

Protecting and improving the nation's health

# Tuberculosis in the East of England Public Health England Centre: Annual review (2014 data)

Data from 2000 to 2014

### About the Field Epidemiology Service

The Field Epidemiology Service (FES) supports Public Health England Centres and partner organisations through the application of epidemiological methods to inform public health action.

FES does this in two 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 FES network, excellence and innovation is encouraged, we foster academic collaborations and take active part and lead in research, development and training.

You can contact your local FES team at EFEU@phe.gov.uk

### About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and to reduce health inequalities. It does this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. PHE is an operationally autonomous executive agency of the Department of Health.

Public Health England Wellington House 133-155 Waterloo Road SE1 8UG

Tel: 020 7654 8000 http://www.gov.uk/phe Twitter: @PHE\_uk

Facebook: www.facebook.com/PublicHealthEngland

Prepared by: Abigail Sunderland, Amy Trindall and Mark Reacher Eastern Field

Epidemiology Services (2014)

For queries relating to this document, please contact: abigail.sunderland@phe.gov.uk

### © Crown copyright 2015

You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence v2.0. To view this licence, visit OGL or email psi@nationalarchives.gsi.gov.uk. Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned. Any enquiries regarding this publication should be sent to efeu@phe.gov.uk.

Published March 2016

PHE gateway number: 2015717

This document is available in other formats on request. Please call 020 8327 7018 or email publications@phe.gov.uk



### Contents

About the Field Epidemiology Service	2
About Public Health England	2
Contents	3
Executive summary	6
Introduction	9
Objectives Tuberculosis epidemiology	10 11
Overall numbers, rates and geographical distribution	11
Demographic characteristics	14
Clinical characteristics	19
Microbiological information	21
TB transmission	22
Delay from onset of symptoms to start of treatment TB Treatment Outcomes	25 26
1: Outcomes for TB patients with expected duration of treatment less than 12 months	s27
2: Outcomes for drug sensitive cohort of patients with CNS, spinal, miliary or cryptic disseminated TB  Drug resistant TB (including outcomes in the drug resistant cohort)	28 29
Drug resistance	29
TB outcome at 24 months for patients with rifampicin resistant disease TB in those with social risk factors and health inequalities associated with TB	30 31
Testing for HIV	34
Discussion	35
Conclusion and recommendations	36
References	38
Appendix A: Description of data sources and definitions	39
Appendix B: TB among East of England residents	41
Appendix C: Local authority TB epidemiological summaries	47

The data presented in this report are correct as December 2015.

### Acknowledgements

We are grateful to all those who contribute information on tuberculosis cases in the East of England, including nurses, physicians, microbiologists, scientists, outreach and social care and administrative staff. We also acknowledge colleagues at the PHE National Mycobacterium Reference Laboratory (NMRL) for information on culture confirmation and drug susceptibility testing. Further thanks are due to the national Centre for Infectious Disease Surveillance and Control (CIDSC) for providing the matched dataset, the Thetford, Letchworth and Witham Health Protection Teams and the Field Epidemiology East of England team for their work supporting Enhanced Tuberculosis Surveillance.

#### **Authors**

This report was prepared by Abigail Sunderland, Amy Trindall and Mark Reacher of the Field Epidemiology Service, East of England, PHE.

### Suggested citation

Public Health England. (December 2015) Tuberculosis in the East of England: Annual review (2014 data), 2014. Public Health England: (East of England)

### **Executive summary**

In 2014, there were 438 tuberculosis (TB) case reports to the Public Health England Enhanced Tuberculosis Surveillance System (ETS) of new TB patients resident in the counties and associated authorities of Bedford, Cambridgeshire, Central Bedfordshire, , Essex, Hertfordshire, Luton, Milton Keynes, Norfolk, Peterborough, Southend-on-Sea, Suffolk and Thurrock. These counties are covered by the East of England Public Health England Centre (EoE PHEC).

The 438 cases in 2014 equate to a rate of 7.0 (95% confidence intervals (CI) 6.3-7.7) cases per 100,000 population. This rate is just above half the rate of the UK as a whole in 2014 (12.0 per 100,000 population). The 2014 rate in EoE PHEC is a slight decrease on the rate seen in 2013 (8.0 per 100,000).

Although the rate of TB in EoE PHEC is lower than that in the UK as a whole, high rates of TB were ascertained in 2014 with Luton (34.6 per 100,000; CI 27.1-43.5), Peterborough (23.6 per 100,000; CI 17.2-31.6) and Bedford (15.2 per 100,000; CI 9.9-22.5). Luton and Peterborough have experienced a clear and substantial upward trend in TB since 2004 when 67 and 34 cases respectively were reported, rising to 85 and 60 case reports in 2012. Both Peterborough and Luton have seen a slight decline in case numbers in 2014 (73 and 45 respectively), but this decline should be interpreted with caution due to the short period of time over which this trend has been observed. These figures indicate that TB services are successfully working to decrease TB, but will need further support to strengthen their services in the East of England PHEC, with special emphasis on Luton, Peterborough and Bedford.

In 2014, 312/425 (73.4%) of all TB cases (425 where country of birth was reported) in the EoE PHEC were in people born outside the UK, and largely reflects the higher incidence of TB in the communities from which migrants have originated. Of these migrant cases, the majority were settled, as opposed to new entrants. That said, the white ethnic group continues to have the largest number of cases each year in the East of England (with ethnicity reported for 97.9% cases in 2014) with 122/429 (28.4%) of reports in 2014, equating to a rate of 2.3 cases per 100,000. This is compared with 101 cases in individuals of Indian ethnicity, representing 23.5% of cases in 2014 and a rate of 116.4 cases per 100,000 population.

About one in 10 (8.6%) of cases were reported as having one or more of the social risk factors of: high alcohol use, substance use, homelessness; and past or current imprisonment. The majority of cases in the EoE were in the unemployed (41.2%). A substantial proportion of EoE cases, however, were employed in the healthcare sector (12.2%) or were associated with the education sector as staff or students (7.4%). This

highlights the importance of TB education and provision of occupational health arrangements for health and educational settings.

In 2014, 29.5% (111/376) of Anglia and Essex patients started TB antibiotic treatment within two months of symptom onset compared with 39.5% of the UK overall. The proportion starting treatment at four months was 58.5% (221/376) for the EoE compared with 69.7% of the UK overall. Delays were longer among patients aged 15-44 years or older, and among those born outside of the UK. Further work is required in Anglia and Essex to reduce the time from diagnosis to treatment as the service overall is currently slower than the UK average.

In 2014, HIV testing information was reported for only 87.7% of cases. Of these, almost one in ten (10.7%) patients were reported not to have been offered an HIV test. This is a cause of concern. UK Born children and those aged 65 years or older were less likely to be offered a test. Information was also poorly completed on BCG vaccination but, where known, 76.3% of patients reported previous vaccination.

Among the 438 TB cases reported for East of England PHEC in 2014, 228 (52.1%) were pulmonary cases and, of these cases, 98 (43.0%) had a sputum smear test done. Of these, 67 (29.4%) were sputum smear positive.

TB antibiotic resistance remains a major concern in the UK and worldwide. Of the 438 TB cases reported for East of England PHEC in 2014 antibiotic resistance information was available for 288 (65.7%). Of these 17 (5.9%) were resistant to isoniazid, five (01.7%) had multidrug-resistant TB (MDR-TB) and none had extensively drug-resistant TB<sup>1</sup>.

Since 2010, 85.5% of culture confirmed cases in Anglia and Essex have been strain typed with at least 23 complete loci. In this time period, 364 cases have clustered with at least one other individual within the East of England, making up 124 different clusters, a clustering proportion of 27.6%. When considering strain typed cases that were part of national clusters, 54.9% of strain typed cases in Anglia and Essex clustered with at least one other case nationally. Of clusters in Anglia and Essex, 60.2% consisted of only two individuals. A higher proportion of clustering was observed in children and adults under 45, the Non-UK Born, and in ethnically White individuals. However, these observations in clustering must be interpreted with caution due to the relatively small number of cases in this area. The Euro-American lineage strain was the

<sup>&</sup>lt;sup>1</sup> World Health Organisation definitions: Multiple Drug Resistant TB (MDR-TB) - resistance to isoniazid and rifampicin, with or without resistance to other first-line drugs and Extensively Drug-Resistant TB (XDRTB) - resistance to at least isoniazid and rifampicin, and to any fluoroquinolone, and to any of the three second-line injectables (amikacin, capreomycin, and Kanamycin).

most common in Anglia and Essex, and 23.7% of clustered cases reported one or more social risk factors.

According to the revised outcome categories, 82.7% of patients reported in 2013 with drug sensitive, non-CNS, non-spinal, non-miliary and non-cryptic disseminated disease completed treatment within 12 months.

The most common reason for not completing treatment in Anglia and Essex was the fact that patients were continuing treatment (6.4%). The next most common reason for not completing treatment was death (4.9%). Patients over 65 were less likely to complete treatment and more likely to die. Patients born in the UK were also more likely to die than their Non-UK Born counterparts.

Although the EoE PHEC has a comparatively low incidence of TB compared with the UK overall, the time to diagnosis and time to commencing TB treatment is worse than the national average and a higher incidence of TB is observed in Peterborough, Bedford and Luton.

