed to support them through treatment.

Recommendations

London TB control board should:

- use evidence of the changing epidemiology of TB in London to inform TB service development
- continue and prioritise work with wider stakeholders to develop strategies to improve outcomes for under-served populations and people with drug resistant TB

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.

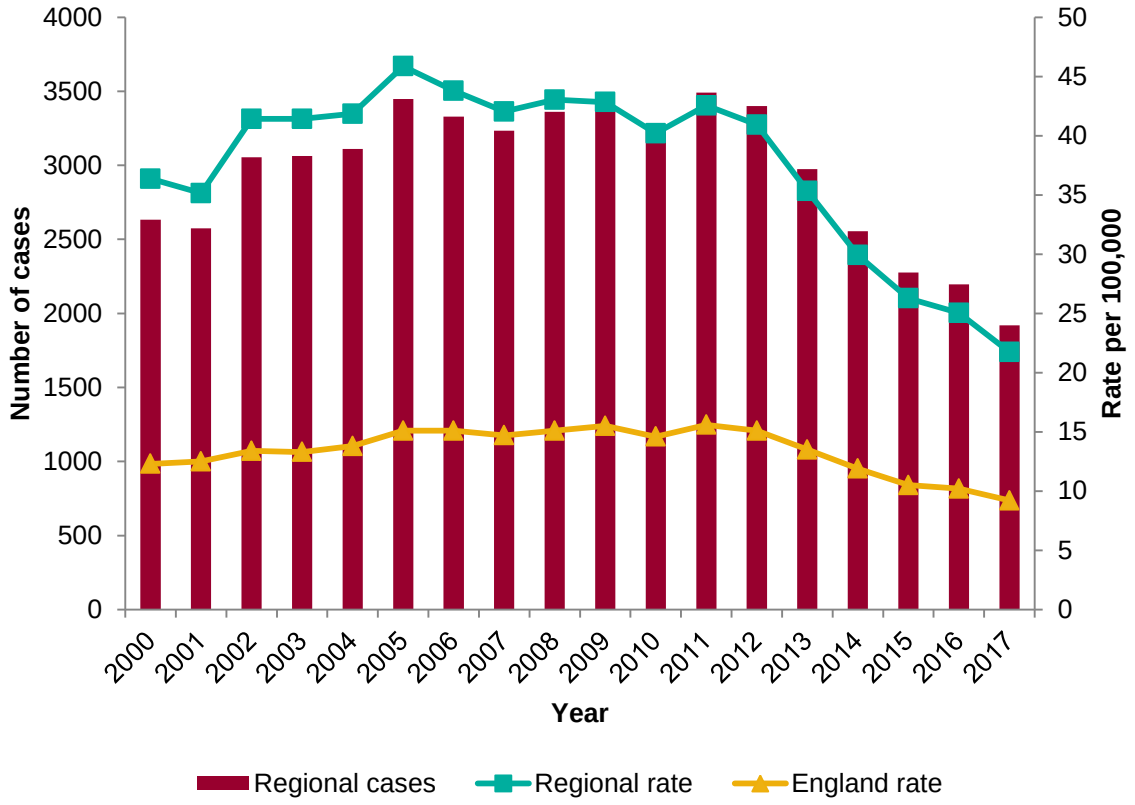
1. TB notifications and incidence

Overall numbers, rates and geographical distribution

In 2017, there were 1,919 cases of tuberculosis (TB) notified in London residents; a rate of 21.7 per 100,000 of the population (Figure 1). This was the lowest number of people notified with TB in London since 2000, and represents a 12% decline in numbers from 2016, and a 45% decrease from 2011. A similar decline of 38% was seen in the number of people with TB in England from 2011 to 2017.

TB Monitoring Indicator 1: Overall TB incidence per 100,000 population

Figure 1: TB case reports and rates, London, 2000 – 2017

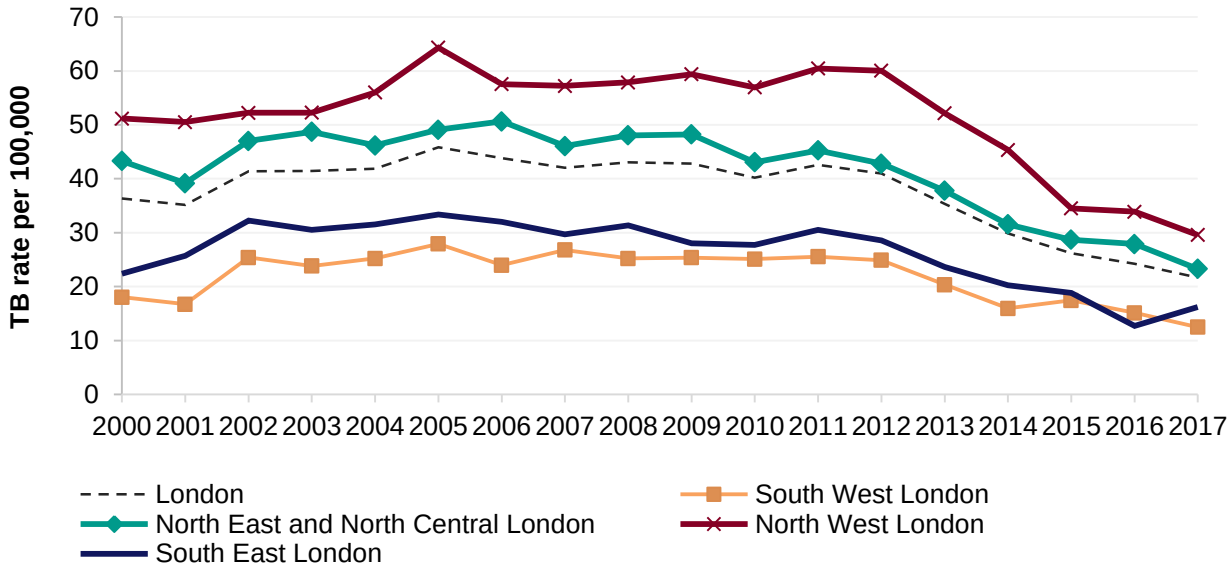


Despite this, the rate of TB in London in 2017 remains over twice as high as the rate for England (9.2 per 100,000) and continues to account for the highest proportion of cases in England (37% of the 5,102 cases in 2017).[1]

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

The highest TB rate was among residents of the North West London Health Protection Team area, 29.6 per 100,000 of the population – despite a 12.6% reduction since 2016. Only South East London had an increase in rates (by 27% from 12.7 per 100,000 in 2016 to 16.2 per 100,000 in 2017), but was still below the rate in South East London for 2015 (18.8 per 100,000) (Figure 2).

Figure 2: TB case rates, by Health Protection Team of residence, London, 2000 – 2017



The London boroughs of Newham (47 per 100,000, 163 cases) and Brent (45 per 100,000, 149 cases) continued to have the highest rates of TB in London (Figure 3). These were the only 2 boroughs with rates over 40 per 100,000. Rates fell in both compared to 2016, for Newham, by 14% and for Brent, by 22%.

The majority of other boroughs experienced continued declines in rates from 2016. However, the rate in Bexley increased by 13% (13.8 per 100,000 in 2017 vs. 12.2 per 100,000 in 2016) following a 56% increase from 2015 to 2016, and in Kensington and Chelsea, TB rates also increased by 39% (13.4 per 100,000 in 2016 to 18.6 per 100,000 in 2017). Smaller increases were seen in Havering (18%, 9.9 per 100,000 to 11.7 per 100,000), Greenwich (8%, 22.2 per 100,000 to 24 per 100,000) and Ealing (8%, 34.2 per 100,000 to 37.6 per 100,000). The increases in Bexley and Greenwich are likely to be the reason for the slight increase in the rate of TB in South East London.

At a higher geographical resolution, a greater degree of variation was seen in the incidence of TB in London, such that high overall rates in boroughs, could be attributed to a relatively small number of very high incidence middle super output areas (Figure 4). This was the case for Brent, Redbridge, Ealing, Newham and Hounslow.

Figure 3: TB case rate by upper tier local authority of residence, London, 2017

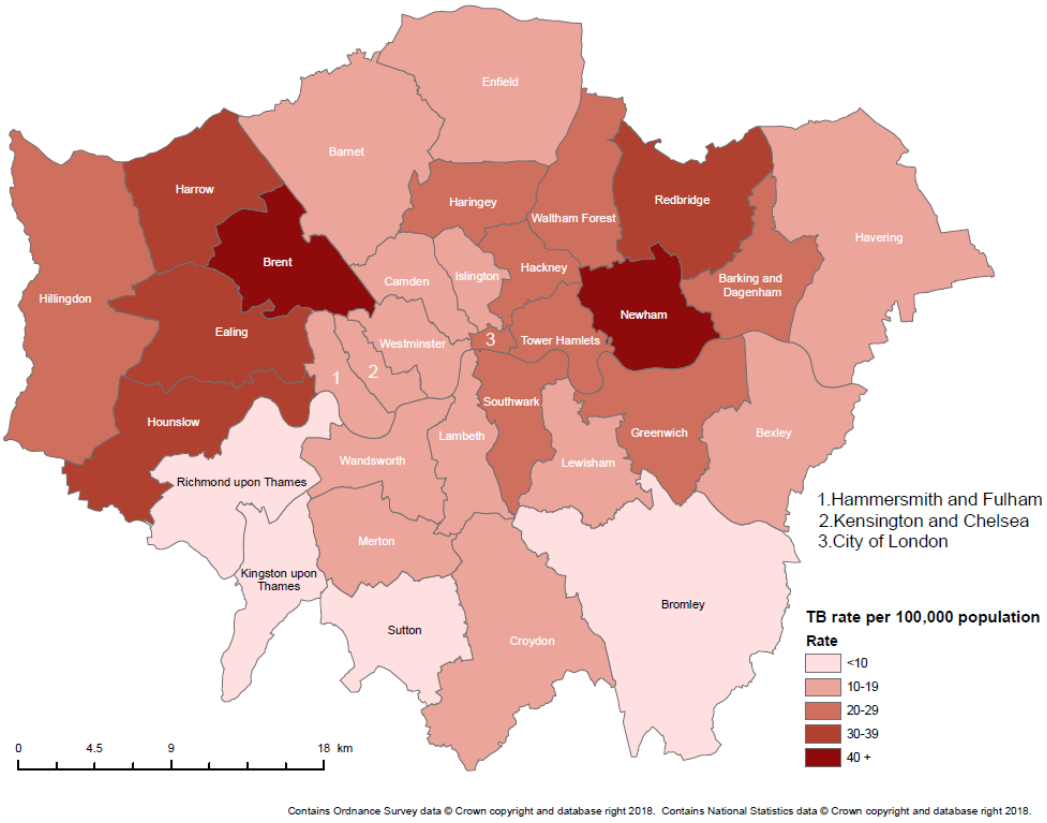
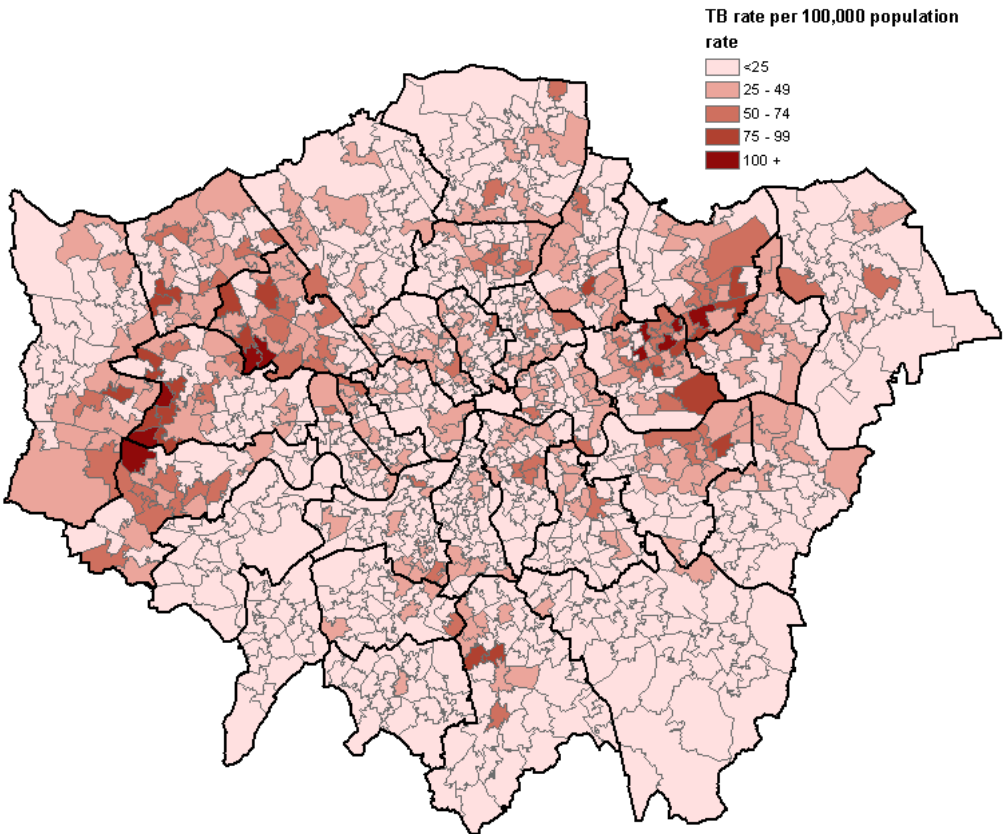


