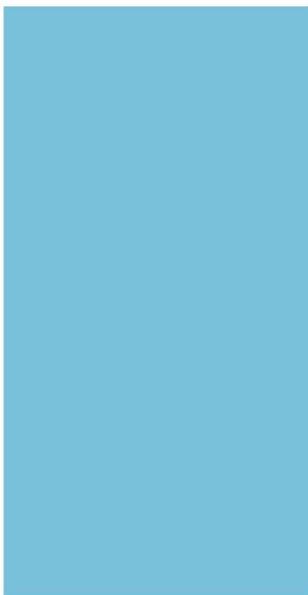
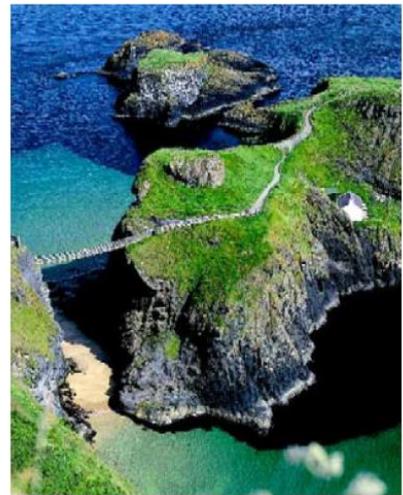
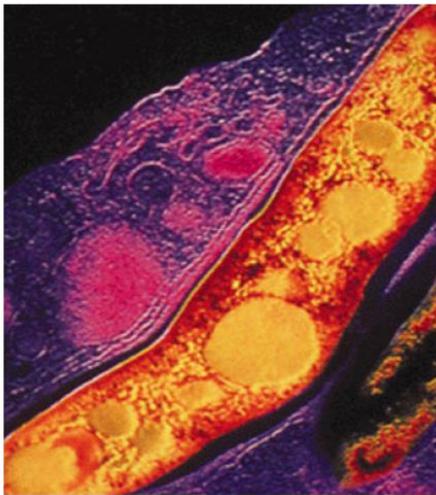


Epidemiology of Tuberculosis In Northern Ireland

Annual surveillance report 2016



Acknowledgements

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Key Points

- There were 85 cases of tuberculosis (TB) notified in Northern Ireland in 2016, giving a rate of 4.6 cases per 100,000 population. This represents a 37% increase in the number of cases and a 35% increase in the rate of TB from 2015 when the number of cases was 62 and the rate was 3.4 per 100,000. However, due to small numbers and considerable year to year variation relatively small differences in the number of cases can give rise to substantial percentage changes.
- Rates of TB were highest in the Southern Health and Social Care Trust at 8.1 cases per 100,000, a 16% increase compared with 2015 when the rate was 7.0 cases per 100,000. Rates of TB in this Trust have been increasing annually.
- The highest rates of TB were in those aged 65 years and over (7.5 per 100,000) but accounted for only 26% of TB cases reported in 2016.
- The proportion of TB cases that were born outside the UK increased slightly from 44% in 2015 to 46% in 2016.
- 40% of patients with pulmonary TB started treatment more than four months after symptom onset in 2016, an increase from 33% in 2015.
- The proportion of drug sensitive TB cases that completed treatment by 12 months, an indicator of the quality of the TB service, increased to 88% in 2016, a 5% increase compared with 2015.
- 7% of culture confirmed TB cases in 2016 were resistant to first line drugs, compared with 10% in 2015.

Introduction

This report presents the epidemiological data for tuberculosis (TB) cases reported in Northern Ireland from 1 January 2016 to 31 December 2016. For comparative purposes and to give indications of trends in TB epidemiology, this report will also present data from previous years.

Outcome of TB treatments are collected annually and reported in retrospect. The treatment outcomes reported in this report are therefore on individuals notified to the Public Health Agency from 1 January 2015 to 31 December 2015.