#### Recommendations

Sustained effort is required across the East of England to improve service delivery measures to be at least as good as the UK average. Peterborough, Luton and Bedford have higher rates of TB, and all three areas need to urgently strengthen their TB services. Case management best practice should be followed for all patients to ensure that opportunities for prevention, early detection of cases and successful treatment are not missed.

### Introduction

Tuberculosis (TB) control remains a major challenge globally and in the UK. TB control is one of the key priorities for Public Health England (PHE). In this report we focus on TB in the East of England PHEC in the context of the recently published Collaborative TB Strategy for England 2015 to 2020 and the Public Health England report into TB in the UK published in September 2015.

The rate of TB is high in the UK compared with similar European countries (12.3 cases per 100,000)<sup>1</sup> and action needs to be taken to address this.

Some progress has been made, with England seeing an 11.1% decline in TB rates in 2014 compared with 2013<sup>1</sup>. TB in England is largely focused in a small number of high incidence areas, and is associated with social deprivation. London and the West Midlands have a high incidence of TB in comparison to the rest of the country.

Information on new TB cases in England is obtained from structured case reports by TB services and clinics to the Public Health England Enhanced Tuberculosis Surveillance System (ETS)<sup>2</sup>. ETS is a web-based system which provides the framework for TB surveillance, in conjunction with TB nurses and PHE staff (local, regional and national) and is further enhanced through the cohort review process. This system also captures laboratory test results, including antibiotic susceptibility and strain typing<sup>2</sup>.

Data obtained from the Office for National Statistics (ONS) was used for denominator data (eg the resident population of a local authority in the East of England Public Health England Centre (PHEC)). These annual reports contain data spanning 10 years and are valuable in that they can measure trends and progress over an extended period of time. While the data in this report covers from 2000 to 2014, it has not always been possible to present all years for each data type.

The East of England PHEC is located in the Midlands and the East of England NHS commissioning board regions, and is comprised of Bedford, Cambridgeshire, Central Bedfordshire, Essex, Hertfordshire, Luton, Milton Keynes, Norfolk, Peterborough, Southend-on-Sea, Suffolk and Thurrock upper tier local authorities. Below this there are 48 local authorities. A local approach will be essential to tackling TB, and it is hoped that these reports will be of use to local decision makers and healthcare workers.

This report should be considered alongside the recently published Collaborative TB Strategy for England 2015 to 2020; the Public Health England report into TB in the UK, published in September 2015, and the National Institute for Health and Care Excellence (NICE) Tuberculosis Pathway<sup>1, 3</sup>.

### **Objectives**

This report describes the recent epidemiology of TB in the East of England. We aim to update public health, clinical and allied colleagues, including clinical commissioning groups, NHS England and local authorities of the latest trends. We also aim to identify at-risk population groups, and opportunities for interventions and prevention of future cases.

As part of the Collaborative TB Strategy for England 2015-2020, a suite of TB Strategy Monitoring Indicators have been developed

https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/403231/C ollaborative\_TB\_Strategy\_for\_England\_2015\_2020\_.pdf

Where data for these indicators are presented in this report, the indicator name is shown, and a summary table of national-level indicators is presented online. Data for indicators which are presented at Upper Tier Local Authority can be found at <a href="http://fingertips.phe.org.uk/profile/tb-monitoring">http://fingertips.phe.org.uk/profile/tb-monitoring</a>.

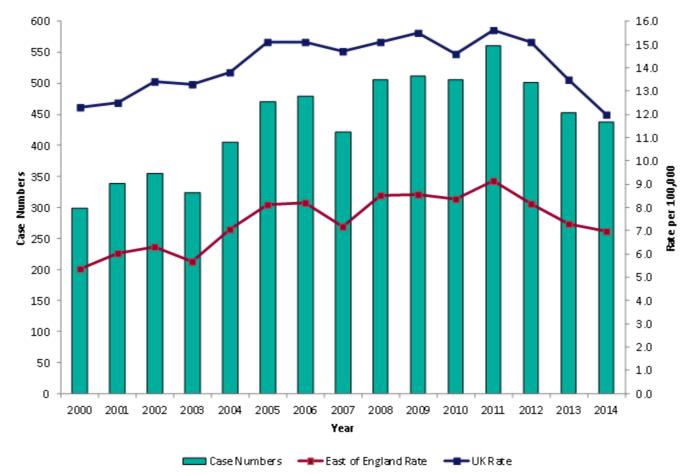
### Tuberculosis epidemiology

### Overall numbers, rates and geographical distribution

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

In 2014, 438 cases of TB were reported among East of England PHEC residents (Fig. 1), a crude rate of 7.0 per 100,000 population (95% confidence intervals (CI) 5.7-7.0). This is considerably lower than the rate of the UK as a whole which is 12.0 (CI 11.7–12.3) cases per 100,000 population. In 2008, the number of cases in the East of England PHEC per year exceeded 500 for the first time, reaching peak case numbers in 2011. Case numbers have gradually been declining in the East of England since.

Figure1: TB case reports and crude rates, East of England, 2000 – 2014



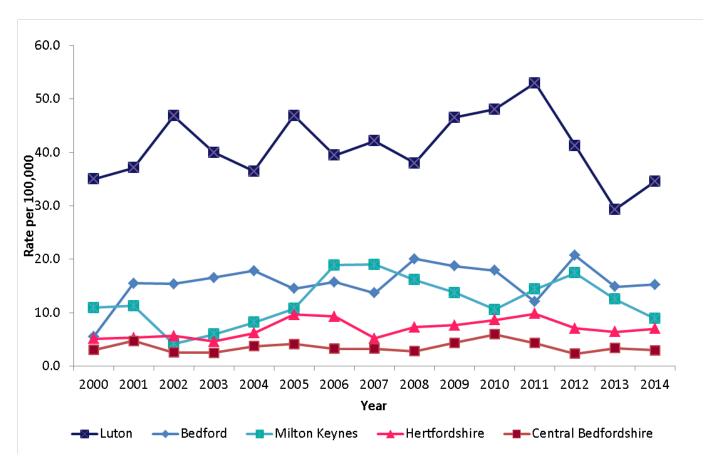
The number of TB cases reported and corresponding rates by upper tier local authority (UTLA) are given in Appendix B.

Hertfordshire had the highest number of cases (81) in 2014, while Thurrock had the lowest number of cases (5) (Fig.2). Decreases in case numbers compared to 2013 have been seen in Cambridgeshire, Essex, Milton Keynes, Peterborough and Southend-on-Sea. Case numbers have increased in Luton and Suffolk compared to 2013.

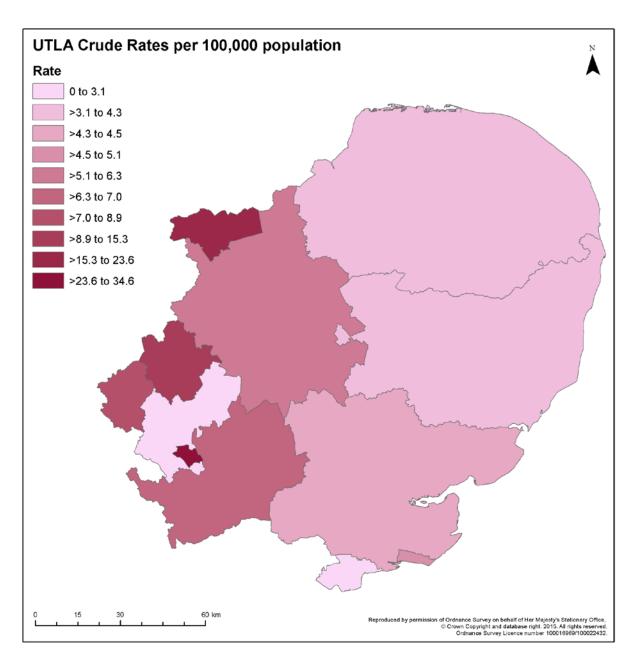
60.0 50.0 Rate per 100,000 30.00 0.00 10.0 0.0 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 Year **—**■Peterborough **──**Southend-on-Sea ── Thurrock --- Cambridgeshire —■ Essex → Norfolk ---Suffolk

Figure 2.A. TB crude rates by UTLA, East of England, 2000-2014

Figure 2.B. TB crude rates by UTLA, East of England, 2000-2014



Map 1: TB crude case rate by upper tier local authority of residence, East of England, 2014

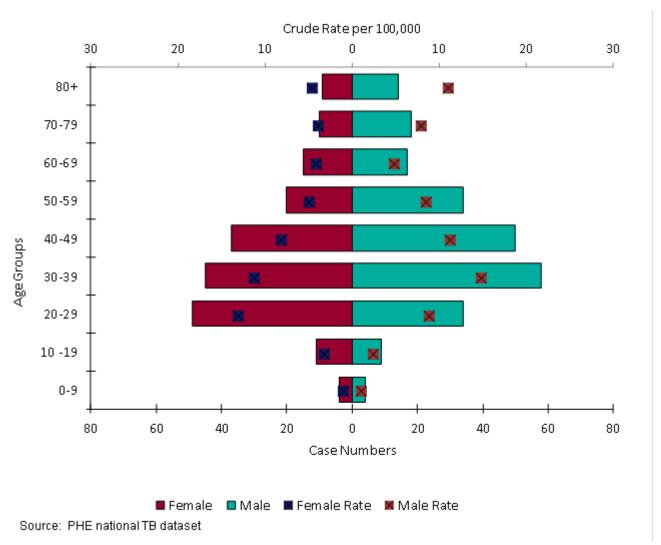


### Demographic characteristics

### Age and sex

In 2014, over half of cases were male (59.5%). The average age of TB cases in 2014 was 42.9 years, with the largest proportion of cases in younger adults aged 20-49 (Fig. 3)

Figure 3: TB case reports and crude rate by age and sex, East of England, 2014



Rates of TB in 2014 were highest in the 20-39 years age band for males, and in the 30-49 years age band for females (Fig.3). In 2014 there were 4 paediatric TB cases in children under 5, compared to 9 in 2013, and 6 in 2012. In comparison to 2013 case rates in the 45-64 years age group increased from 6.1 to 7.0 per 100,000 population (Fig.4.). 2014 rates for 15-44 years and 65+ years decreased compared to 2013, and remained the same for 0-14 year olds (Fig. 4).