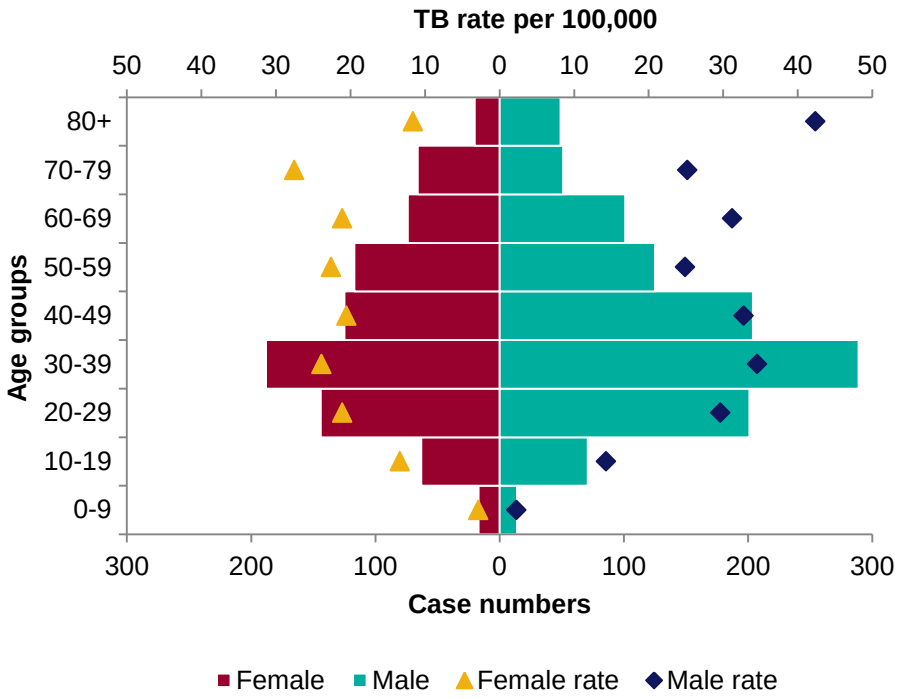
Figure 4: TB case rate by Middle Super Output Area of residence, London, 2017



Demographic characteristics

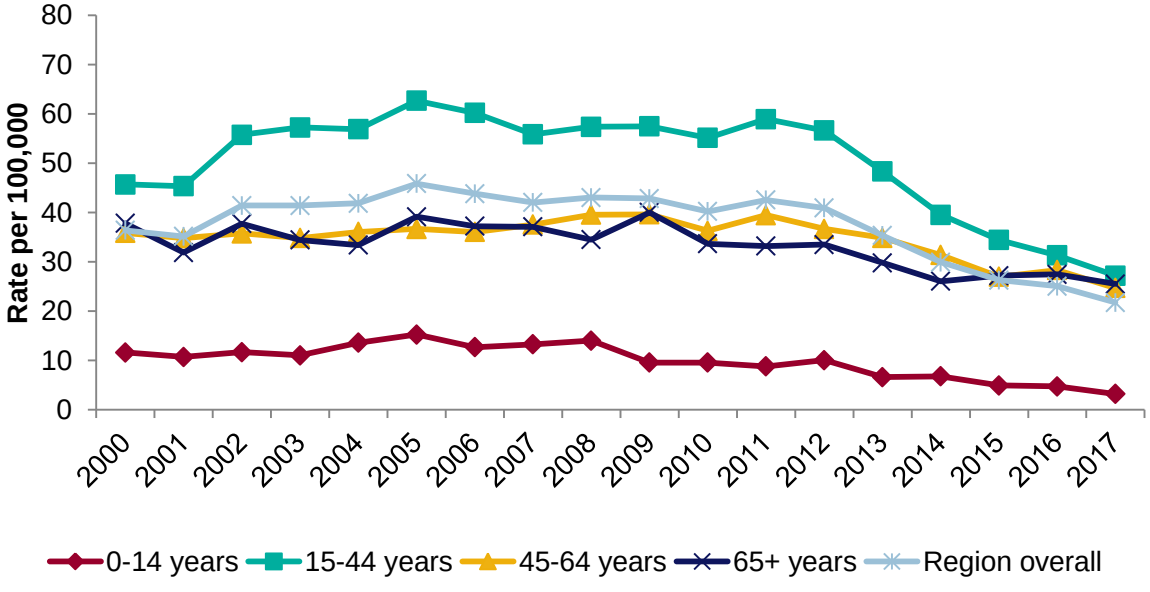
Age and sex

Figure 5: TB case reports and rate by age and sex, London, 2017



In 2017, 58% (1,105) of people with TB in London were male, and the rate was higher among males (25 per 100,000) than for females (18 per 100,000). Rates were highest for males aged over 80 (42 per 100,000) and for females 70-79 years old (28 per 100,000). This was a shift from 2016, where the rate was highest in males aged 40-49, and in women aged 20-29 years old.

Figure 6: TB case rates by age group, London, 2000 – 2017



Other than the increase in rates seen in the older age groups, rates in adults with TB did not appreciably differ across the age-strata. This convergence of rates was largely driven by the decline in the rate of TB in people aged 15-44 since 2011, which at 27 per 100,000 was similar to those aged 45-64 (25 per 100,000) in 2017 (Figure 6).

Place of birth and time since entry

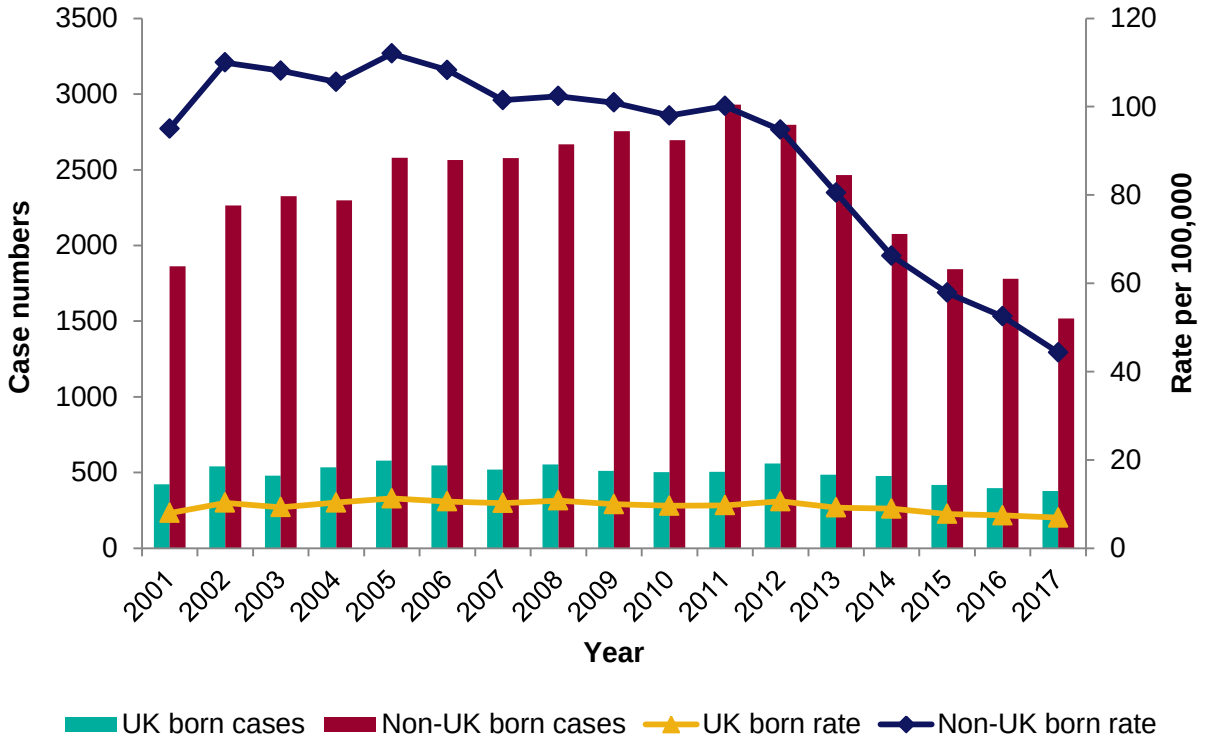
In 2017, 79% of all people with TB in London were born abroad – higher than the proportion of cases born abroad seen nationally (74%). This ranged from 43% in Bromley, to 90% in Greenwich.