There may be slight differences in numbers of TB cases quoted in the UK National TB report compared with this regional report, principally due to differences in time of data extraction and analysis between the two reports. This regional report takes account of late notifications that may have been reported after the national data extraction process has taken place.

Definitions

Notified case: Refers to clinically active disease caused, or thought to be caused, by infection with organisms of the *Mycobacterium tuberculosis* complex (*M. tuberculosis*, *M. bovis*, *M. africanum*).

Culture confirmed cases: Where the diagnosis has been confirmed by culture as *M. tuberculosis*, *M. bovis* or *M. africanum*.

Other than culture confirmed cases: In the absence of culture confirmation, a case with a clinician's judgement that the patient's clinical and/or radiological signs and/or symptoms are compatible with tuberculosis *and* a clinician's decision to treat the patient with a full course of anti-tuberculosis treatment¹

Pulmonary tuberculosis: A disease involving the lung parenchyma and/or bronchial tree, with or without extra-pulmonary tuberculosis diagnosis.

Sputum smear result: Sputum smear positive tuberculosis is defined as a positive microscopy result on spontaneously produced or induced sputum.

Multi-drug resistance (MDR): Resistance to at least isoniazid and rifampicin.

Extensively-drug resistant (XDR): An MDR case with additional resistance to any fluoroquinolone and at least one of the second-line drugs (capreomycin, karamycin, amikacin).

Health and Social Care Trusts in Northern Ireland (HSCT): There are 5 HSCTs in Northern Ireland; Belfast (BHSCT), South East (SEHSCT), Northern (NHSCT), Southern (SHSCT) and Western (WHSCT).

Treatment outcome: A patient is defined as having completed treatment if; a) the case was reported, b) the patient completed a full course of treatment and c) was officially discharged by the attending physician.

Methodology

Data collection

Completed TB notification forms are forwarded to the Public Health Agency (PHA) in Northern Ireland where the information is entered onto a secure database. Treatment outcome forms are generated and forwarded, approximately twelve months after initial notification, to the patient's clinician, who then returns them to the PHA. This information is then appended to the initial notification details.

Information on *Mycobacterium tuberculosis* complex isolates are obtained from local hospital diagnostic laboratories and the mycobacterial reference laboratory. Collected data include species (*Mycobacterium tuberculosis*, *M. bovis* and *M. africanum*), specimen type, strain type and drug susceptibility.

Data on cause of death, including TB, are also collected from the Northern Ireland Statistics and Research Agency (NISRA).

Datasets are validated (using laboratory reports and anti-microbial susceptibility information), updated and analysed.

Data analysis

Data are entered onto the PHE National Enhanced TB Surveillance database and analysed using STATA. TB rates per 100,000 population, stratified by age, sex and Health and Social Care Trusts in Northern Ireland (HSCT), were calculated using the mid-year estimates of the Northern Ireland population from NISRA.

Results

Overall number of cases and rates of infection

In 2016, a total of 85 cases of TB were reported in Northern Ireland. This gives a rate of 4.6 cases per 100,000 population, a 35% increase from the rate of 3.4 cases per 100,000 reported in 2015, but a 12% decrease compared with 2014 when the rate was 5.2 per 100,000 (Figure 1).