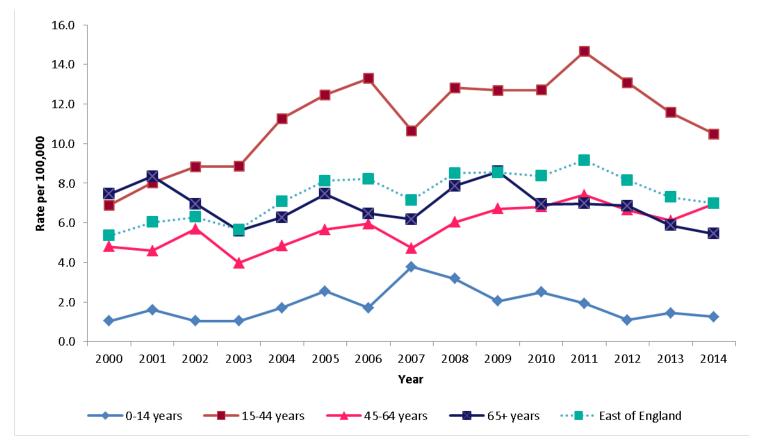


Figure 4: TB case rates by age group, East of England, 2000 – 2014.

Place of birth and time since entry

TB Monitoring Indicator 2: TB incidence in UK Born and Non-UK Born populations (England)

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 the pre-entry screening of long term migrants to the UK for active pulmonary TB in 15 high TB incidence countries<sup>4</sup>. In 2012 this pre-entry screening was extended to all countries with a high incidence of TB (>40 cases per 100,000 population). In 2014, 97.0% of cases had a reported country of origin and of these 73.4% (312/425) of TB cases in the East of England were in Non-UK Born patients (Fig.5.)

The UTLAs where 30% or more of all TB cases were UK Born include Thurrock (60.0%), Hertfordshire (32.1%), Suffolk (31.2%), Milton Keynes (30.4%) and Norfolk (30.3%).

In 2014, the year of entry for Non-UK Born patients was reported in 91.3% of cases. Among those that were Non-UK Born with a reported date of entry, 37.2% had arrived in the UK 10 or more years previously and 25.3% within the previous 2 years. The number of TB cases in people who entered the UK more than 10 years before their TB diagnosis has increased since 2002, but has been stable from 2012-2014 (Fig. 6).

Figure 5: TB case reports and rate by place of birth, East of England, 2000 - 2014

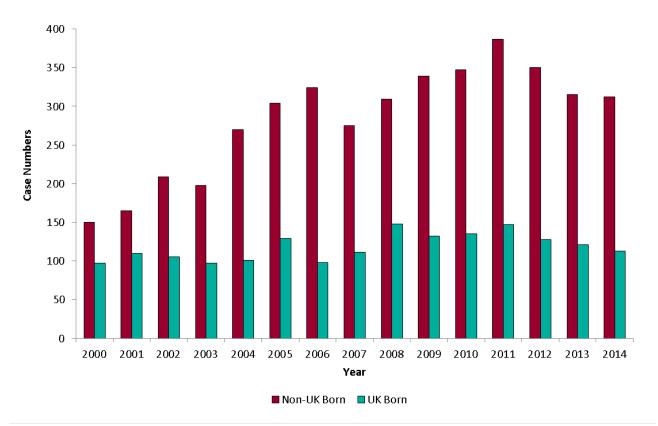


Figure 6: Time between entry to the UK and TB notification for Non-UK Born cases by year, East of England, 2000–2014

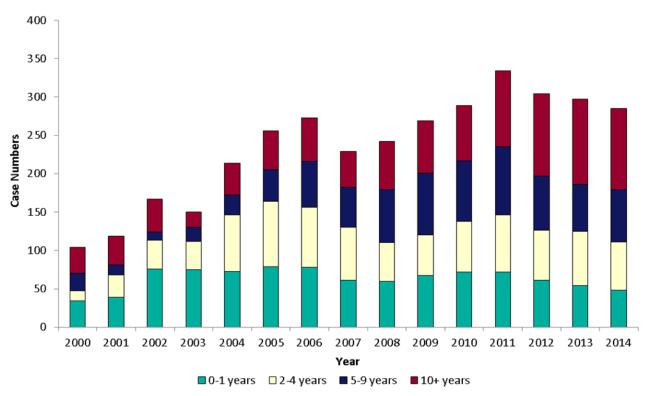


Table 1: Ten most common countries of birth of Non-UK Born TB patients, East of England, 2014

Non-UK Born Countries of Origin, East of England, 2014						
Country of Origin	Case Count	% of total Non-UK Born				
India	83	36.7%				
Pakistan	44	19.5%				
Bangladesh	22	9.7%				
Zimbabwe	17	7.5%				
Philippines	13	5.8%				
Lithuania	12	5.3%				
Nigeria	11	4.9%				
Kenya	10	4.4%				
Romania	8	3.5%				
Sri Lanka	6	2.7%				
Total	226					

### **Ethnicity**

In 2014 99.7% of cases in East of England reported ethnic group. Of those cases where ethnic group was reported, the white ethnicity group accounted for the largest proportion of TB cases (28.4%) (Fig.7). However, the highest crude rates of TB were seen in the Indian (116.4 per 100,000), Pakistani (96.6 per 100,000) and Black African (95.8 per 100,000) ethnic groups. Ethnic rates should be interpreted with caution, as ethnic group denominator data is sourced from the ONS 2011 Census, and may not be fully representative of 2014 ethnic group denominators.

Figure 7: TB Case Numbers and Rate by Ethnic Group, East of England, 2014

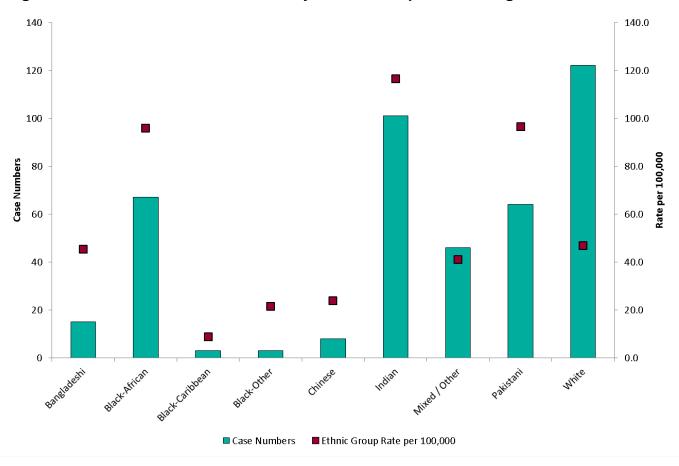
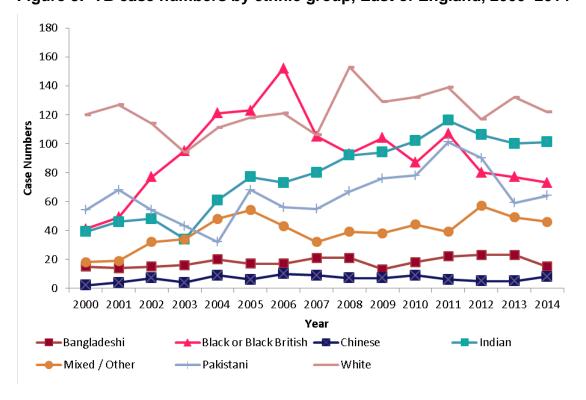


Figure 8: TB case numbers by ethnic group, East of England, 2000-2014



### Occupation

In 2014, 30.7% of cases in people of working age (18-65 years) were not in employment, 12.2% were healthcare workers and 7.4% were studying or working in the education sector (Table 2). 6.3% of cases in people of working age did not report an occupation, and 41.2% were listed as "Other".

Table 2: Occupational category of TB patients aged 18 to 65 years, East of England, 2014

Occupation Category*	Number of Cases	% of occupation in 18-65 year olds
Other	145	41.2
Unemployed	108	30.7
Health care worker	43	12.2
Education	26	7.4
Unknown	22	6.3
Total Cases Aged 18-65	352	

<sup>\*</sup>only shown where 5< cases

### Clinical characteristics

#### Site of disease

In 2014 43.6% of TB patients in the East of England had pulmonary disease only (Table 3). All pulmonary TB cases (including cases with other extrapulmonary sites) account for 52.5% of cases in 2014. The next most common disease site in 2014 was extra-thoracic lymph nodes, accounting for 23.5% of cases (Table 3).