The rate of TB in people born outside of the UK fell by 15.5% from 2016 (52 per 100,000 vs. 44 per 100,000 in 2017), reaching the lowest it has been since 2001 (Figure 7). However, despite this decline, the rate of TB in people born abroad was still over 7 times greater than the rate of TB in people born in the UK.

The number of people with TB and rate in those born in the UK (378, 6.9 per 00,000) declined slightly from 2016 (397, 7.4 per 100,000). However, the TB rate in people born in the UK in London was more than double the England rate (3.2 per 100,000).

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

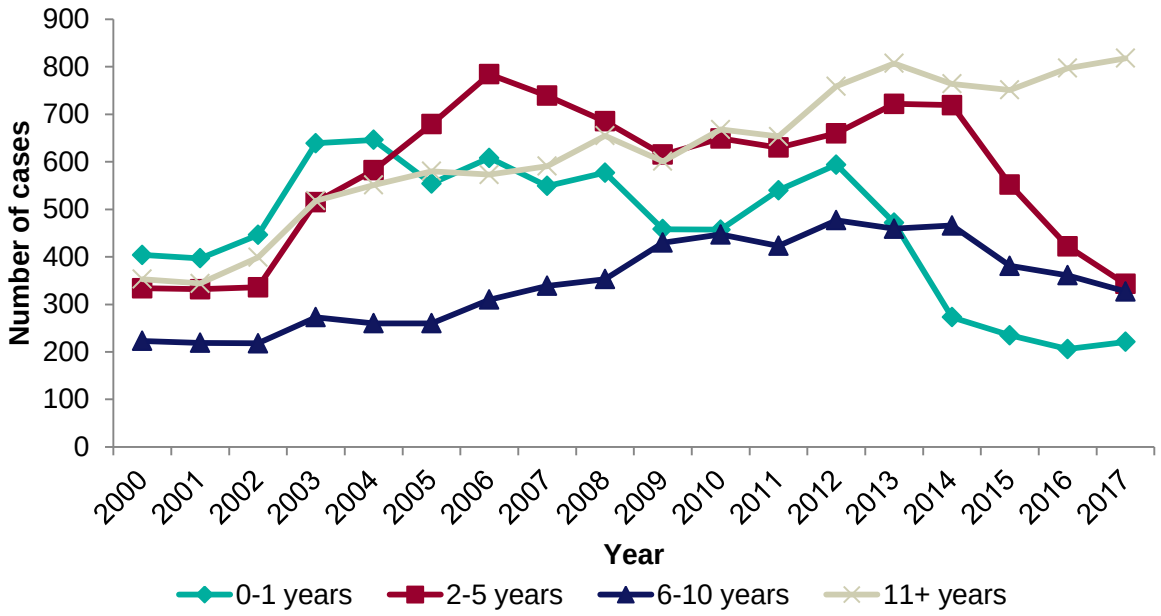
Figure 7: TB case reports and rate by place of birth, London, 2001 – 2017



The rates of TB in the non-UK born population should be interpreted in the context of changes to pre-UK entry screening policies. In 2005, the UK piloted pre-entry screening of long term migrants for active pulmonary TB in 15 high TB incidence countries. In 2012, this pre-entry screening was extended to all countries with a high incidence of TB (>40 cases per 100,000 population)[2].

In 2017, information on the time since entry to the UK and notification date of TB was available for 90% of non-UK born cases (1,370/1,518). Similar to recent years, the median time since entry was 10 years (IQR 4– 39 years). In recent years, the number of people diagnosed with TB in less than 10 years from entering the UK has decreased, but the number who arrived 11 or more years earlier has increased (Figure 8).

Figure 8: Time between entry to the UK and TB notification for non-UK born people by year, London, 2000 – 2017



In 2017, the country of birth was known for 97% (1,465/1,518) of people not born in the UK. As in previous years, the most common country of birth for people with TB who were not born in the UK was India (26%, 379/1,465), and the median time since entry was 9 years (IQR 9 -17 years) – increasing from a median of 8 in 2016 and 6 in 2015 (Table 1). The median time since entry also increased slightly for those born in Pakistan, the second most common country of birth, to 11 years (from 10 years in 2016 and 8 years in 2015).

[2] Reference Public Health England. UK pre-entry tuberculosis screening report 2015. 2016; Available from: www.gov.uk/government/uploads/system/uploads/attachment_data/file/555150/U K_pre-entry_tuberculosis_screening_2015_GTW230916.pdf.

Of those countries which make up the 10 most common countries of birth for people with TB born outside of the UK, those born in Sri Lanka had the longest median time since entry in 2017 (15.5 years), followed by Somalia (14 years). People with TB from Romania were more likely to be recent entrants, with a median time from entry to diagnosis of 2 years.

Table 1: 10 most common countries of birth of non-UK born people with TB and time between entry to the UK and TB notification, London, 2017

	n	% non-UK born people with TB	Median time to entry	IQR	
India	379	25.9	9	4	17
Pakistan	120	8.2	11	5	24
Bangladesh	87	5.9	11.5	4.5	26
Somalia	86	5.9	14	7	19
Romania	79	5.4	2	1	4
Nigeria	56	3.8	11	5	20
Sri Lanka	44	3.0	15.5	8.5	20
Afghanistan	41	2.8	7	1	16
Nepal	37	2.5	7	4	10
Philippines	36	2.5	12	8	20

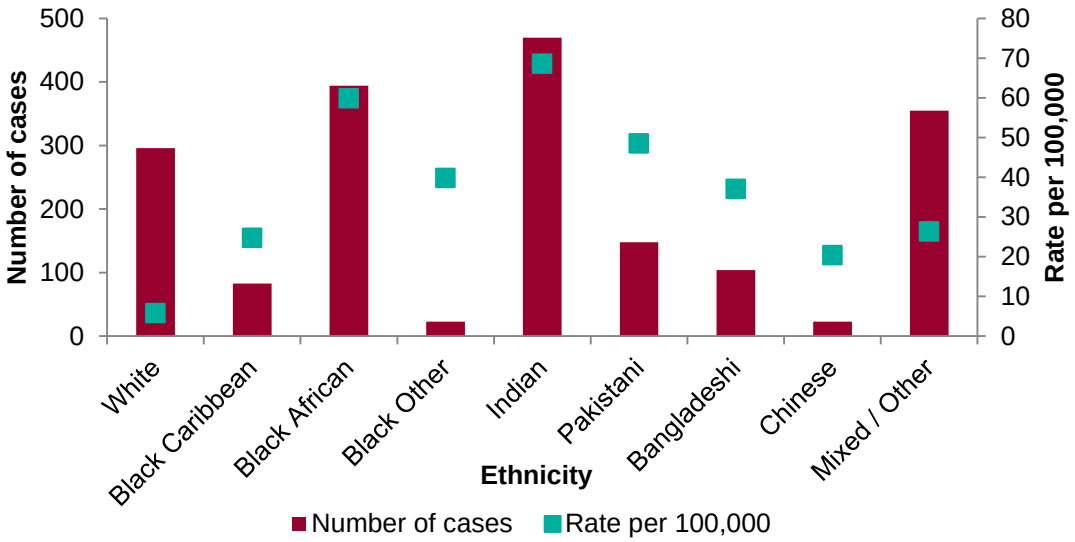
Ethnicity

These rates should be interpreted with caution. Population estimates used as the denominators for the different ethnic groups were calculated using the Labour Force Survey, which is liable to sampling error for small population groups.[3] Previously this report has used the London Data Store, but information on ethnicity has not been updated since 2015.

In 2017, 98% of people with TB in London had their ethnicity recorded (1,896/1,919). As in previous years, people of Indian ethnicity had the highest rate of TB in London (69 per 100,000) and continued to account for the highest proportion of cases overall (25%, 470/1,896) (Figure 9). Following those of Indian ethnicity, as in 2016, people of black African (60 per 100,000) and Pakistani (49 per 100,000) ethnicities had the next highest rates of TB in London in 2017. The lowest rates in London again were seen in those of white ethnicity (5.8 per 100,000), but this group accounted for a slightly greater proportion of the number of people with TB in London in 2017 (16%) than in 2016 (14%). Only half of those of white ethnicity, 51%, were UK born.

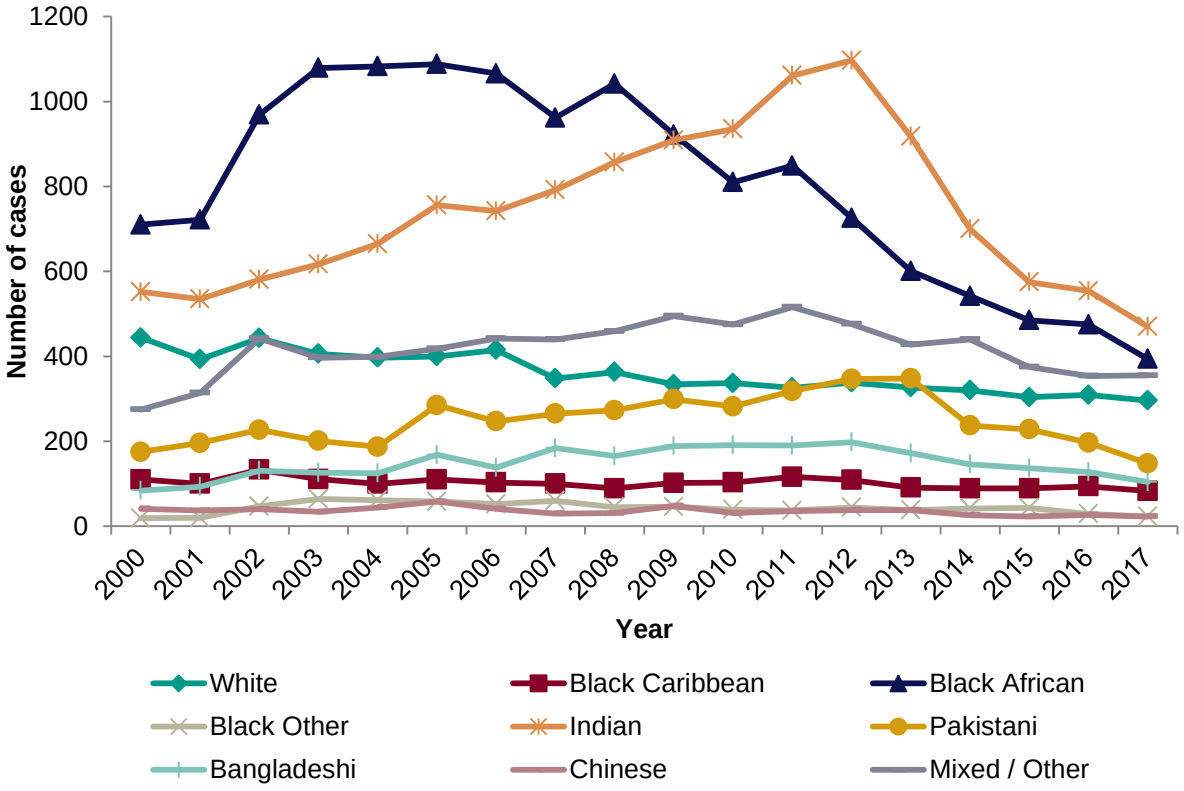
[3] The Labour Force Survey (LFS) was used to calculate population estimates based on a random sample of surveyed individuals, weighted to represent others in the region. Small populations are often underrepresented in the LFS sample and should be treated cautiously.