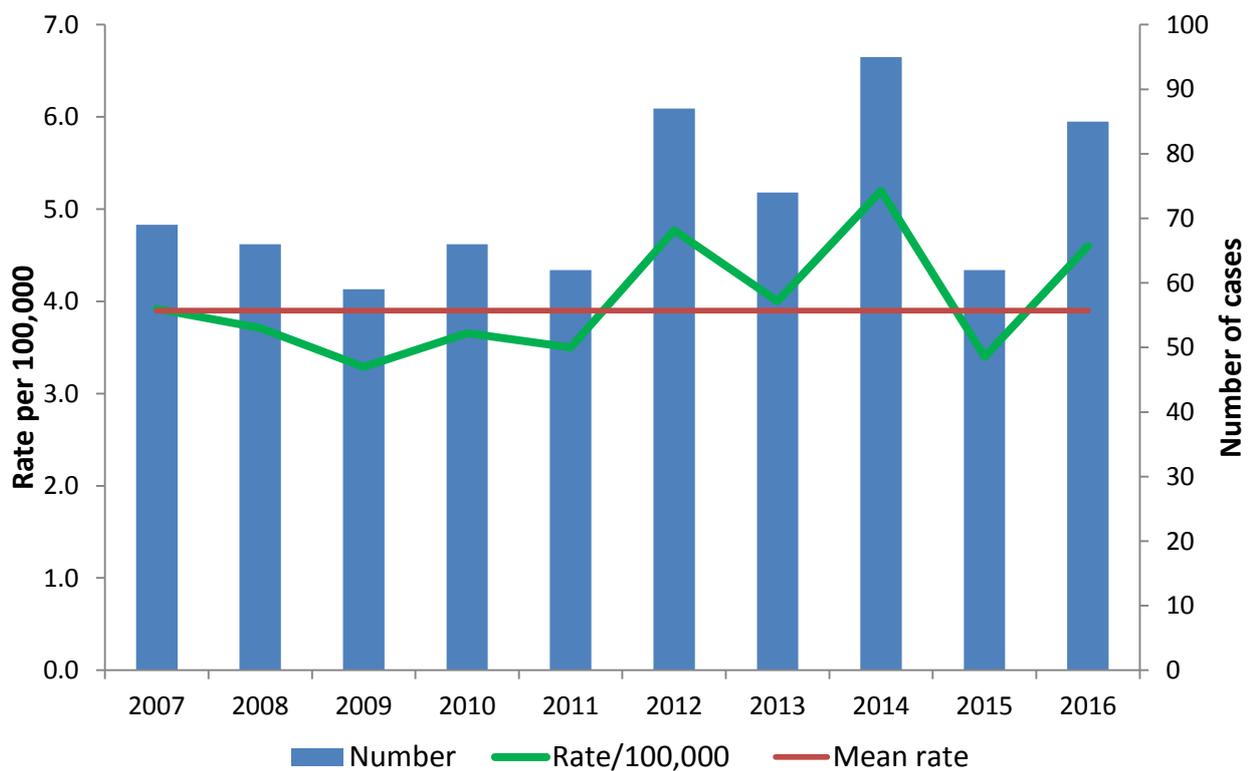


Figure 1: Tuberculosis case reports and rates, Northern Ireland, 2007-2016

Northern Ireland is a low incidence region for TB averaging 4 cases per 100,000 population. The three-year moving average numbers and rates of notified TB cases for 2006-2016 are shown in Figure 2.