In 2014 UK Born patients had a higher proportion of pulmonary disease (66.4%) than Non-UK Born patients (46.2%). Patients reported as having at least one social risk factor had a higher proportion of pulmonary TB (78.7%, 26/33) than cases with patients with no reported risk factors (48.3%, 170/352, where risk factors were actively reported), although this should be interpreted with caution due to small case numbers.

Table 3: Site of disease of TB patients, East of England, 2014 (n=438)

	2014	
Site of Disease	Case Numbers	% of total case number*
Pulmonary ONLY	191	43.6%
Lymph nodes (extra thoracic)	103	23.5%
IT Lymph nodes	41	9.4%
Pleural	39	8.9%
Other (extra pulmonary)	38	8.7%
Pulmonary with Extra pulmonary	37	8.4%
Gastrointestinal	22	5.0%
Bone/Joint (spinal)	15	3.4%
Miliary	13	3.0%
Genitourinary	10	2.3%
Unknown	9	2.1%
Bone/Joint (other - non-spinal)	8	1.8%
CNS Other	6	1.4%
Cryptic	6	1.4%
CNS (meningitis)	4	0.9%
Laryngeal	1	0.2%

<sup>\*</sup>patients may have multiple disease sites therefore % does not equal 100

### Previous diagnosis of tuberculosis

In 2014, where reported, 6.4% (26/406) of cases had a report for previous diagnosis of TB. Of these cases, 5.7% (23/406) of patients had a previous TB diagnosis more than 12 months ago. 38.4% (10/26) of whom received DOT. This is approximately equal to the national proportion (6.8%, 419/6,520) but slightly higher than the national percentage receiving DOT (31.4%). Compared to East of England in recent years, 2014 saw a slight increase in cases with a previous TB diagnosis compared to 2013 (5.2%, 22/425) and 2012 (5.2%, 24/462).

#### **BCG** vaccination

In 2014 BCG status was known for 68.2% of cases (299/438), 76.3% (228/299) of whom had previously received BCG vaccination (Table 4). Over three quarters (76.9%, 10/13) of cases aged 0-14 years had received BCG vaccination; the proportion of children who had received BCG vaccination was lower in Non-UK Born children (50.0%, 2/4) than in UK Born children (88.9%, 8/9), but due to small numbers this should be interpreted with caution.

Table 4. Number and proportion of TB patients with BCG vaccination, East of England, 2014

Country of Origin	<5 years old		<15 years old			All Ages			
	n	N	%	n	N	%	n	N	%
UK Born	3	4	75.0%	8	9	88.9%	57	82	69.5%
Non-UK Born	0	0		2	4	50.0%	171	216	79.2%
All Cases	3	4	75.0%	10	13	76.9%	228	299	76.3%

### Microbiological information

### Culture confirmation and speciation

In 2014 65.8% (288/438) of all cases were culture confirmed, increasing to 78.9% (180/228) cases culture confirmed in pulmonary TB cases. Of the 288 culture confirmed cases, 97.6% (281/288) were *M. tuberculosis*, 1.0% (3/288) were *M. africanum*, 1.0% (3/288) were *M. bovis* and 0.3% (1/288) were part of an *M. tuberculosis* complex.

### Sputum smear

Among 438 TB cases reported for East of England PHEC in 2014 52.1% (228/438) were pulmonary cases and, of these cases 43.0% (98/228) had a sputum smear test done. Of these, 68.4% (67/98) were sputum smear positive.

In 2013, 59.0% of all cases were confirmed by culture (154/261). This increased to 71.0% (98/138) among pulmonary cases, among which 77.6% (76/98) had a sputum smear result, and of those 65.0% (39/76) were sputum smear positive. Of those with extra-pulmonary disease, 45.9% (56/122) were culture confirmed (65/120).

### TB transmission

### Strain typing and clustering

The PHE National Strain Typing Service was established in January 2010. All TB isolates are typed using 24 loci mycobacterial interspersed repetitive unit-variable number tandem repeats (MIRU-VNTR) at the National Mycobacterium Reference Laboratory (NMRL). Cases with an identical strain pattern are considered clustered<sup>2</sup>. All data shown are for patients reported between 2010 and 2014.

### Proportion of cases clustered and geographical distribution

Between 2010 and 2014 1542 cases of TB were culture confirmed in the East of England, of which 1318 (85.5%) were strain typed to a MIRU-VNTR profile with at least 23 complete loci (Table 5.). There were 364 cases clustered to at least one other case in the East of England since 2010, giving a clustering proportion<sup>2</sup> of 27.6%. These cases comprise of 124 separate clusters.

Table 5. TB Cases Clustered between 2010 and 2014 in the East of England

		Strain t cases*	Strain typed cases*		es Clustered^		
Year	Culture Confirmed Cases	n	% of culture confirmed	n	% strain typed	Number of Clusters	
2010-2014	1542	1318	85.5%	364	27.6%	124	

<sup>\*</sup> Culture confirmed cases with a MIRU-VNTR profile with at least 23 complete loci

If clustering included cases linked to national clusters, there would be 723 TB cases from 2010-2014 clustered from the East of England, giving a clustering proportion of 54.9%. The following analysis only includes clusters within the East of England.

<sup>^</sup>Clusters outside of the East of England were excluded.

<sup>&</sup>lt;sup>2</sup> The proportion of culture confirmed, strain typed cases that had the same 23 loci MIRU-VNTR profile as at least one other case in the East of England between 2010 and 2014.

#### Size of clusters

Between 2010 and 2014 124 clusters were identified in the East of England. Of these clusters 60.5% included 2 linked TB cases, and 8.1% included 5 or more linked TB cases. The largest cluster included 24 TB cases.

### Cluster Lineage

Between 2010 and 2014 364 TB cases were linked to a cluster in the East of England. Half of these clustered cases (50.3%) had TB strains of the Euro-American lineage, 20.9% Central Asian lineage, 9.3% Beijing lineage, 8.0% East African Indian lineage and 0.5% *M. bovis* lineage.

- of all strain typed TB cases between 2010 and 2014 (including cases not clustered, and cases clustered outside of the East of England) 43.1% had TB strains of the Euro-American lineage. Of all cases typed within the Euro-American lineage, 32.2% were clustered within the East of England<sup>3</sup>
- of all cases typed within the Central Asian lineage, 27.5% were clustered within the East of England

#### Characteristics of cases in clusters

Of all cases that were cultured confirmed to at least 23 complete loci and clustered to another case within the East of England between 2010-2014, the most common ethnic group was white (37.1%) followed by Black African (20.1%) (Table 6.). Pulmonary cases made up over three quarters (76.6%) of all cases clustered in the East of England, with 86.7% of pulmonary cases testing sputum positive where sputum samples were taken (30/57 sampled cases). 9.0% of clustered cases had a previous diagnosis of TB from over 12 months ago.

Of the cases clustered in the East of England 10.2% (37) had at least one social risk factor. Of all cases with at least one social risk factor in the East of England between 2010 and 2014 23.7% (37) were part of a local cluster (Table 7). For all cases associated with a local cluster 50% (21) were reported to have alcohol misuse, 25.9% (15) were homeless, 28.6% (16) had misused drugs and 12.3% (9) had a history of imprisonment.

<sup>&</sup>lt;sup>3</sup> Clustered in the East of England – a case was linked to at least one other case within the East of England PHEC geography. Does not include cases that are clustered to cases outside of the East of England.

Table 6. Characteristics of cases clustered in the East of England (excluding cases clustered outside of the PHEC), 2010-2013

		Number of	clustered cases*
Characteristics		n	% of total cases 2010-2014 that are clustered within EoE
Sex	Male	235	64.6%
	Female	129	35.4%
Age	0-14	6	1.6%
	15-44	247	67.9%
	45-64	72	19.8%
	65+	39	10.7%
Country of Birth	UK Born	121	34.1%
	Non-UK Born	234	65.9%
Ethnic Group	White	131	37.1%
	Black African	71	20.1%
	Black Caribbean	7	2.0%
	Indian	61	17.3%
	Pakistani	42	11.9%
	Bangladeshi	5	1.4%
	Mixed/Other	36	10.2%
	Unknown	11	3.1%
	Pulmonary	279	76.6%
Clinical Characteristics	Sputum Smear Positive (of pulmonary cases where smear sample recorded [30/57])	113	86.7%
	Previous TB Diagnosis	31	9.0%

<sup>\*</sup>denominator is variable depending on field completion

Table 7. Proportion of cases reported to have risk factors in the East of England from 2010-2014 associated with a local cluster

Risk	Number Where Reported	Yes	No	Number Clustered in EoE	% of Total Cases with Risk Factor
At least 1 risk factor	2121	156	1965	37	23.7%
Drug Use	2238	56	2182	16	28.6%
Alcohol Use	1220	42	1178	21	50.0%
Imprisonment	2196	73	2123	9	12.3%
Homelessness	2267	58	2209	15	25.9%

### Delay from onset of symptoms to start of treatment

### Time symptomatic

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

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

Table 8: Time between symptom onset and diagnosis\*, East of England, 2014

Time Delay	Extra-pulmo	nary	Pulmonary		
Tillie Delay	Number %		Number	%	
<2 months	45	24.9%	75	37.3%	
2 - <4 months	52	28.7%	66	32.8%	
4 months +	84	46.4%	60	29.9%	
All	181		201		

<sup>\*</sup>excluding asymptomatic cases, and those with missing onset dates

The median time from symptom onset to diagnosis for pulmonary cases in 2014 was 80 days (IQR<sup>4</sup> 111 days), compared to 113 days (IQR 146 days) for extra-pulmonary cases.