Figure 9: TB case number and rate by ethnic group, London, 2017



Declines, or little change, were seen in the number of people with TB in each ethnic group compared to 2016 (Figure 10). Little change was seen in the numbers of people of black other ethnicity, Chinese or mixed/other ethnicities, but larger declines were seen in the number of people with TB who were of Pakistani (24%) or black African (17%) ethnicities.

Figure 10: TB case number by ethnic group, London, 2000 – 2017



Occupation

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

Occupation	n	%
Agricultural/animal care worker	2	<1
Education	136	10
Health care worker	83	6
Other	740	51
None	475	33
Total	1,436	100

In 2017, occupation was known for 92% (1,436/1,551) of people with TB between 18 and 65 years old (Table 2). Of these, 475 (33%) were not working, of whom 6.5% (31/475) were retired. Most healthcare workers diagnosed with TB were born abroad (82%, 68/83), as were the majority of those working or engaged in education (69%, 93/135).

Clinical characteristics

Site of disease

Table 4: Site of disease of people with TB, London, 2017

Site of disease	n	%*
Pulmonary	966	50.3
Lymph nodes (extra-thoracic)	424	22.1
Lymph nodes (intra thoracic)	244	12.7
Pleural	208	10.8
Extra pulmonary (Unknown)	192	10.0
Other (extra-pulmonary)	187	9.7
Gastrointestinal	102	5.3
Bone/joint (spine)	91	4.7
Bone/joint (other)	53	2.8
Miliary	46	2.4
CNS† (meningitis)	44	2.3
CNS† (other)	39	2.0
Genitourinary	32	1.7
Cryptic disseminated	22	1.1
Laryngeal	6	0.3

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

In 2017, half of people with TB had pulmonary disease. Pulmonary TB was more common in people who were born in the UK (63%, 238/378) compared to those born abroad (47%, 717/1,518). It was also more common in those of white (78%, 232/296)

and Chinese (70%, 16/23) ethnicity and less common in those of Bangladeshi (36%, 37/104) and Indian (37%, 175/470) ethnicity.

Previous history of tuberculosis

As in recent years, 5.7% (108/1,889) of people with TB in 2017 had a previous TB diagnosis. The median time between diagnoses was 6.5 years (IQR 3 – 20). Of people who received Directly Observed Therapy (DOT), 10% had a previous TB diagnosis.

Hospital inpatient and directly observed therapy (DOT)

In 2017, information on hospital inpatient status was available for 98% (1,889/1,919) of people with TB. Just under a third (32%, 589/1,866) were hospital inpatients at the point of their diagnosis. Being hospitalised was more common among people over 65 years old (42%, 106/255). A greater proportion of people who were of black other (52%, 12/23) or black Caribbean ethnicity (41%, 33/80) were hospitalised than other ethnic groups, although numbers were small. People with pulmonary TB (38%, 357/942) were more likely to be hospitalised and of people with pulmonary TB who were sputum smear positive, just under half were hospitalised (49%, 175/360). People who were hospitalised were also more likely to have a social risk factor (59%, 124/211) or drug resistant forms of TB (MDR or rifampicin resistant) (71%, 10/14).

In 2017, 17% (331/1,588) of people with TB received DOT – a slight decline from 2016 (19%, 416/2,208). Of those with at least 1 social risk factor, 56% (120/215) were placed on DOT. Of those with MDR-TB, 57% (8/14) were placed on DOT.

Co-morbidities

Data for a number of key co-morbidities (diabetes, hepatitis B and C, chronic liver disease, chronic renal disease, and immunosuppression) began being collected in London in 2016. Data was available for 90% (1,728/1,919) of people notified with TB in 2017. Of those, 22% (378/1,728) had at least 1, and of those, 17% (64/378) had more than 1. The prevalence of these key co-morbidities was similar in London as seen nationally. The most common was diabetes, 12% (214/1,844) followed by immunosuppression (6%, 109/1,809), then chronic renal disease (2.8%, 52/1,777). The proportion of people with TB who had hepatitis C (1.5%, 24/1,720) was the same as the proportion with hepatitis B (1.5%, 26/1,723). 1.4% had chronic liver disease (26/1,811).

There was little difference in the proportion of people with TB and at least 1 co-morbidity by sex in 2017 (21%, 157/739 of females vs. 22%, 221/989 of males). They were more common among people with TB who were born abroad (23%, 314/1,383 of non-UK born vs. 16%, 54/330 of those UK born). Every person with TB who also had chronic renal disease in 2017 was non-UK born (49).

2. Laboratory confirmation of TB

Laboratory tests data collection

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

Culture confirmation and speciation

Similar to previous years, 61% (1,170/1,915) of people with TB had their diagnosis confirmed by culture in 2017. This is also similar to the proportion seen nationally of 62% (3,153/5,102). This was higher among those with pulmonary TB (77%, 741/966 vs. 45%, 427/949 of people with exclusively extra pulmonary TB). However, this remains below the 80% target set by the European Centre for Disease Prevention and Control for culture confirmation of pulmonary TB.

Of those people who had a positive culture diagnosis, the vast majority had *Mycobacterium tuberculosis* (98%, 1,142), 20 had *M. africanum*, and 6 had *M. bovis*. There were 2 people who could not be categorised beyond M. *tuberculosis* complex.

Of the 749 people without a positive culture diagnosis, 22 had positive microscopy, 100 had positive histology, and 39 had a positive PCR result. Of these 1 person had a positive result by all 3 methods, 1 was positive by microscopy and histology alone, 6 had positive microscopy and PCR alone, and 2 had positive histology and PCR alone. In total, 598 (31%) of the 1,915 people with TB in 2017 had no recorded laboratory evidence of TB; this is slightly higher than in 2016 (28%, 629/2,210). 34% (202/598) of those with no recorded laboratory evidence of TB didn't have a sample taken at all. Not having any laboratory evidence was more common among those with extra-pulmonary TB only compared to those with pulmonary TB (44%, 413/949 vs. 19%, 183/966). It was also slightly more common amongst those with a previous diagnosis of TB (43%, 46/108 vs. 31%, 547/1,781 of people with no previous TB diagnosis) and those who had no social risk factors (33%, 535/1,630 vs. 21%, 45/215 of people who had at least on social risk factor). No differences were seen based on sex, age, ethnic group, or Health Protection Team area.

Sputum smear

In 2017, sputum smear results were known for 82% (778/949) of people with pulmonary TB; an increase from 2016 (75%, 820/1,087). Of these people, 47% (368) had a positive smear result, higher than in 2016 (40%, 440/1,087).

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 London was 2.4 per 100,000 (CI 1.67-3.27, 37 cases). This was a continuation of the decline since 2008, when rates were at their relative highest (9.2 per 100,000, 119 cases).

Figure 11: Rate of TB in UK born children under 15 years of age, London 2001 – 2017

Strain typing and clustering

In 2017, strain typing in London continued to be by MIRU-VNTR, and 28% (553) of all 1,919 people with TB in London were identified as clustered with 1 or more London residents in the period 2010-2017 (Table 4) [4]. Identification of clustering requires specimens to be cultured and typed to at least 23 loci. Around 60% were culture confirmed each year from 2010–2017 and over 90% of these were strain typed to at least 23 loci from 2012–2016 (Table 4). The proportion of people with strain-typed TB that clustered with at least 1 other person in London has remained at around 54% for 2016 and 2017. In 2017, there were only 121 new clusters formed.

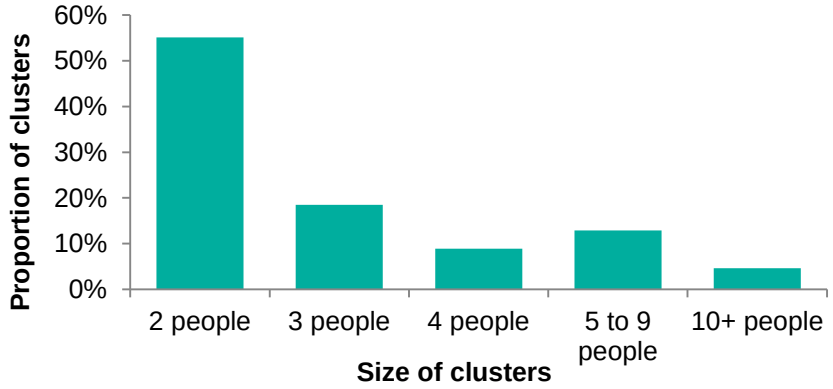
[4] Clusters are valid if there are a minimum of 2 cases within the London notified within the time period of analysis with indistinguishable MIRU-VNTR profiles. Consequently, clusters reported here represent new or expanding clusters in the PHE London area. Cases must have at least 23 loci typed to be considered part of a cluster. At least 1 case in the cluster must have 24 typed loci, otherwise all cases in the cluster must have the same untypeable locus.

Table 4: Number and proportion of people with TB clustered using MIRU-VNTR and new clusters by year, London, 2010 – 2017

Year	Notified cases	Culture-confirmed		Strain-typed (≥ 23 loci)		Clustered[a]		New clusters[b]
	n	n	%	n	%	n	%	n
2010	3241	1,950	60%	1,423	73%	771	54%	146
2011	3491	2,089	60%	1,804	86%	944	52%	214
2012	3401	2,092	62%	1,900	91%	1096	58%	253
2013	2975	1,773	60%	1,601	90%	925	58%	207
2014	2555	1,540	60%	1,436	93%	755	53%	196
2015	2271	1,360	60%	1,264	93%	658	52%	111
2016	2210	1,382	63%	1,317	95%	713	54%	158
2017	1919	1,170	61%	1,020	87%	553	54%	121
	22,063	**13,356**	**61%**	**11,765**	**88%**	**6,415**	**55%**	**1406**

The 553 people in clusters in London in 2017 were assigned to 303 clusters, with a median cluster size of 3 people (range 2 -131). The majority (83%, 250/303) were small (<5 people), with 30% containing only 2 people (Figure 12). There were 40 clusters which comprised of 20 or more people, which made up 24% (132/553) of clustered cases in London in 2017. Analysis of these large clusters showed that the majority exhibited significant spatial clustering, indicating likely transmission in London[5]. This study also found that cases in these large clusters were more likely to have multiple social risk factors, be of black ethnicities, born in the UK, have pulmonary and drug resistant disease, and live in the more deprived areas of London.