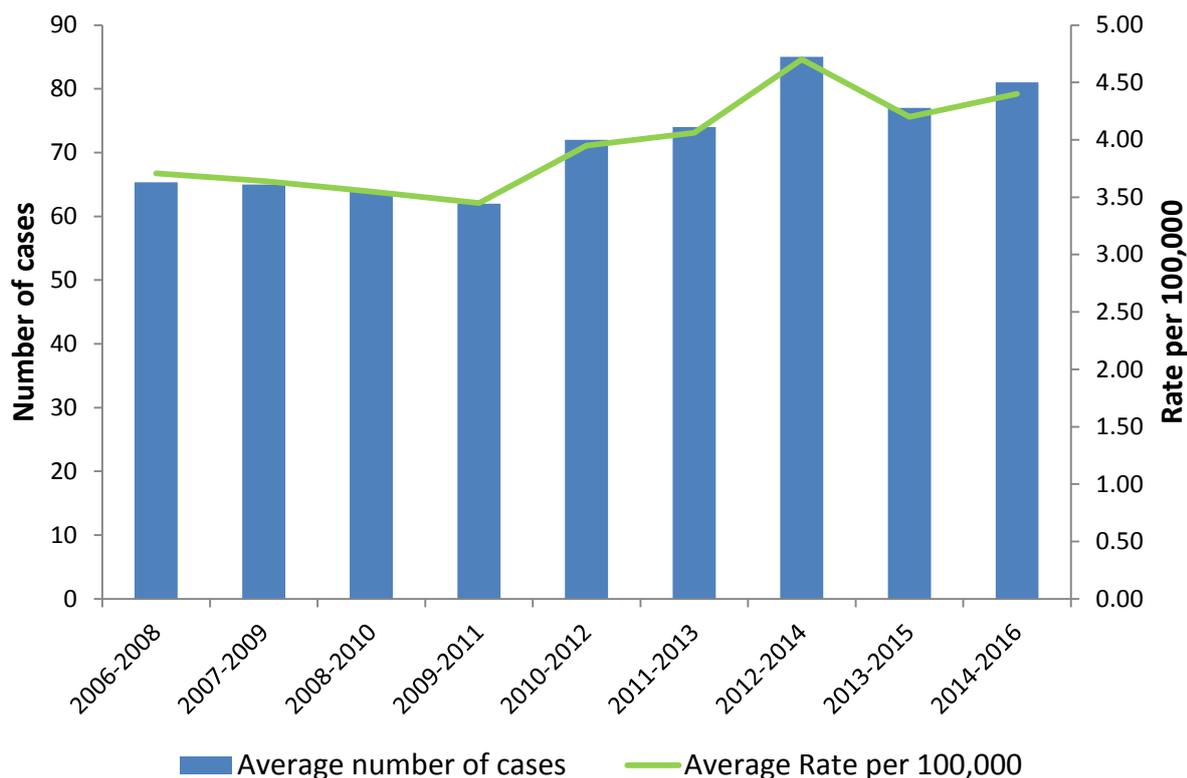


Figure 2: Three year moving average numbers and rates of Tuberculosis cases in Northern Ireland, 2006-2016

In 2016, TB rates were highest in the Southern Health and Social Care Trust (SHSCT) at 8.1 cases per 100,000 population, a 16% increase compared to 2015 when the rate was 7.0 per 100,000. TB rates also increased from 2015 to 2016 in both the Belfast Health and Social Care Trust (BHSCT) from 4.3 to 6.3 cases per 100,000, and in the Western Health and Social Care Trust (WHSCT) from 1.5 to 4.4 cases per 100,000. Rates of TB in 2016 remained similar to 2015 in the Northern Health and Social Care Trust (NHSCT) at 2.4 cases per 100,000 and in the South Eastern Health and Social Care Trust (SEHSCT) at 2.6 cases per 100,000. Rates of TB in the SHSCT are increasing annually and for the last number of years have had higher rates than the more urban BHSCT. Small numbers of cases in some of the Trusts will affect percentages (Figures 3 and 4).

Epidemiology of Tuberculosis in Northern Ireland, Annual Surveillance Report 2016



Figure 3: Tuberculosis case reports and rates by Health and Social Care Trust, Northern Ireland, 2007-2016