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

Out of 376 cases that were symptomatic, and with a reported start date, 155 cases had a delay between symptom onset and diagnosis of 4 months (120 days) or more. 51.6% (80/155) of these cases were female, and 48.4% (75/155) were male. 54.8% of cases with delay to treatment exceeding 4 months were in the 15-44 years age group, followed by 27.7% of cases in the 45-64 age group. 68.4% of cases with long delays were in Non-UK Born cases.

Of 376 cases that were symptomatic, 153 had a reported disease site. The largest delays were seen in patients with extrapulmonary disease sites, with 60.8% (93/153) of cases experiencing a delay to starting treatment exceeding 4 months.

<sup>&</sup>lt;sup>4</sup> The interquartile range (IQR) is a measure of variability, based on dividing a data set into quartiles. Quartiles divide a rank-ordered data set into four equal parts. The values that divide each part are called the first, second, and third quartiles; and they are denoted by Q1, Q2, and Q3, respectively. The IQR is the difference between Q3 and Q1.

### **TB Treatment Outcomes**

TB patient outcomes are reported in accordance with the revised 2013 World Health Organization (WHO) treatment outcome definitions<sup>3</sup>. Under these, treatment outcomes at 12 months are reported for the cohort of patients diagnosed in 2013 with drug (rifampicin) sensitive TB with an expected course of treatment of less than 12 months (excluding patients with initial or acquired rifampicin or multidrug-resistance),, and separately for those with CNS, spinal, miliary or cryptic disseminated disease.

Outcomes at 24 months are reported for the cohort of patients diagnosed in 2012 with initial or acquired rifampicin or multidrug resistance.

The national surveillance team further revised the outcome data provided by clinics and, where the time between treatment start and end dates was greater than 365 days, any coded as completed within 12 months were reassigned to 'still on treatment at one year', and similarly for 24 and 36 month outcomes. PHE will be working with clinic staff to improve and validate any amendments to outcome data.

### Drug sensitive cohort

For the purposes of TB outcome reporting the drug sensitive cohort excludes all TB cases with rifampicin resistant TB (initial or amplified) including MDR-TB (initial or amplified), and non-culture confirmed cases treated as MDR-TB.

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

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

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

Table 9: Number and proportion completing treatment at 12 months, East of England, 2002 – 2013\*

Year	TB Patients			
Teal	N	n	%	
2002	316	222	70.3%	
2003	291	218	74.9%	
2004	382	275	72.0%	
2005	426	309	72.5%	
2006	434	328	75.6%	
2007	373	292	78.3%	
2008	452	325	71.9%	
2009	452	352	77.9%	
2010	461	369	80.0%	
2011	494	402	81.4%	
2012	447	353	79.0%	
2013	405	335	82.7%	

<sup>\*</sup>excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

Table 10: TB outcome at 12 months, East of England, cases diagnosed in 2013\*

Outcome	TB Pa	atients
Outcome	n	%
Treatment completed	335	82.7%
Still on treatment	26	6.4%
Died	20	4.9%
Lost to follow up	14	3.5%
Not Evaluated	8	2.0%
Treatment stopped	2	0.5%
All*	405	

<sup>\*</sup>excludes rifampicin resistant TB, and patients with CNS, spinal, miliary or cryptic disseminated disease

The most common reason for not having completed treatment at 12 months in the drug sensitive cohort (excluding CNS, spinal, miliary or cryptic disseminated TB) was continuation of treatment (6.4%) followed by death (4.9%) (Table 10). In CNS, spinal, miliary or cryptic disseminated TB cases, the most common reason for not having completed treatment at 12 months was also continuation of treatment (16.1%) but the second was patients being lost to follow up (12.9%) (Table 11).

Older (65+) and very young patients (0-14 years) were less likely to complete treatment within 12 months. Only 70.0% (42/60) patients over 65 and 73.3% (11/15) of patients 14 years and under completed treatment (although this should be interpreted with caution due to small numbers). Older patients also had worse outcomes, with 23.3% (14/60) patients dying before completing treatment. All patients lost to follow up were 15-64 years of age.

Outcomes did not differ greatly between male and female patients (treatment completed at 12 months 81.0% in females and 84.0% in males).

UK Born patients had worse outcomes at 12 months, with 8.0% (9/112) patients dying before completing treatment, compared to 3.6% (10/280) in Non-UK Born patients. Treatment completion did not differ greatly between UK Born and Non-UK Born (85.0% vs 80.4%) but Non UK Born patients were more likely to be lost to follow up (4.3% vs. 1.8%).

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

Table 11: TB outcome at 12 months for patients with rifampicin sensitive, CNS, spinal, miliary or cryptic disseminated disease, East of England, cases diagnosed in 2013\*

Outcome at 12 months	TB Patients		
Outcome at 12 months	n	%	
Treatment completed	17	54.8%	
Still on treatment	5	16.1%	
Lost to follow up	4	12.9%	
Died	3	9.7%	
Not Evaluated	1	3.2%	
Treatment stopped	1	3.2%	
Total	31		

<sup>\*</sup>excludes rifampicin resistant TB

Outcomes for patients with drug sensitive CNS, spinal, miliary or cryptic TB diseases (Table 11.) were worse than for patients with other drug sensitive disease sites (Table 10.) Nearly twice as many patients died (9.2% CNS, spinal, miliary, cryptic vs. 4.9% non CNS etc.) and patients were more likely to be lost to follow up (12.9% CNS, spinal miliary cryptic vs. 2.5% non CNS etc.). This should be interpreted with caution due to small numbers in both disease site groups.

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

20 deaths were reported in the drug sensitive cohort (excluding CNS, spinal, miliary or cryptic disseminated TB and rifampicin resistant cases), four of which were diagnosed post mortem. Death records indicated that TB contributed to seven (35.0%) deaths, was incidental in four (20.0%) deaths and was unknown for nine (45.0%) of deaths. The median age of patients who

died was 76.5. In this cohort, 14 cases were lost to follow up; seven left the UK and seven were lost for unknown reasons.

None of the three deaths in the drug sensitive cohort of CNS, spinal, miliary or cryptic disseminated cases indicated whether TB was causative to death. Four cases in this cohort were lost to follow up, three (75.0%) because they left the UK and one (25%) for unknown reasons.

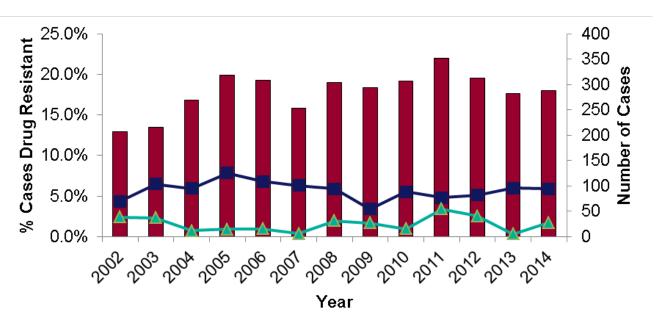
## Drug resistant TB (including outcomes in the drug resistant cohort)

### Drug resistance

### Overall drug resistance and geographical distribution

In 2014, of 288 culture confirmed TB cases, 5.9% (17/288) had first line drug resistance, and 1.7% (5/288) had multidrug resistance. First line drug resistance was higher in pulmonary cases (7.4% single, 2.0% MDR) than in extra-pulmonary cases (4.6% single, 0.9% MDR).

Figure 9: Proportion of TB cases with first line drug resistance, East of England, 2002 – 2014



- Number of Culture Confirmed TB Cases
- --- Proportion of culture confirmed cases with first line drug resistance
- Proportion of all culture confirmed TB cases with MDR

Source: PHE national TB dataset

### TB outcome at 24 months for patients with rifampicin resistant disease

Table 12: TB outcome at 24 months for patients with rifampicin resistant disease, East of England, cases diagnosed in 2012

Outcome at 24	TB Cases						
months	n	%					
Treatment completed	3	37.5%					
Still on treatment	2	25.0%					
Lost to follow up	2	25.0%					
Died	1	12.5%					

In 2012, eight cases of rifampicin resistance cases were reported to ETS, two of which were XDR. At 24 months, three had completed treatment (compared to none at 12 months), two were still on treatment (compared to five at 12 months), one was lost to follow up and one patient died. Of these rifampicin resistant cases, the majority were male (7/8) and Non-UK Born (7/8), and three reported to have risk factors.

## TB in those with social risk factors and health inequalities associated with TB

#### Social risk factors

Information on social risk factors (homelessnes, drug and alcohol misuse, imprisonment and mental health issues) has been available since 2009.