Figure 12: Proportion of clusters by size, London, 2017



[5] Smith CM, Maguire H, Anderson C, et al. Multiple large clusters of tuberculosis in London: a cross-sectional analysis of molecular and spatial data. *ERJ Open Research* Jan 2017, 3 (1) 00098-2016; DOI: 10.1183/23120541.00098-2016: openres.ersjournals.com/lookup/doi/10.1183/23120541.00098-2016

The most common lineage of clusters was Euro American, which accounted for 42% of clusters (Table 5). Cluster size was similar across lineages (median size 2 to 3), although a higher proportion of clusters of the Beijing lineage had 10 or more people (32%, 9/28) compared to the other lineages – which may reflect that 24 loci MIRU-VNTR strain typing strain typing used in England was less discriminatory in this lineage.

Table 5: Cluster lineage and size, London 2017

Cluster size	Total clusters	Euro American		Central Asian		East African Indian		Beijing		Other*	
		n	%	n	%	n	%	n	%	n	%
2	167	77	61	47	55	17	57	9	32	17	53
3	56	18	14	20	23	4	13	8	29	6	19
4	27	13	10	5	6	4	13	4	14	1	3
5 to 9	39	14	11	11	13	3	10	4	14	7	22
10+	14	5	4	3	3	2	7	3	11	1	3
Total	**303**	**127**	**100**	**86**	**100**	**30**	**100**	**28**	**100**	**32**	**100**

Contact tracing

Screening of people exposed to a person with active TB is a key strategy to find and treat active and latent TB, and prevent further transmission. This is routinely undertaken by TB services with input from PHE Health Protection Teams for wider incident management. In addition, the outcomes of contact tracing activities are discussed by cohort reviews undertaken in all areas of London.

Overall in 2017, 1,413 had at least 1 contact identified and this equated to 6,306 contacts identified with a median of 3 (IQR: 1-5) contacts identified per person with TB. Of these identified contacts 86% (5,404) were subsequently screened: a median of 2 (IQR: 1-5) per person with TB. Of those screened, 21% had latent TB infection (LTBI) and 3% had active disease.

Of people with pulmonary TB, 4,519 contacts were identified with a median of 4 (IQR: 2-6) contacts identified per person. Of these identified contacts 86% (3,877) were subsequently screened: a median of 3 (IQR: 1-6) per person with TB. Of those screened, 23% had LTBI and 3% had active disease.

4. Delay from onset of symptoms to start of treatment

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

Thirteen people with pulmonary TB were asymptomatic at diagnosis. Out of the remaining people with pulmonary TB information on delay from onset of symptoms to start of treatment was available for 91% (870/953) in 2017. The median time from symptom onset to start of treatment was 73 days (IQR 37-128). This was 1 day more than in London in 2016 and also above the medians seen from 2013 to 2015 (table 5). This is however 6 days less than the median of 79 for England in 2017 (IQR 39-143). Overall in 2017 median healthcare delays were slightly longer than and had more variation at 37 days (IQR: 10-89) than median presentation delays at 24 days (IQR: 1-68).

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

	0-2 months		2-4 months		>4 months		Median days (IQR)		Total
Year	n	%	n	%	n	%			N
2013	500	45	323	29	278	25	65	(33 - 121)	1101
2014	441	42	316	30	288	28	69	(35 - 129)	1045
2015	462	46	304	30	240	24	67	(34 - 116)	1006
2016	410	42	297	30	268	27	72	(36 - 129)	975
2017**	355	41	281	32	234	27	73	(37 - 128)	870

*excluding those with missing onset dates

** excluding asymptomatic individuals, and those with missing onset dates

London was the PHE Centre with the second lowest proportion of people with pulmonary TB who waited more than 4 months from symptom onset to start of treatment (27%, 234/870). Similar proportions were seen across all London Health Protection Team areas. The average for England was 31%.

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

Delays greater than 4 months were more common in women (31%, Table 8) compared to men (24%) in 2017, although this was not seen in London in 2016 when similar proportions of men and women experienced delays. As in previous years the proportion of people with pulmonary TB experiencing delays increased with age from 16% (4/25) in children under the age of 15 to 37% (45/122) in those over 64 years old.

Out of people with pulmonary TB who were born in the UK 31% (65/211) experienced delays, greater than the 25% (166/654) of those born outside the UK. Overall, the greatest proportion of people who experienced a delay of more than 4 months occurred in those of white ethnicity (37%, 79/212).

The ethnic group with the lowest proportion experiencing delays was those of Indian ethnicity (18%, 29/160), a change from London in 2016 when they were the group with the highest proportion (43%, 13/30). Delays were also more common among people who had at least 1 social risk factor (35%).

Table 1: 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, London, 2017

		North East and North Central London n=364		North West London n=264		South London n=241		Total n=870	
		n	%	n	%	n	%	n	%
Sex	Male	52	25	40	25	37	23	130	24
	Female	51	33	31	30	22	28	104	31
Place of birth	UK born	34	32	15	31	16	29	65	31
	Non-UK born	68	27	56	26	41	22	166	25
Any social risk factor	Yes	25	37	11	35	10	29	46	35
	No	77	26	58	26	45	23	180	25
Overall delayed		**103**	**28**	**71**	**27**	**59**	**24**	**234**	**27**

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 the following groups:

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.

For 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 are presented for the entire drug sensitive cohort.

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

The majority (88%, 1,914/2,179) of those notified with rifampicin-sensitive TB in 2016 did not have CNS, spinal, miliary or cryptic disseminated disease. Of these, 87% (1,661/1,914) had completed treatment at 12 months, the same proportion as in 2015 (1,700/1,962) and slightly higher than the national population in 2016 (84%, 4,201/4,975). Among the 1,712 people for whom duration of treatment was known, the median treatment time was 185 days (IQR 181-224).

The proportion completing treatment within 12 months was similar across all London Health Protection Team areas. The overall trend in treatment completion in London has remained around the same for a number of years now (Table 6).

Table 6: Number and proportion completing treatment at 12 months, London, 2010 – 2016*

	People with TB		
Year	n	%	Total
2010	2435	86	2832
2011	2619	86	3063
2012	2573	86	2989
2013	2253	87	2600
2014	1953	88	2232
2015	1708	87	1968
2016	1661	87	1914

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

The most common reasons for not completing treatment were still being on treatment (4%, 84/1,914) and loss to follow up (4%, 80/1,914); see Table 7. Of those still on treatment at 12 months information on why they were still on treatment was available for 81 people. Out of these 37 were on a planned treatment regime that exceeded 12 months (10 of these were due to initial drug resistance). A further 32 had their treatment changed (14 due to intolerance/ side effects and 13 due to poor clinical response to treatment) and 12 were still on treatment due to treatment interruptions.

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

Outcome at 12 months	n	%
Completed	1,661	86.8
Died	62	3.2
Lost to follow up	80	4.2
Still on treatment	84	4.4
Treatment stopped	13	0.7
Not evaluated	14	0.7
Total	**1,914**	

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

Treatment completion was lower among men (85%, 961/1,132 vs. 90% for women, 700/782) with still being on treatment as the most common reason for not completing for both men and women (32%, 55/171 vs. 35%, 29/82). This difference in treatment completion between men and women was not seen in the previous year. Treatment completion decreased with age with only 74% (178/240) of people over 64 years old completing treatment. By far the most common reason for not completing in this group was death (63%, 39/62).

As in previous reports, treatment completion was lowest amongst individuals of white ethnicity (82%, 234/284) and even lower in people born in the UK and of white ethnicity

(80%, 103/129). The primary reason for not completing treatment by 12 months amongst people of white ethnicity born in the UK was death (50%, 13/26). However this group was older on average with a median age of 56 (IQR 44-69) compared to a median of 38 (IQR 28-52) across all those notified with rifampicin-sensitive TB in 2016.

Treatment completion was also lower among people who had at least 1 social risk factor compared to people who had no social risk factors (77%, 140/181 vs. 89%, 1,495/1,683), with still being on treatment and loss to follow up the primary reasons for not completing in both groups. This difference is similar to those notified in 2015 (76%, 149/195 vs. 89%, 1,516/1,704).

Only 61% (46/75) of people with isoniazid resistant TB (but sensitive to rifampicin and without CNS, spinal, miliary or cryptic disseminated disease) had completed treatment at 12 months. A further 24% (18) were still on treatment, however, and the proportion that had completed by last known outcome had increased to 80% (60).

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

Of the 265 people with CNS, spinal, miliary, or cryptic disseminated TB who were notified in 2016, 52% (138) had completed treatment at 12 months (Table 8).

Table 8: TB outcome at 12 months for people with rifampicin sensitive, CNS, spinal, miliary, or cryptic disseminated diagnosed in London in 2016*

Outcome at 12 months	n	%
Completed	138	52.1
Died	25	9.4
Lost to follow up	11	4.2
Still on treatment	74	27.9
Treatment stopped	2	0.8
Not evaluated	15	5.7
Total	**265**	

*Excludes rifampicin resistant TB.

The proportion that had completed increased to 73% (193) by the last recorded outcome, the same as seen nationally (416/573). By the last recorded outcome only 7% of people (19) were still on treatment. For those who completed, the median treatment time was 362 days (IQR 252-367). Similar trends in treatment completion at 12 months were seen across age, ethnicity, and place of birth compared to those reported for people with rifampicin sensitive TB without CNS, spinal, miliary or cryptic disseminated disease.

However in people notified in 2016 with CNS, spinal, miliary or cryptic disseminated TB completion was lower in women compared to men (46%, 53/115 vs 57%, 85/150); the most common reason for not completing for both was still being on treatment. There was a higher proportion of women over 64 years old in this group (23%, 26/115 vs 9%, 14/150 of men).

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

Overall, 4% (88/2,179) of people with rifampicin sensitive TB notified in 2016 died before completing treatment, the same proportion as among those notified in 2015 (4%, 86/2,252) and less than the national proportion of those notified in 2016 (6%, 304/5,548). TB was reported to have caused or contributed to over half of these deaths (57%, 50/88) which is an increase from the previous year when TB contributed to or caused 42% (36/86) of deaths in this group. TB was reported to have been incidental to 23% (20/88) of the deaths and had an unknown relationship to 20% (18/88). Two individuals (2%) were diagnosed with TB post mortem and for both TB was reported to have contributed to death.

The median age at death was 71 years old (IQR 55-82) but TB caused or contributed to the deaths of 5 individuals under the age of 40 (range 25-38 years old); all of these people were born outside the UK and 3 were of Indian ethnicity. Overall, proportion of deaths was similar among those born in the UK and those born outside the UK (5%, 18/396 vs 4%, 66/1,764).

Similar to previous years and to the national proportion, 4% (91/2,179) of people with rifampicin sensitive TB notified in 2016 were lost to follow up at 12 months. Of those lost to follow up, 40% (36/90) had left the UK and 87% (75/86) were known to have been born abroad. 4% of males and of females notified in 2016 were lost to follow up (56/1,282 vs 35/897) and the median age of those lost to follow up was similar to previous years at 32 years old (IQR 27-44). People who had at least 1 social risk factor were more likely to be lost to follow up compared to those who had none (8%, 16/206 vs 3%, 66/1,914).