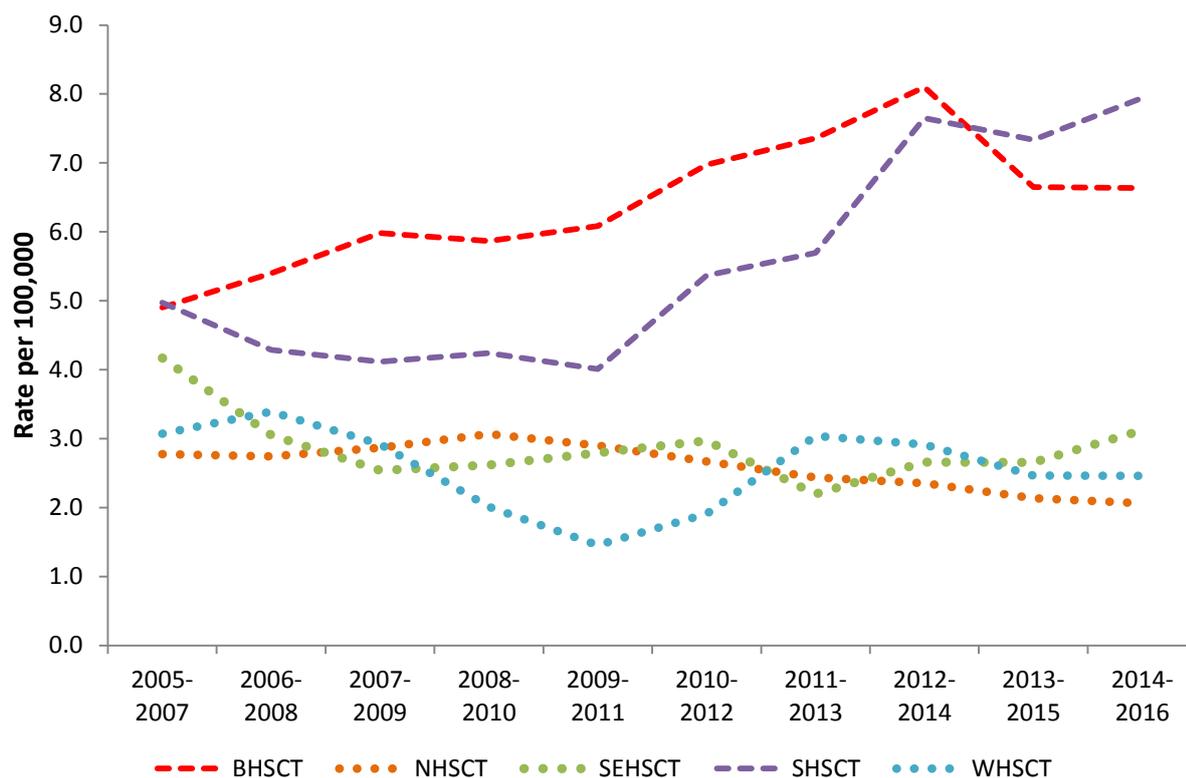


Figure 4: Three year moving average number and rates of Tuberculosis cases by HSC in Northern Ireland, 2005-2016

Demographic Characteristics

Age and gender:

Of the 85 notified cases of TB in 2016, 49 were male and 36 were female, giving a sex ratio male/female (M/F) of 1.36. The ages ranged from 4 years to 88 years, with a median age of 47 years and a mean age of 48 years. Patients aged 15-44 years accounted for 42% of cases, a decrease from 2015 when this group accounted for 60% of cases. Those aged 45-64 years accounted for 28% in 2016 (19% in 2015); those age 65 years and over accounted for 26% in 2016 (16% in 2015); and patients aged 0-14 years accounted for the remaining 4% of TB cases in 2016 (5% in 2015).

In 2016, rates of TB were highest in those aged over 65 years at 7.5 per 100,000 population. This age-group accounted for 26% (n=22/85) of TB cases reported in 2016 (Figure 5). While the rate of TB in this age-group increased significantly compared with 2015 (3.4 per 100,000), on average the highest rates of TB in Northern Ireland remained in those aged 15-44 years (Figure 5a).

In 2016, the highest proportion of UK-born cases were in those aged 65 years and over (48%, n=22/46). 33% (n=15/46) of UK-born cases were in those aged 45-64 years, 13% (n=6/46) were aged 15-44 years and the remaining 6% (n=3/46) were aged 14 years or under. In comparison, the highest proportion of non-UK born cases were in those aged 15-44 years at 77% (n=30/39), with the additional 23 % (n=9/39) of cases being in those aged 45-64 years. There were no cases of TB reported in those under 14 years or in those aged over 65 years in individuals born outside the UK in 2016.

In 2016 there was also some evidence of recent transmission with four cases of TB diagnosed in those aged 16 years or under. Three of the four cases were born in the UK/Ireland.