In 2014, of the 438 TB cases recorded in the East of England, 87.9% (385) were assessed for the presence of social risk factors, and of these cases 9.4% (33/385) had at least one risk factor.

In TB cases notified to ETS between 2009 and 2014 6.4% (191/2971) had at least one risk factor (Table 13.). Homelessness was the most common risk factor reported, appearing in 44.5% (85/191) of cases reported with at least one risk factor from 2009-2014. Outcomes for patients with social risk factors (Table 13) were worse than the EoE average for the 2014 drug sensitive cohort (Table 10.), even with DOT provision.

Of these cases, offer and provision of DOT was reported for 77.0% (147/191) of cases. Where reported, 42.2% (62/147) of cases with at least one risk factor received DOT between 2009 and 2014. Of patients receiving DOT, at final outcome reported 59.7% (37/62) completed treatment. Treatment completion was slightly increased in patients with risk factors not receiving DOT (64.7%, 55/85) but this may be representative of historical risk factors (eg previous history of drug use), as opposed to active ongoing risk factors (eg current drug use) in patients receiving DOT.

Of all patients with at least one social risk factor between 2009-2014, 81.2% (155/191) were male and 18.9% (36/191) were female. Country of birth was reported for 92.7% (177/191) of cases with reported risk factors, with no difference in proportion of UK Born and Non-UK Born patients with risk factors (49.2% vs. 50.8% respectively). The majority of cases with at least 1 risk factor were between the ages of 15-44 (116/191, 60.7%). HIV testing was reported in only 35.1% (67/191) cases, with 71.6% (48/67) of these cases having a HIV test offered and done. This rises to 90.1% reported and 70.3% HIV test offered and done in all cases reported in the East of England in 2014.

Table 13: Social risk factors among TB patients, East of England, 2009 - 2014

Total Cases	N		%*				
Reported to ETS 2009- 2014	2971						
Any Risk Factor	191		6.4%**				
Any Alcohol Use	67		35.1%				
Any Drug Use	63		33.0%				
Any Imprisonment	67		35.1%				
Any Homelessness	85		44.5%				
Outcomes	DOT (N=62	2)	No DOT (N=85)				
Outcomes	n	%	n	%			
Treatment completed	37	59.7%	55	64.7%			
Still on Treatment			1	1.2%			
Lost to Follow Up	8	12.9%	10	11.8%			
Died	5	8.1%	4	4.7%			
Not Evaluated	11	17.7%	15	17.6%			
Treatment Stopped	1	1.6%					

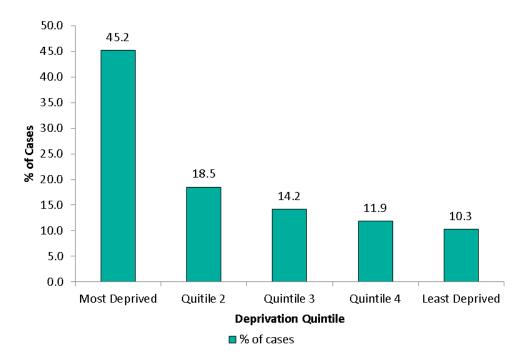
\*cases may have more than one risk factor, therefore % does not amount to 100.0%, percentage take from cases reported to have at least 1 risk factor.

<sup>\*\*</sup> The percentage of cases with at least 1 risk factor between 2009-2014

### Deprivation

Based on the Index of Multiple Deprivation (IMD 2010), nearly half of all TB cases in the East of England came from those in the most deprived quintiles (Fig.8) Over three quarters of TB cases (77.9%) were in the three most deprived quintiles, indicating that TB disproportionately affects the poorest members of society.

Figure 8: Proportion of TB case numbers by deprivation index quintile (calculated using the IMD), East of England, 2014



### Testing for HIV

### **HIV** testing

In 2014, of the 438 notifications to ETS, 384 (87.7%) reported on HIV Testing. Of those cases where HIV testing was reported, 89.3% (343) were offered a HIV test (75.5% offered and done, 1.3% offered and refused and 3.9% offered but not done). 10.7% (41) of cases in 2014 were not offered a HIV test, and in 8.9% (34) cases the HIV status of the patient was already known.

HIV testing was offered to 100% of patients in Southend-On-Sea, 93.1% of cases in Norfolk and 91.9% of cases in Luton.

In Thurrock, 80% of cases were offered a HIV test, and 68.4% in Milton Keynes. Due to small numbers of cases in some UTLAs, these proportions should be interpreted with caution.

### Discussion

Although overall rates of TB in the East of England PHEC (EoE PHEC) are lower than in the UK as a whole, high rates of TB per 100,000 continue in Peterborough (23.6 (CI: 17.2-31.6)), Luton (34.6 (CI:27.1-43.5) and Bedford (15.3 (CI: 9.9-22.5)). Certain demographic groups are known to be at higher risk of catching TB. The highest case rate of TB is within the 15-44 years age group, similarly to what is seen in the UK data<sup>1</sup>.

In 2014, 73.4% of all TB cases in the EoE PHEC were seen in people born outside the UK. This is similar to the UK average figures. In Non-UK Born TB cases, 37.2% of cases arrived in the UK 10 or more years previously and only 15.8% within the previous year. Therefore there are more TB cases among settled migrants than new entrants. The most common ethnic group affected, accounting for 27.9% of tuberculosis cases in 2014, was the White ethnic group. The highest crude TB rates were seen in the Indian ethnic group.

In 2014, an HIV test was not offered or not recorded as offered, to nearly one in ten TB patients in Anglia and Essex. Where social risk factors were investigated, 7.5% of all TB cases assessed had at least one social risk factor (this includes a history of alcohol or drug misuse, homelessness and imprisonment). Many of the TB cases were unemployed, and a sizeable proportion of cases also came from the healthcare profession (12.2%) and the education sector (7.4%). TB in the EoE PHEC disproportionately affects the most deprived communities, with approximately two thirds of all TB cases coming from the two most deprived quintiles.

Drug resistance can present a serious problem at both the local and national level. The proportion of cases with first line drug resistance has remained relatively stable from 2002 to the present from 4.3% to 5.9%. The proportion of cases with MDR-TB ranges from 2.4% to 1.7% between 2002 and 2014.

One indicator of the quality of TB services is the treatment completion rate for drug-sensitive TB cases. In 2013 Anglia and Essex PHEC, 82.7% of drug sensitive TB cases had completed treatment by 12 months. This is similar to the UK rate (85.0% of drug sensitive cases completed treatment with expected treatment duration of less than 12 month in the UK as a whole). Older patients and very young patients were less likely to complete treatment, and UK Born patients were more likely to die while on treatment than Non-UK Born patients.

Of strain typed cases from 2010 to 2014, 27.6% were found to cluster with one other case in the East of England. The majority of clusters consist of only two people (60.2%) and only 8.1% of clusters contained five or more cases. The Euro-American lineage was the most common strain in the East of England. Higher proportions of clustering in the East of England were observed among males, the Non-UK Born, those aged 15 to 44 years, and ethnically White TB patients. These observations should be interpreted with caution due to the relatively small number of cases.

### Conclusion and recommendations

Important performance indicators of the proportion of TB cases tested for HIV and time to treatment from onset of symptoms remain weak.

The proportion of pulmonary TB cases having a delay of more than two months between symptom onset and treatment start was 70.4%. This may be partly explained by the fact that 32.2% of cases waited more than two months from first presentation to any healthcare setting to starting treatment (ie the delay in diagnosis). These figures show that the health and social systems for early diagnosis and treatment of TB continue to need attention and support to bring them up to NICE standards of clinical excellence<sup>3</sup>.

Health, education and associated services need to continue to strive to better understand and meet the needs of different client groups with emphasis on early recognition of TB symptoms, access to expert TB diagnostic and treatment services, and support to individuals to complete the prolonged courses of antibiotics they require to cure them of infection and to mitigate the risk they pose to others.

Key recommendations for the NHS and PHE derived from the data presented in this report include:

- 1. CCGs serving Local Authorities with high burdens of TB should prioritise TB control and treatment, in accordance with the new Collaborative TB Control Strategy<sup>5</sup>.
- 2. Ensure relevant information is completed both timely and accurately on the PHE Enhanced TB Surveillance system.
- 3. Offer HIV testing to all those diagnosed with tuberculosis, and record the results. If a test is offered but not done, this should be investigated at cohort review<sup>6</sup>.
- 4. Ensure better recording of social risk factors as this could inform local prevention activity.
- 5. Hospitals and healthcare providers should examine where the highest burden of TB is in each demographic group, and tailor services appropriately (this includes hard-to-reach groups).
- 6. Ensure that treatment outcomes are recorded for all patients, and investigate where completion is low in some hospitals.
- 7. Use cohort review as an opportunity to learn and share lessons on patient management and to decrease time between onset of symptoms and diagnosis<sup>3, 7</sup>.
- 8. Ensure that those working in the healthcare sector are aware of the signs and symptoms of tuberculosis as a sizeable proportion of cases came from the healthcare industry.