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

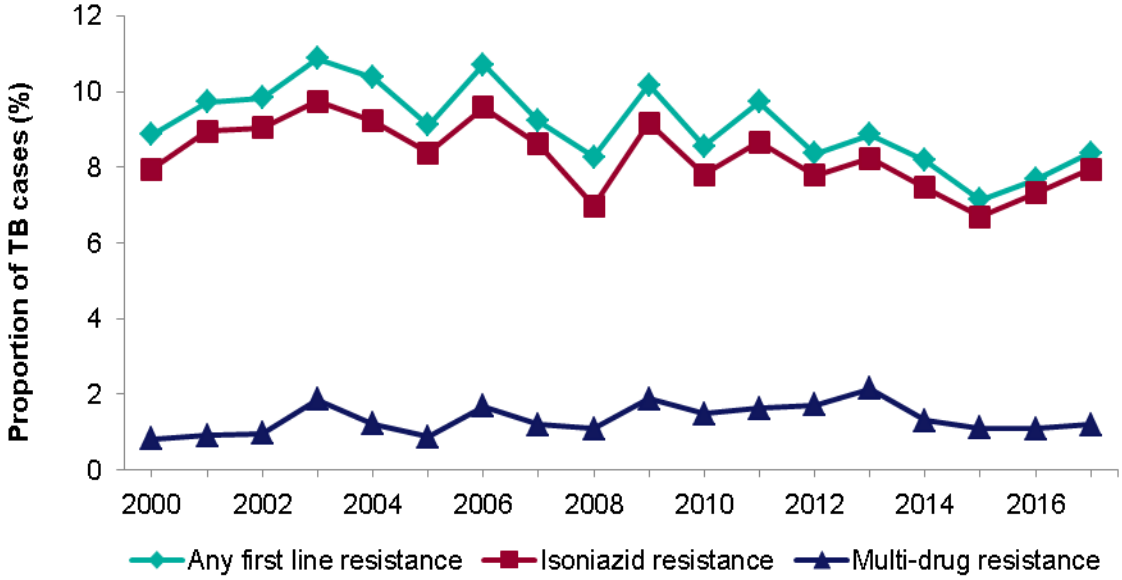
Drug resistance

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 (eg amikacin, capreomycin, kanamycin), fluoroquinolones (eg moxifloxacin, ofloxacin, ciprofloxacin) and other oral bacteriostatic agents. People with multi-drug resistant (MDR) TB are initially resistant to at least isoniazid and rifampicin. People with extensively drug resistant (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% (1,157) of the 1,170 people with TB in London who had a positive culture. The proportion who had a positive culture that was resistant to 1 or more first line drugs was 8.4% (98/1,170), slightly higher than in the previous year (7.7%, 106/1,366), and similar to the proportion nationally (8.5%, 265/3,115). Over the last 17 years in London, the proportion of people with TB resistant to at least 1 first line drug has ranged from 7.1% in 2015 to 10.7% in 2006 (Figure 9).

Figure 9: Proportion of TB cases with initial drug resistance, London, 2000 – 2017



The proportion of people with TB resistant to isoniazid also increased slightly in 2017 (7.9%, 93/1157) compared to the previous year (7.3%, 101/1366) but remained within the range seen in London across the past 17 years. The proportion of those with MDR TB was similar to the previous year (1.2%, 14/1,157 in 2017 vs 1.1%, 15/1,378 in 2016) and similar to what has been seen over the last 17 years.

Characteristics of people with drug resistant TB

Any first line drug resistance

In 2017, a higher proportion of women compared to men had resistance to at least 1 first line drug (11.2%, 51/453 vs. 6.7%, 47/704). Although the youngest age group, 0 to 14 year olds, had the highest proportion of people with first line resistance at 15.8% (3/19), these were very small numbers. Among those aged 45 to 64 years 11.0% (31/281) were resistant, while 7.5% (52/694) of those aged 15 to 44 and 7.5% (12/163) of those over 64 years old were resistant. Similar to previous years, drug resistance was more common among people born in the UK (12.4%, 28/226), 57% of whom were of white ethnicity (16/28). This compares to 7.3% first line drug resistance (67/913) among those born outside the UK.

First line drug resistance was at similar levels in those with pulmonary TB (8.2%, 60/732) compared to those with exclusively extra-pulmonary TB (8.8%, 37/423). Of those with a known sputum smear result the proportion of first line drug resistance was higher in those with a positive result (9.8%, 35/357 vs. 7.7%, 28/363 in those with a negative result), this is similar to previous years.

In 2017 those with a previous diagnosis of TB were much more likely to have TB resistant to at least 1 first line drug compared to those with no previous diagnosis (15.7%, 8/51 vs. 8.1%, 88/1,081). This trend has been seen in previous years however the difference was less pronounced in 2016 (9%, 6/66 vs. 7.7%, 96/1,243). People with a previous diagnosis of TB only made up 8.2% (8/98) of all those with first line drug resistance. People who had at least 1 social risk factor were also more likely to have first line resistant TB (13.0%, 20/154) compared to those who had none (7.9%, 75/951).

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

In London in 2017 there were 14 people culture confirmed with MDR TB and none with XDR TB. No-one was treated for MDR TB without a positive culture result. Of those with MDR TB, 65% were women (9/14) and the median age was 43 years old (range 13-75) with 4 people under the age of 21. The majority were born outside the UK (71%, 10/14) and the most common country of birth was India (4), with the rest from Lithuania, Russia, Somalia, and South Africa. Five were of white ethnicity and a further 5 were of Indian ethnicity. Ten (71%) had pulmonary TB and half (7) of all those with MDR TB

had sputum smear positive disease. Only 3 had a previous diagnosis of TB and 3 more had at least 1 social risk factor. Five people were ‘pre-XDR TB’. This is defined as MDR resistance plus resistance to either an injectable agent or fluoroquinolone but not to both. All 5 were resistant to a fluoroquinolone.

Acquired resistance

1 person acquired isoniazid resistance and 1 person acquired pyrazinamide resistant. Both of these were determined by phenotypic assessment only. No-one else acquired resistance and no-one acquired MDR TB.

TB outcome at 24 months for people with rifampicin resistant disease

In 2015 there were 19 people with rifampicin resistant TB at the start of treatment and no-one was reported as acquiring rifampicin resistance during treatment. Of these people 15 had MDR TB, 3 had XDR TB, and 3 had pre-XDR TB. After 24 months, and according to the most recent information, 10 out of the 19 people with rifampicin resistant TB had completed treatment and 2 were still on treatment (Table 9). Further 4 people had died, 2 were lost to follow up, and 1 was not evaluated. Of the 4 people who died TB was reported as causing the death of 2 and contributing to the death of 1. The reasons for loss to follow up and not being evaluated were unclear.

Table 9: TB outcome at 24 months for people with rifampicin resistant TB, diagnosed in London in 2015

Outcome at 24 months	n	%
Completed	10	53
Died	4	21
Lost to follow up	2	11
Still on treatment	2	11
Not evaluated	1	5
Total	**19**	

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 in London, 12% of people with TB aged 15 years or over experienced at least 1 social risk factor (Table 10). This was a small increase from 2016 although numbers have remained stable since 2014. As in previous years, 37% of those with at least 1 social risk factor had multiple.

Table 10: Social risk factors among people with TB, London, 2009 – 2017

	Any social risk factors		
Year	n	%	Total
2010	313	11.8	2662
2011	268	9.0	2964
2012	260	8.9	2945
2013	263	9.8	2689
2014	229	9.9	2319
2015	227	10.8	2115
2016	212	10.1	2059
2017	215	12.0	1791

The most common social risk factor was alcohol misuse (5.2%, 94 people) followed by homelessness (5%, 91 people), drug use (4.3%, 78 people) and imprisonment (3.5%, 64 people). All of these proportions increased compared to 2016.

Social risk factors were twice as common among people with TB born in the UK (Table 11). Amongst people who were born in the UK with a social risk factor, 65% reported drug use. Almost half of those of black Caribbean ethnicity born in the UK had a social risk factor.

Of those from outside the UK, the most common countries of birth were India, Romania and Eritrea. However social risk factors were most commonly experienced by people with TB who were born in Ireland (50%, 4/8), Albania (43%, 3/7), Poland (41%, 9/22), Eritrea (35%, 12/34) Lithuania (33%, 5/15) and Ethiopia (32% 7/22). A social risk factor was more often experienced by people with TB of black-other (ie not black African or black Caribbean) or white ethnicity. Amongst people who were born outside the UK with a social risk factor, 48% reported homelessness and 46% alcohol misuse.

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

	Any social risk factors		
	n	%	Total
UK born	66	20	332
- ***Black Caribbean***	17	41	42
Non-UK born	147	10	1450
- ***Black-other***	4	29	14
- ***White***	31	23	135
Male	178	17	1033
Female	37	5	758
Pulmonary	144	16	894
Extra-pulmonary only	71	8	896
Sputum smear positive	70	20	343

Social risk factors were also twice as common among people with pulmonary disease: of the 343 people in 2017 who had infectious (sputum smear positive) disease, 20% had 1 or more social risk factor. Drug resistant disease was also more common among people with a social risk factor (13%, 20/154 compared to 7.7%, 72/932 among those with no social risk factors).

Of those with drug sensitive TB and least social risk factor, who were notified in 2016, just 74% (154) completed treatment within 12 months (Table 12). Although 8% were still on treatment, the remaining 18% had either died, were lost to follow up or had no further information on what happened to them.

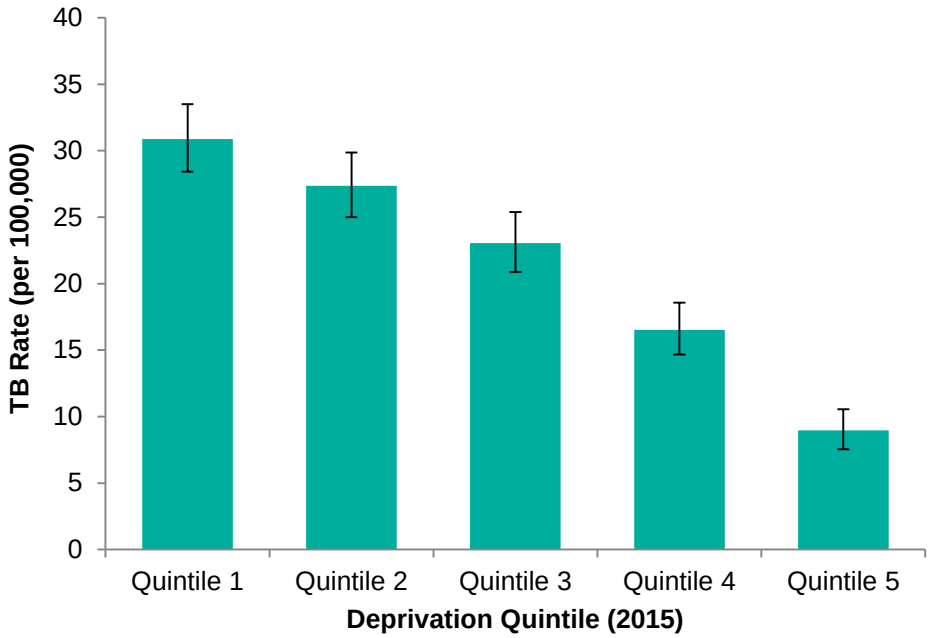
Table 12: Treatment outcome at 12 months for people with drug sensitive TB and at least one social risk factor, London, 2016

	n	%
Treatment completed	154	73.7
Died	10	4.8
Lost to follow up	16	7.7
Still on treatment	20	9.6
Not Evaluated/Missing	9	4.3
Total	**209**	**100**

Deprivation

Since 2010, when the Indices of Multiple Deprivation (IMD) was first introduced, the distribution of cases by London deprivation quintile has remained fairly stable. Over half of people with TB in 2017 resided in areas which constitute the 2 most deprived quintiles (56%, 1077/1914), compared to 7.5% (143) who lived in the least deprived quintile.

Figure 12: TB case rate by deprivation, London, 2017



Rates correlated similarly with deprivation, and as in recent years, the rates of TB experienced in the most deprived quintiles were almost 3.5 times higher than the least deprived areas. However, rates in each quintile have decreased from 2016 – 2017, with the greatest decrease seen in the most deprived quintiles, 24% from 2016 (40.6 per 100,000) to 2017 (30.9 per 100,000).

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

HIV testing

In 2017, information on HIV testing was available for 99% (1,902/1,919) of people with TB. For 74 of these people HIV status was already known. Of the remaining 1,828, 99% (1,801) were offered testing and 97% (1,773) received testing; this is above the national figure of 93%. Another 2% (28) were offered but did not receive testing, of whom 18% (5) declined. In 2017, the proportion of people not offered a test was 1.5% (27), as compared to 3.9% nationally. No great differences were seen in this proportion between London Health Protection Team areas.

TB-HIV co-infection rates

The latest available information on TB-HIV co-infection for notified adults 15 years and above, estimated that 2.7% (50) of people with TB in London in 2017 were co-infected with HIV[6]. In England, 2.8% of people with TB were estimated to be co-infected with HIV. This was lower than the proportion in 2016 and 2015.

[6] Tuberculosis in England: 2018 (presenting data to end of 2017), Public Health England, prepared by: Tuberculosis Unit, National Infection Service: 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 people with TB

Information on BCG vaccination was available for 82% (1,564/1,919) of London residents notified in 2017, of whom 72% (1,120) were vaccinated (Table 13). Consistent with previous years, a higher proportion of non-UK born cases had been vaccinated (73%, 911/1250) than UK born cases (66%, 203/307).

Of the 16 children aged less than 5 years old with TB, 14 were UK born and only 6 were vaccinated. Of the 8 UK born not vaccinated, 2 were black African, 1 Indian, 1 Pakistani, 1 Bangladeshi and 1 was of mixed/other ethnicity. None had miliary or CNS disease, but 1 child sadly died (the relationship between TB and death was not reported).

Table 13: BCG vaccination coverage among people with TB, London, 2017

	< 5 years old			< 15 years old			All ages		
	n	N	%	n	N	%	n	N	%
UK born	6	14	43%	17	34	50%	203	307	66%
Non-UK born	0	1	0%	11	12	92%	911	1250	73%
All cases*	**7**	**16**	**44%**	**30**	**48**	**63%**	**1120**	**1564**	**72%**

*including missing place of birth

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 are 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

TB rates in London continue to decline, reaching the lowest number of people notified with TB since 2000, and almost half the number notified in 2011. Most of the decline was in people born outside of the UK, with smaller decreases in the UK born population of London which still has more than twice the rate as for England.

The majority of cases still occur among people from the Indian sub-continent, although the numbers from East and Central Europe have increased in recent years.

People with TB frequently have complex needs. More than 1 in 4 had 1 of either the key social risk factors or co-morbidities. Diabetes was the most common co-morbidity affecting more than 10% of all people with TB in London in 2017. The key co-morbidities collected in surveillance were more prevalent among people born outside the UK.

Conversely, social risk factors were more often experienced by UK born people with TB. These vulnerable groups were also more likely to have infectious and drug resistance disease, and less likely to complete treatment. A continued focus on early diagnosis and support through treatment for these groups must therefore remain a priority for control TB in London.

London maintained excellent levels of HIV testing among people with TB with 99% of those whose HIV status was not already known being offered testing and 97% receiving testing. Furthermore, people with TB in London had shorter delays from symptom onset to start of treatment than the national average.

Treatment completion amongst those with rifampicin-sensitive TB without CNS, spinal, miliary or cryptic disseminated disease remains relatively high, but was noticeably lower among vulnerable groups including those with CNS, spinal, miliary or cryptic disseminate disease, drug resistance, and social risk factors.

Culture confirmation was still below the 80% target. Obtaining a culture confirmation of disease is particularly important to check for drug resistance and the proportion that was resistant to 1 or more first line drugs increased slightly from 2016.

Conclusion and recommendations

In conclusion, it is encouraging that TB rates in London have declined to their lowest level since 2000, but focus remains necessary to ensure continued success in TB control. People with TB frequently have complex needs both medically and socially, and integrated health and social strategies are needed to support them through treatment.

Recommendations

London TB control board should:

- use the evidence of the changing epidemiology of TB in London to inform TB service development
- continue and prioritise work with wider stakeholders to develop strategies to improve outcomes for under-served populations and people with drug resistant TB

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.

Appendix A: Notes on the report

About the Field Service

The Field Service (FS) supports Public Health England (PHE) Centres and partner organisations through the application of epidemiological methods to inform public health action. It does this in 2 main ways, 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 tuberculosis (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 London TB Control Board and local clinical and health protection forums.

Aim of report

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

Further TB information

The national report of TB in England is available at: www.gov.uk/government/publications/tuberculosis-in-england-annual-report. Additional data on TB notifications in the UK to the end of 2017, and breakdowns by country, can be found in the Official Statistic for TB, ‘Reports of cases of tuberculosis to enhanced tuberculosis surveillance systems: United Kingdom, 2000 to 2017’. This is available at: www.gov.uk/government/collections/tuberculosis-and-other-mycobacterial-diseases-diagnosis-screening-management-and-data.

As part of the Collaborative TB Strategy for England 2015-2020, TB Strategy Monitoring Indicators are available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/403231/Collaborative_TB_Strategy_for_England_2015_2020_.pdf). Where data for these indicators are presented in this report, the indicator name is shown.

A number of TB indicators at Upper Tier Local Authority and Clinical Commissioning Group level can be found at: fingertips.phe.org.uk/profile/tb-monitoring.

Data sources

This report is based on TB case notifications made to the PHE London TB Register Enhanced Tuberculosis Surveillance system (ETS) in England to the end of 2017. This information is updated annually to take into account denotifications (where the person 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 cases. Results for microscopy, polymerase chain reaction (PCR), histology and culture are collected in ETS. Appropriate referral of clinical specimens to the Mycobacterium Reference Laboratories is an important part of the routine work of the diagnostic laboratories in the investigation and management of TB cases.

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.

Appendix B: 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 with TB caused by indistinguishable strains, with at least 23 complete MIRU-VNTR loci
CNS	Central nervous system
Cohort review	The systematic review of all TB people notified by a TB service in a 3-4 month period, looking at standard outcomes in terms of patient care and number of contacts screened
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 in the PHE East of England area
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 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 tuberculosis	A pulmonary case is defined as TB 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 (eg amikacin, capreomycin, kanamycin), fluoroquinolones (eg 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 reported 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

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. Tuberculosis rates by ethnic group were calculated using population estimates from the Labour Force Survey (LFS) [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 by the National Mycobacterial Reference Service using 24 MIRU-VNTR profiling. Analysis was undertaken on strain type clusters as defined above. Analysis of clustering in region was carried out on cases that clustered in region and notified between 2010 and 2017.

Appendix C: TB among London residents

Table Ci: TB case numbers by upper tier local authority of residence, London, 2000 – 2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Barking and Dagenham	39	29	35	41	43	60	49	62	69	72	69	61	65	71	67	42	65	53
Barnet	87	77	103	102	93	116	124	104	113	105	115	98	111	73	73	74	74	64
Camden	65	86	118	108	77	101	96	90	85	100	69	70	62	45	43	37	50	44
Enfield	79	90	84	98	95	103	100	72	100	116	95	75	79	68	68	70	66	54
Hackney & City of London	132	126	147	157	157	130	135	142	124	118	94	91	89	88	74	61	69	63
Haringey	134	147	139	128	150	130	155	93	104	132	100	134	100	86	76	64	73	59
Havering	31	16	20	13	12	30	23	16	20	30	13	18	27	28	24	23	25	30
Islington	87	78	105	94	86	86	96	93	93	91	63	82	69	63	59	48	42	42
Newham	244	203	219	245	241	256	261	277	283	309	301	370	367	334	252	248	188	163
Redbridge	88	83	92	111	109	120	144	135	162	147	137	161	154	150	130	113	124	109
Tower Hamlets	88	64	126	148	118	128	132	153	132	139	153	140	120	100	93	82	90	66
Waltham Forest	90	66	106	100	99	114	120	91	129	92	114	122	123	119	86	99	85	81
North East North Central London	**1164**	**1065**	**1294**	**1345**	**1280**	**1374**	**1435**	**1328**	**1414**	**1451**	**1323**	**1422**	**1366**	**1225**	**1045**	**961**	**951**	**828**
Brent	221	225	214	216	229	283	240	274	305	297	295	311	308	281	204	166	191	149
Ealing	214	185	201	186	254	237	233	236	198	219	207	242	246	213	210	160	118	129
Hammersmith and Fulham	83	67	73	66	70	89	80	67	67	73	53	68	46	48	36	40	34	32
Harrow	93	95	118	115	99	132	123	122	125	135	138	153	184	151	111	83	92	83
Hillingdon	70	91	106	115	117	137	124	124	151	121	125	130	139	101	122	98	87	66
Hounslow	81	121	119	102	115	167	134	134	134	170	197	181	190	162	152	111	119	89
Kensington and Chelsea	46	40	32	51	48	47	53	32	52	50	36	47	33	35	36	21	21	29
Westminster	90	77	76	91	85	95	84	85	69	81	62	67	53	59	52	37	39	37
North West London	**898**	**901**	**939**	**942**	**1017**	**1187**	**1071**	**1074**	**1101**	**1146**	**1113**	**1199**	**1199**	**1050**	**923**	**716**	**701**	**614**
Bexley	14	17	22	25	30	22	19	26	21	17	20	35	25	33	17	19	30	34
Bromley	23	16	27	31	29	29	41	33	19	32	34	42	29	30	18	24	22	23
Greenwich	49	68	81	72	88	87	98	104	138	121	119	111	131	105	97	92	62	68
Lambeth	107	125	158	156	126	144	134	104	126	117	114	97	98	76	77	62	58	49
Lewisham	60	68	96	80	77	98	84	100	82	73	73	106	84	70	69	63	63	49
Southwark	84	96	106	100	132	136	125	103	117	95	95	118	115	92	76	79	79	68
South East London	**337**	**390**	**490**	**464**	**482**	**516**	**501**	**470**	**503**	**455**	**455**	**509**	**482**	**406**	**354**	**339**	**314**	**291**
Croydon	96	96	109	113	118	113	102	115	111	124	110	132	120	109	79	90	84	71
Kingston upon Thames	11	14	20	20	22	28	25	29	29	31	37	30	28	25	26	21	11	6
Merton	43	31	55	41	62	61	66	57	63	61	54	64	72	60	47	51	46	35
Richmond upon Thames	9	11	16	11	12	19	20	14	13	20	16	16	13	12	9	14	11	10
Sutton	11	17	32	31	24	25	28	32	18	30	33	32	29	25	24	22	26	15
Wandsworth	63	49	100	96	94	125	80	115	110	84	100	87	92	63	48	63	52	49
South West London	**233**	**218**	**332**	**312**	**332**	**371**	**321**	**362**	**344**	**350**	**350**	**361**	**354**	**294**	**233**	**261**	**230**	**186**
London	**2632**	**2574**	**3055**	**3063**	**3111**	**3448**	**3328**	**3234**	**3362**	**3402**	**3241**	**3491**	**3401**	**2975**	**2555**	**2277**	**2196**	**1919**