Tuberculosis in the East of England (2014)

Public Health England and NHS England have recently published the Collaborative TB Strategy for England 2015 to 2020, which sets out the improvements that need to be achieved across 10 key areas to bring about a sustained decline in TB in England, and the mechanisms by which these aims should be achieved<sup>5</sup>.

### References

- 1. Tuberculosis in the UK: 2015 report. Public Health England, September 2015. https://www.gov.uk/government/publications/tuberculosis-in-england-annual-report
- 2. Public Health England. TB Strain Typing Cluster Investigation Handbook, 3rd Edition, February 2014.

http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb\_C/1317140774833

- 3. National Institute of Health and Clinical Excellence. Tuberculosis full guideline [Internet]. NICE. 2011. http://www.nice.org.uk/guidance/cg117/resources/cg117-tuberculosis-full-guideline3
- 4. Public Health England. UK pre-entry tuberculosis screening brief report 2013. Public Health England: London, November 2013. https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/328468/TB\_preentry\_screening brief report 2013.pdf
- 5. Collaborative Tuberculosis Strategy for England, 2015 2020. 2015. https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/403231/Collaborative\_TB \_Strategy\_for\_England\_2015\_2020\_.pdf
- 6. British HIV Association. UK National Guidelines for HIV Testing. September 2008 http://www.bhiva.org/documents/guidelines/testing/glineshivtest08.pdf
- 7. Royal College of Nursing. Tuberculosis case management and cohort review. RCN 2012. http://www.rcn.org.uk/\_\_data/assets/pdf\_file/0010/439129/004204.pdf

## Appendix A: Description of data sources and definitions

#### **Data sources**

Data on TB cases in East of England comes from the national Enhanced TB surveillance (ETS) system. Data collected includes notification details, and demographic, clinical and microbiological information, including drug resistance and strain type, provided by the National Mycobacterium Reference Laboratory (NMRL).

#### **Definitions**

#### Treatment outcome

Information on outcomes was reported for all cases reported in the previous year, excluding those with known rifampicin resistant disease: outcomes for these cases were reported at 24 months. Definitions for outcome are based on World Health Organization (WHO) and European definitions, but adapted to the UK context. In this report, all data was obtained from the ETS matched dataset provided in September 2015.

### **Proportions**

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

#### **Confidence intervals**

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

#### Population denominator

Tuberculosis rates by geographical area (Centre, local authority, MSOA and LSOA), age, sex and place of birth were calculated using ONS mid-year population estimates. Tuberculosis rates by ethnicity were calculated using ONS 2011 census data. http://www.ons.gov.uk/ons/rel/census/2011-census/key-statistics-for-local-authorities-in-england-and-wales/rft-table-ks201ew.xls

### **Cluster definitions**

Strain typing was performed at the TB reference laboratories using 24 MIRU-VNTR profiling. Analysis was undertaken on strain type clusters defined as two or more people with TB caused by indistinguishable strains, with at least 23 complete VNTR loci. Analysis of clustering in East of England was carried out on cases that clustered in the East of England and notified between 2010 and 2014.

Tuberculosis in the East of England (2014)

### Appendix B: TB among East of England residents

Table Bi: TB 3 year rolling average case numbers by local authority of residence, East of England, 2002 – 2014

Table Bi: TB 3 yea	2000-	2001-	2002-	2003-	2004-	2005-	2006-	2007-	2008-	2009-	2010-	2011-	2012-
LA of Residence	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Babergh	2	2	2	2	2	1	3	3	3	2	2	1	1
Basildon	7	7	7	9	11	12	13	12	14	14	11	11	11
Bedford	18	24	25	25	24	22	25	27	29	25	27	25	27
Braintree	4	3	3	3	4	3	4	2	4	4	6	5	5
Breckland	1	2	3	5	5	5	5	5	5	4	3	4	3
Brentwood	5	4	3	2	3	3	5	5	5	4	3	3	5
Broadland	2	2	2	2	3	4	4	3	2	2	2	3	3
Broxbourne	4	4	6	7	8	6	5	4	5	4	5	7	7
Cambridge	8	8	8	10	16	17	18	13	15	13	15	15	14
Castle Point	4	3	4	3	3	3	3	3	2	2	2	3	3
Central Bedfordshire	8	8	7	8	9	9	8	9	11	12	11	9	8
Chelmsford	8	8	10	8	8	6	8	7	6	7	6	5	5
Colchester	7	6	6	5	6	8	7	7	8	12	11	10	6
Dacorum	4	4	4	5	6	7	7	6	7	8	11	9	7
East Cambridgeshire	2	1	2	2	3	2	3	2	2	3	2	2	3
East Hertfordshire	4	4	4	5	5	4	3	2	2	4	4	4	3
Epping Forest	7	6	6	5	6	4	4	5	7	8	9	11	11
Fenland	3	3	3	3	3	2	4	4	4	4	4	7	8
Forest Heath	1	1	1	2	2	3	4	4	3	2	2	3	3
Great Yarmouth	2	4	5	5	4	6	10	13	12	11	9	8	9
Harlow	7	7	7	5	6	6	8	7	7	9	15	17	15
Hertsmere	10	10	9	8	8	8	7	7	11	12	13	11	11
Huntingdonshire	4	6	6	8	7	7	6	9	9	10	7	8	8
Ipswich	9	8	11	8	7	7	8	12	12	11	9	6	8
East of England	331	339	361	399	451	457	469	480	508	526	523	505	464

Table Bi (cntd.): TB 3 year rolling average case numbers by local authority of residence, East of England, 2002 – 2014

LA of Residence	2000- 2002	2001- 2003	2002- 2004	2003- 2005	2004- 2006	2005- 2007	2006- 2008	2007- 2009	2008- 2010	2009- 2011	2010- 2012	2011- 2013	2012- 2014
King's Lynn and West Norfolk	4	5	5	5	5	5	6	6	7	5	4	4	5
Luton	74	77	76	76	76	80	76	81	87	98	96	85	73
Maldon	2	2	2	2	2	1	1	2	1	2	1	1	1
Mid Suffolk	2	1	1	2	2	3	2	2	1	2	2	2	2
Milton Keynes	19	15	13	18	28	37	42	38	32	32	35	37	33
North Hertfordshire	7	5	4	6	9	9	9	10	10	10	7	8	7
North Norfolk	3	2	2	4	4	7	7	8	4	4	4	5	3
Norwich	6	7	10	13	14	12	11	10	11	11	12	12	10
Peterborough	26	22	25	28	36	33	37	36	43	45	53	56	54
Rochford	3	3	3	2	3	3	3	4	3	3	1	1	1
South Cambridgeshire	5	4	5	6	7	8	9	10	9	6	7	7	8
South Norfolk	3	3	2	4	4	4	3	3	2	2	2	2	2
Southend-on-Sea	14	17	20	22	24	23	22	22	21	22	20	17	13
St Albans	5	4	7	8	11	8	7	6	10	10	10	7	8
St Edmundsbury	1	2	3	5	5	6	4	6	6	6	6	6	7
Stevenage	5	4	5	9	12	11	11	8	11	10	9	8	8
Suffolk Coastal	2	2	4	4	3	3	3	4	5	5	6	5	4
Tendring	3	5	4	3	3	3	3	4	4	4	3	3	3
Three Rivers	5	5	4	5	5	7	5	5	4	6	7	7	8
Thurrock	5	7	11	13	12	9	10	11	16	16	15	11	8
Uttlesford	1	1	1	2	3	3	3	3	3	3	2	2	2
Watford	14	16	13	16	18	20	15	12	13	17	17	15	12
Waveney	10	9	6	6	5	5	8	10	9	6	5	5	5
Welwyn Hatfield	2	2	4	5	6	6	9	12	13	16	13	13	8
East of England	331	339	361	399	451	457	469	480	508	526	523	505	464

Table Bii: TB crude rate\* per 100,000 by local authority of residence, East of England, 2002 – 2014
\*rates calculated using ONS mid-year population estimates