Table Cii: TB rate* per 100,000 by local authority of residence, London, 2000 – 2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Barking and Dagenham	23.8	17.5	21.0	24.7	26.0	36.1	29.3	36.7	40.0	40.5	37.7	32.6	34.1	36.5	33.7	20.7	31.2	25.2
Barnet	27.6	24.1	32.1	31.7	28.7	35.4	37.5	31.1	33.3	30.4	32.7	27.4	30.5	19.8	19.5	19.5	19.2	16.5
Camden	33.1	42.5	57.9	52.9	37.1	47.8	45.5	42.5	40.4	47.0	32.1	31.8	27.6	19.5	18.2	15.2	20.1	17.4
Enfield	28.7	32.5	29.9	34.8	33.7	36.2	34.8	24.7	33.6	38.4	30.9	23.9	24.9	21.2	21.0	21.3	19.9	16.2
Hackney & City of London	62.7	58.7	67.4	71.5	71.1	58.1	59.4	61.2	52.0	48.3	37.7	35.7	34.4	33.4	27.5	22.2	24.6	22.2
Haringey	61.0	66.4	61.9	56.9	66.2	56.7	66.5	39.3	42.5	52.8	39.6	52.4	38.8	32.9	28.7	23.9	26.8	21.8
Havering	13.8	7.1	8.9	5.8	5.3	13.2	10.1	7.0	8.6	12.8	5.5	7.6	11.3	11.6	9.8	9.2	9.9	11.7
Islington	48.9	43.5	58.3	52.0	47.6	46.9	51.8	49.3	48.4	46.3	31.5	39.8	32.7	29.2	26.6	21.1	18.1	17.9
Newham	99.4	81.4	85.8	95.6	94.7	100.9	101.2	104.0	102.4	107.9	100.6	119.2	116.0	103.9	76.8	73.8	54.6	46.8
Redbridge	36.7	34.3	37.7	44.9	43.8	47.7	56.3	51.9	61.0	54.4	49.8	57.2	54.1	51.9	44.2	37.9	41.2	36.1
Tower Hamlets	44.6	31.8	60.9	70.9	55.9	60.0	60.4	67.9	56.9	57.8	61.6	54.7	45.5	36.5	32.7	27.9	29.9	21.4
Waltham Forest	40.7	29.7	47.4	44.6	44.0	50.3	52.0	38.6	53.3	37.1	44.9	47.0	46.9	44.8	32.1	36.6	31.0	29.4
North East North Central London	**43.3**	**39.2**	**47.0**	**48.7**	**46.2**	**49.1**	**50.6**	**46.1**	**48.1**	**48.2**	**43.1**	**45.3**	**42.8**	**37.8**	**31.6**	**28.7**	**27.9**	**23.3**
Brent	83.4	83.5	79.3	80.5	85.3	104.5	86.8	96.7	104.8	99.6	96.8	99.6	97.9	88.6	63.7	51.3	58.5	45.3
Ealing	70.3	60.2	65.0	60.4	81.9	75.8	73.9	74.1	61.1	66.4	62.0	71.3	72.3	62.3	61.2	46.5	34.2	37.6
Hammersmith and Fulham	50.5	39.6	42.4	38.5	40.7	51.4	45.8	38.0	37.8	40.5	29.3	37.3	25.3	26.5	19.8	22.0	18.7	17.5
Harrow	44.5	45.2	55.6	53.8	45.8	59.7	55.0	53.9	54.5	57.8	58.1	63.6	76.0	62.1	45.3	33.6	37.0	33.3
Hillingdon	28.5	37.0	42.9	46.4	47.0	54.5	48.7	48.3	57.8	45.5	46.4	47.2	49.4	35.3	41.9	33.1	29.0	21.8
Hounslow	37.7	56.0	54.9	47.1	52.4	74.6	58.7	57.4	56.3	69.9	79.0	71.0	73.5	62.0	57.6	41.7	44.4	33.1
Kensington and Chelsea	29.7	24.7	19.5	30.9	29.0	27.9	32.1	19.6	32.0	30.9	22.4	29.7	21.0	22.3	22.8	13.2	13.4	18.6
Westminster	45.8	37.9	36.5	43.1	39.6	42.6	37.7	38.5	31.6	37.3	28.5	30.5	23.7	26.2	22.6	15.5	16.1	15.1
North West London	**51.2**	**50.5**	**52.2**	**52.3**	**56.0**	**64.3**	**57.6**	**57.2**	**57.9**	**59.4**	**57.0**	**60.5**	**60.1**	**52.1**	**45.4**	**34.5**	**33.9**	**29.6**
Bexley	6.4	7.8	10.0	11.4	13.6	9.9	8.5	11.6	9.3	7.5	8.7	15.0	10.7	13.9	7.1	7.8	12.2	13.8
Bromley	7.8	5.4	9.1	10.4	9.8	9.7	13.6	10.9	6.2	10.4	11.0	13.5	9.2	9.4	5.6	7.4	6.7	7.0
Greenwich	22.9	31.3	36.6	32.1	38.7	37.7	41.9	44.0	57.6	49.7	47.8	43.4	50.4	39.8	36.1	33.5	22.2	24.0
Lambeth	39.6	45.7	57.9	57.3	45.9	51.9	47.8	36.5	43.6	39.8	38.3	31.9	31.7	24.3	24.3	19.3	18.0	15.1
Lewisham	23.8	26.7	37.8	31.8	30.5	38.4	32.6	38.3	30.8	27.0	26.8	38.3	29.9	24.6	23.8	21.4	21.1	16.3
Southwark	33.2	37.4	41.4	39.2	51.3	51.9	46.7	37.8	42.2	33.8	33.5	40.9	39.2	30.8	25.1	25.6	25.3	21.6
South East London	**22.4**	**25.7**	**32.2**	**30.5**	**31.5**	**33.4**	**32.0**	**29.7**	**31.4**	**28.0**	**27.7**	**30.5**	**28.6**	**23.6**	**20.3**	**18.8**	**12.7**	**16.2**
Croydon	28.7	28.6	32.5	33.6	35.0	33.3	30.0	33.4	31.8	35.2	30.7	36.2	32.5	29.2	21.0	23.7	21.9	18.4
Kingston upon Thames	7.5	9.4	13.4	13.4	14.6	18.4	16.3	18.8	18.6	19.7	23.3	18.7	17.2	15.1	15.4	12.2	6.3	3.4
Merton	22.8	16.2	28.9	21.7	32.8	32.0	34.3	29.3	32.2	30.8	27.1	31.9	35.6	29.5	23.0	24.8	22.3	17.0
Richmond upon Thames	5.2	6.3	9.1	6.2	6.7	10.5	11.0	7.7	7.1	10.8	8.6	8.5	6.9	6.3	4.7	7.2	5.6	5.1
Sutton	6.1	9.4	17.7	17.1	13.3	13.7	15.3	17.4	9.7	15.9	17.4	16.7	15.0	12.8	12.1	11.0	12.9	7.4
Wandsworth	23.5	18.0	36.4	34.7	33.7	44.1	27.8	39.5	37.4	28.1	33.0	28.3	29.7	20.1	15.2	19.7	16.2	15.2
South West London	**18.0**	**16.7**	**25.4**	**23.8**	**25.2**	**27.9**	**24.0**	**26.8**	**25.2**	**25.4**	**25.1**	**25.6**	**24.9**	**20.3**	**16.0**	**17.5**	**15.1**	**12.5**
London	**36.4**	**35.2**	**41.4**	**41.4**	**41.9**	**45.9**	**43.8**	**42.0**	**43.0**	**42.8**	**40.2**	**42.6**	**41.0**	**35.3**	**29.9**	**26.2**	**24.2**	**21.7**

*rates calculated using ONS mid-year population estimates

Table Ciii: TB case numbers and rate by age and sex, London, 2017

Age Group	Female		Male	
	n	rate	n	rate
0-9	17	2.9	14	2.3
10-19	63	13.4	71	14.3
20-29	144	21.1	201	29.6
30-39	188	23.9	289	34.6
40-49	125	20.5	204	32.8
50-59	117	22.6	125	24.9
60-69	74	21.1	101	31.2
70-79	66	27.5	51	25.5
80+	20	11.6	49	42.4

*rates calculated using ONS mid-year population estimates

Table Civ: Drug resistance among people with culture confirmed TB*, London, 2000 – 2017

	Any first line resistance		Isoniazid resistance		Multi-drug resistant		Total*
	n	%	n	%	n	%	
2000	107	8.86	96	7.95	10	0.8	1208
2001	127	9.72	117	8.96	12	0.4	1306
2002	173	9.83	159	9.03	17	1	1760
2003	192	10.88	172	9.75	33	1.9	1765
2004	188	10.38	167	9.22	22	1.2	1812
2005	186	9.11	171	8.38	18	0.9	2041
2006	216	10.71	193	9.57	34	1.7	2016
2007	169	9.21	158	8.62	22	1.2	1834
2008	160	8.27	135	6.98	21	1.1	1935
2009	194	10.17	175	9.17	36	1.9	1908
2010	167	8.56	152	7.79	29	1.5	1950
2011	203	9.72	181	8.66	34	1.6	2089
2012	175	8.37	163	7.8	16	1.7	2091
2013	157	8.86	146	8.23	38	2.1	1773
2014	126	8.18	115	7.46	20	1.3	1541
2015	97	7.18	91	6.69	15	1.1	1360
2016	106	7.76	101	7.39	15	1.1	1382
2017	98	8.47	93	8.04	14	1.2	1170

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