rates salsalated using one link	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Babergh	1.7	1.7	0.0	0.9	2.6	0.9	0.0	0.0	2.6	1.7	2.6	1.8	0.9	0.9	1.8
Basildon	11.5	10.0	11.7	15.0	8.4	20.3	27.2	13.7	27.6	22.5	24.3	26.2	8.8	23.2	25.3
Bedford	11.7	34.1	34.4	37.7	40.9	33.4	36.6	32.2	47.8	44.9	43.8	30.0	52.5	38.7	41.0
Braintree	3.9	5.3	0.0	1.4	6.9	2.8	7.0	2.8	0.0	2.9	8.8	5.9	10.4	6.0	6.0
Breckland	1.2	1.2	2.4	4.9	5.0	8.8	6.3	2.6	9.0	6.5	3.9	5.2	4.0	6.6	1.3
Brentwood	3.4	4.8	2.1	1.4	2.1	1.4	2.8	2.1	5.0	4.4	2.2	2.2	1.5	3.7	5.3
Broadland	2.4	1.2	3.6	1.2	1.2	4.9	3.7	6.2	3.7	2.5	1.2	3.7	3.8	5.0	1.3
Broxbourne	2.6	2.6	4.4	3.5	8.8	5.3	8.1	1.8	4.6	5.5	2.8	2.8	7.6	8.5	4.8
Cambridge	8.8	8.8	9.9	7.8	7.9	17.6	29.2	11.5	23.2	10.5	18.0	17.2	18.8	21.5	12.9
Castle Point	4.3	1.7	3.5	2.6	4.4	0.9	1.8	4.4	0.9	2.6	0.9	2.6	1.8	3.5	1.8
Central Bedfordshire	16.2	25.7	14.2	14.3	21.6	24.2	19.5	19.7	17.4	27.5	37.9	28.1	15.6	23.8	21.5
Chelmsford	0.0	12.6	12.7	11.2	24.4	4.9	11.5	14.8	11.6	8.3	10.0	15.2	3.4	6.8	15.4
Colchester	12.4	6.2	14.0	7.9	4.8	13.0	9.8	14.9	8.4	13.5	17.2	31.3	10.6	8.9	10.8
Dacorum	4.1	0.0	6.9	4.2	5.5	9.7	11.1	9.8	9.9	4.3	17.2	14.5	16.1	8.9	6.0
East Cambridgeshire	2.2	0.7	0.7	8.0	3.0	8.0	2.4	1.6	2.4	1.6	1.7	3.4	0.9	1.7	4.3
East Hertfordshire	0.0	5.2	3.9	0.0	6.5	5.2	6.6	2.7	2.7	2.7	4.1	8.3	4.2	2.8	7.2
Epping Forest	8.4	8.5	9.7	3.6	8.5	4.9	8.6	2.5	4.9	9.9	11.2	7.5	15.1	20.3	7.7
Fenland	4.1	3.3	8.0	0.0	4.4	0.9	1.8	2.8	6.6	2.8	1.9	5.7	3.8	10.6	9.8
Forest Heath	0.0	0.6	0.0	0.0	0.6	1.2	1.7	2.3	2.3	2.3	1.2	0.6	1.2	3.1	1.3
Great Yarmouth	2.7	0.9	1.8	7.4	4.7	1.9	5.7	8.6	14.4	14.5	6.8	9.7	9.8	4.9	10.8
Harlow	0.0	3.9	7.1	4.7	4.7	2.4	7.1	4.7	7.2	4.8	4.9	11.5	20.7	10.8	6.8
Hertsmere	7.5	9.4	11.3	8.5	4.7	10.4	8.6	4.8	7.8	8.9	16.9	10.0	12.1	10.1	10.2
Huntingdonshire	4.7	7.9	4.8	16.0	8.1	16.3	8.2	8.2	11.6	26.7	8.4	15.3	12.0	12.0	15.6
_Ipswich	8.2	4.7	17.7	6.0	14.5	7.4	3.7	15.1	11.5	19.4	15.8	9.4	9.4	6.7	14.8
East of England	5.4	6.0	6.3	5.7	7.1	8.1	8.2	7.2	8.5	8.5	8.4	9.2	8.1	7.3	7.0

Table Bii(cntd.): TB rate\* per 100,000 by local authority of residence, East of England, 2002 – 2014

\*rates calculated using ONS mid-year population estimates 2003 2004 2005 2007 2012 2014 2000 2001 2002 2006 2008 2009 2010 2011 2013 King's Lynn and West 4.0 4.1 8.2 8.3 2.8 8.5 8.6 2.9 8.8 4.4 7.4 5.9 3.0 16.0 13.5 Norfolk 120.6 128.3 161.5 136.9 123.0 161.3 138.6 151.8 140.2 177.9 191.6 219.9 175.0 126.9 154.0 Luton 1.2 0.0 0.0 1.2 1.2 0.0 0.0 0.6 1.2 0.6 1.2 0.6 0.6 0.6 Maldon 0.6 Mid Suffolk 0.0 0.9 1.8 0.9 0.9 2.7 0.0 2.8 0.9 1.0 2.9 2.0 1.0 3.0 1.0 Milton Keynes 48.3 51.0 63.8 81.8 59.6 19.4 28.3 39.5 53.6 97.7 101.7 89.5 79.3 90.0 111.0 North Hertfordshire 11.6 7.0 5.9 3.6 6.0 10.9 14.6 7.4 10.0 21.3 6.3 8.9 10.3 10.3 5.2 North Norfolk 3.9 0.0 2.0 0.0 0.0 4.0 3.0 14.0 5.0 4.0 2.0 5.1 0.0 5.1 1.0 8.5 Norwich 7.3 6.1 13.5 18.6 17.6 16.5 10.2 16.6 11.6 15.7 17.2 16.1 13.6 11.0 Peterborough 22.5 111.8 39.2 40.9 41.3 55.6 60.2 66.3 41.4 82.7 64.4 85.4 95.9 107.4 85.7 Rochford 1.6 4.0 3.3 2.5 2.5 4.2 8.0 1.7 8.0 0.8 8.0 8.0 1.6 2.4 8.0 South Cambridgeshire 3.9 3.9 1.3 13.7 8.4 12.7 17.2 13.1 7.4 7.5 15.1 10.6 9.2 11.9 8.1 South Norfolk 1.1 5.5 2.2 2.3 3.4 6.9 3.5 2.4 1.2 2.5 2.5 0.0 2.6 4.6 4.8 Southend-on-Sea 14.5 25.7 25.8 29.1 43.6 35.8 36.0 43.0 30.3 35.7 43.0 33.1 29.7 24.6 16.0 St Albans 5.2 13.3 3.9 9.1 2.6 15.8 14.5 4.0 9.5 9.7 22.3 9.9 11.4 10.0 11.6 St Edmundsbury 1.0 1.0 2.0 2.0 4.1 8.3 3.1 6.4 3.2 9.8 5.5 5.6 8.9 6.7 7.8 Stevenage 7.1 4.0 1.6 4.8 4.8 12.0 12.1 2.4 11.4 6.6 10.0 9.3 3.4 7.7 8.6 Suffolk Coastal 2.3 3.5 2.5 6.2 5.0 6.2 6.2 1.2 1.2 0.0 4.7 6.0 1.2 9.9 2.5 1.4 7.0 **Tendring** 6.9 5.6 7.0 2.8 4.2 4.2 0.0 0.0 5.6 4.2 6.9 1.4 5.5 3.4 5.3 9.9 Three Rivers 5.0 3.3 5.0 2.5 6.7 4.2 6.8 2.6 2.6 4.4 7.9 5.4 Thurrock 7.1 5.7 10.1 14.6 25.0 19.3 10.5 10.6 23.0 32.9 22.2 17.7 8.2 18.6 14.4 Uttlesford 0.7 0.7 0.7 0.0 1.4 2.9 2.2 8.0 3.8 2.4 8.0 0.0 1.7 8.0 1.4 Watford 7.2 14.5 11.2 12.9 7.3 17.3 12.4 7.6 11.2 14.2 20.9 9.4 13.4 19.7 10.1 10.4 3.5 6.9 5.8 Waveney 10.0 11.2 0.0 8.0 4.6 7.0 4.6 7.0 16.3 5.8 7.0 Welwyn Hatfield 1.0 2.0 0.0 1.0 6.0 7.2 5.3 5.3 17.2 17.3 7.7 26.6 10.1 6.8 11.6 7.2 **East of England** 5.4 6.0 6.3 5.7 7.1 8.1 8.2 8.5 8.5 8.4 9.2 8.1 7.3 7.0

Table Biii: TB case numbers and rate by age and sex, East of England, 2014

	Male				Female					All Cases				
Age group (years)	N	Rate	Lower CI	Upper CI	N	Rate	Lower CI	Upper CI	N	Rate	Lower CI	Upper CI		
0-14	8	1.38	0.60	2.73	6	1.09	0.40	2.37	14	1.24	0.68	2.08		
15-44	123	10.42	8.66	12.43	124	10.56	8.79	12.59	247	10.49	9.22	11.88		
45-64	65	8.14	6.28	10.37	48	5.84	4.31	7.74	113	6.97	5.75	8.38		
65+	42	7.87	5.67	10.64	22	3.43	2.15	5.20	64	5.45	4.20	6.96		
All ages	238	7.70	6.75	8.74	200	6.28	5.44	7.21	438	6.98	6.34	7.66		

Tuberculosis in the East of England (2014)

Table Biv: Drug resistance among TB patients with culture confirmed disease\*, East of England, 1999 – 2014

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

Year	Any Res	istance		niazid sistance	MDR		
	n	%	n	%	n	%	
2000	9	6.3%	7	4.9%	0	0.0%	
2001	19	10.6%	18	10.0%	2	1.1%	
2002	16	7.8%	13	6.3%	5	2.4%	
2003	19	8.8%	18	8.3%	5	2.3%	
2004	18	6.8%	18	6.8%	2	0.8%	
2005	29	9.2%	26	8.2%	3	0.9%	
2006	24	7.8%	23	7.5%	3	1.0%	
2007	17	6.8%	17	6.8%	1	0.4%	
2008	25	8.4%	24	8.1%	6	2.0%	
2009	20	6.9%	14	4.8%	5	1.7%	
2010	22	7.3%	20	6.6%	3	1.0%	
2011	30	8.7%	29	8.4%	12	3.5%	
2012	28	9.2%	24	7.8%	8	2.6%	
2013	19	6.8%	18	6.4%	1	0.4%	
2014	24	8.3%	22	7.6%	5	1.7%	

### Appendix C: Local authority TB epidemiological summaries

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