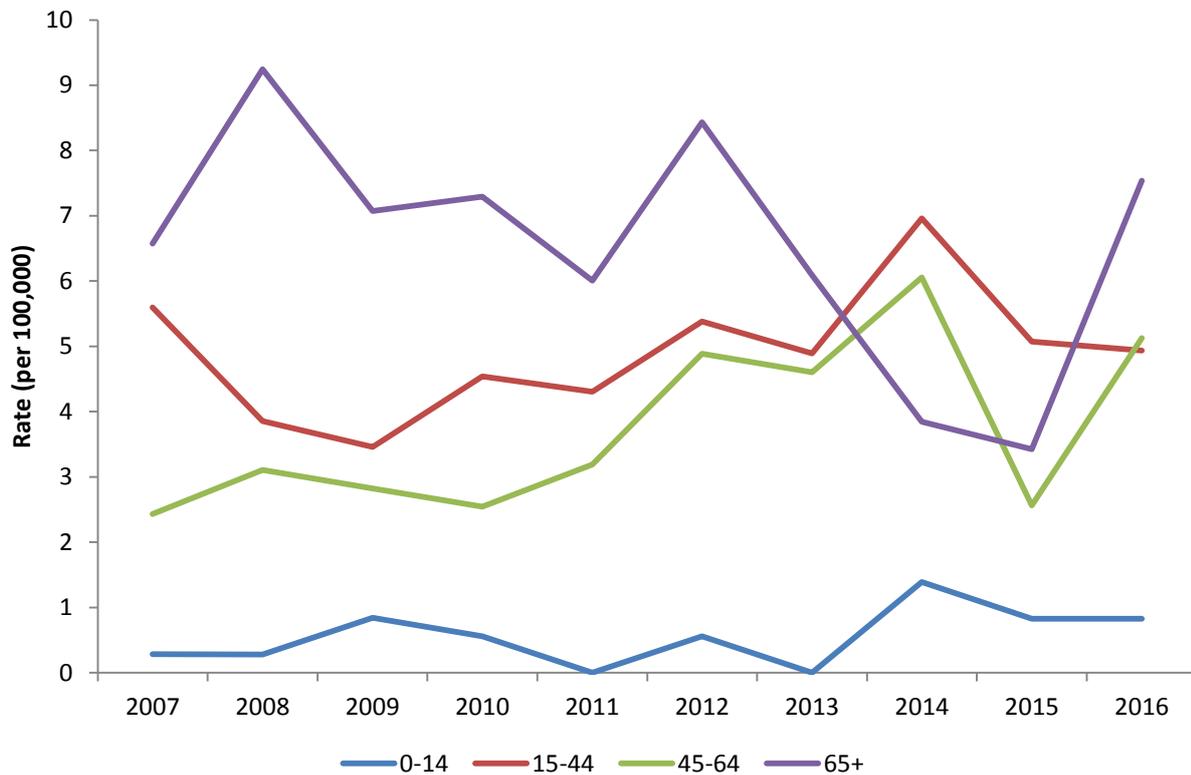


Figure 5: Northern Ireland TB rates per 100,000 by age group, 2007-2016

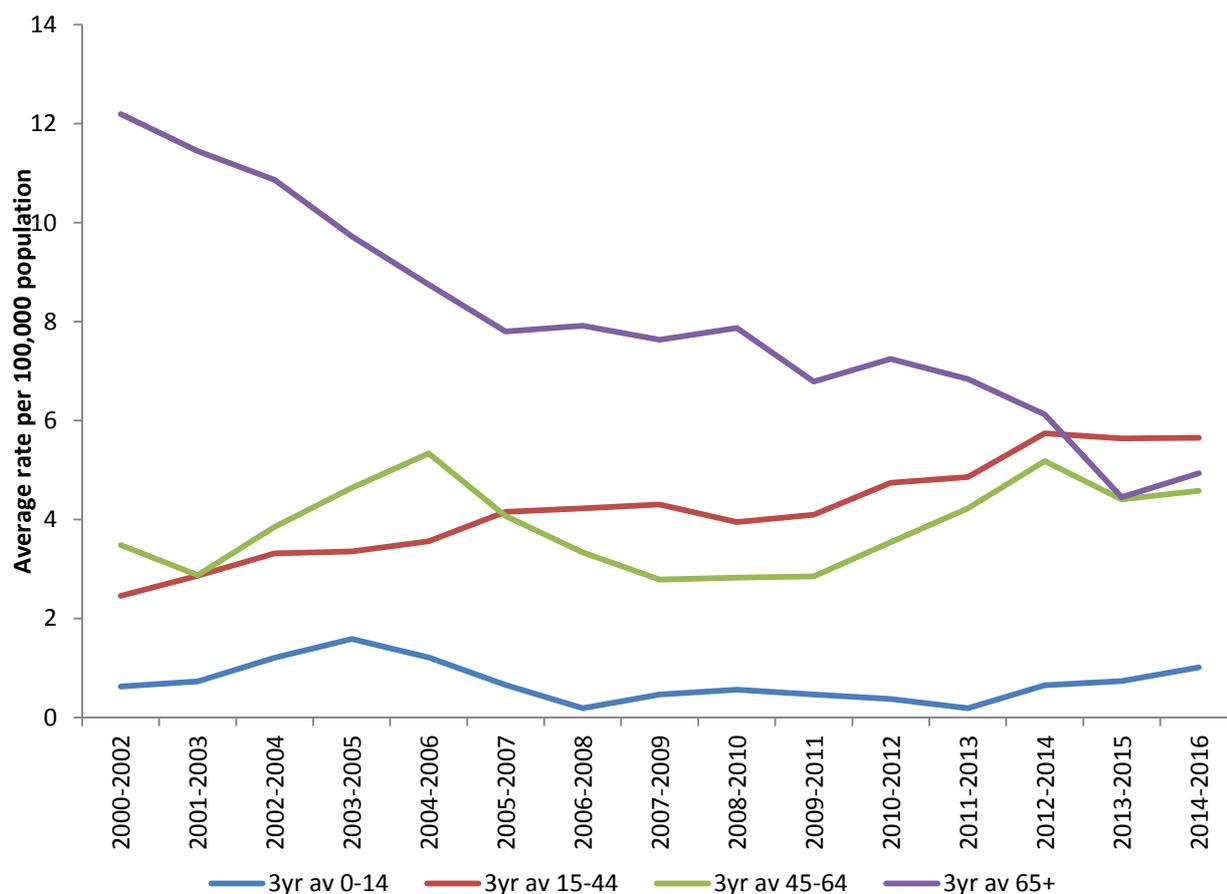


Figure 5a: Northern Ireland three year moving average TB rates per 100,000 by age group, 2000-2016

Place of birth

In 2016, 46% (n=39/85) of TB cases were born outside the UK/Ireland, a slight increase compared with 2015 when the proportion of non-UK-born cases was 44%. The rate of TB in the UK-born population remained relatively stable at 2.6 per 100,000 population in 2016 compared with 2.0 per 100,000 in 2015. The highest rates of TB remained in those born outside of the UK/Ireland, with rates in this group increasing from 33.2 per 100,000 in 2015 to 48.0 per 100,000 in 2016 (Figure 6).

The country of origin was known for all 39 TB cases born outside the UK/Ireland in 2016. Similar to previous years the majority of TB cases born outside the UK/Ireland in 2016 originated from South-East Asia (46%, n=18/39). However, the proportion was less than 2015 (88%, n=21/24) (Figures 7 and 8). Timor-Leste (28%, n=11/39), India (15%, n=6/39) and Lithuania (15%, n=6/39) were the most common countries of origin.

Information was available on ethnicity for all cases in 2016. The highest proportion of cases were of white ethnicity (67%, n=57/85), with 11 of these cases born outside the UK/Ireland.

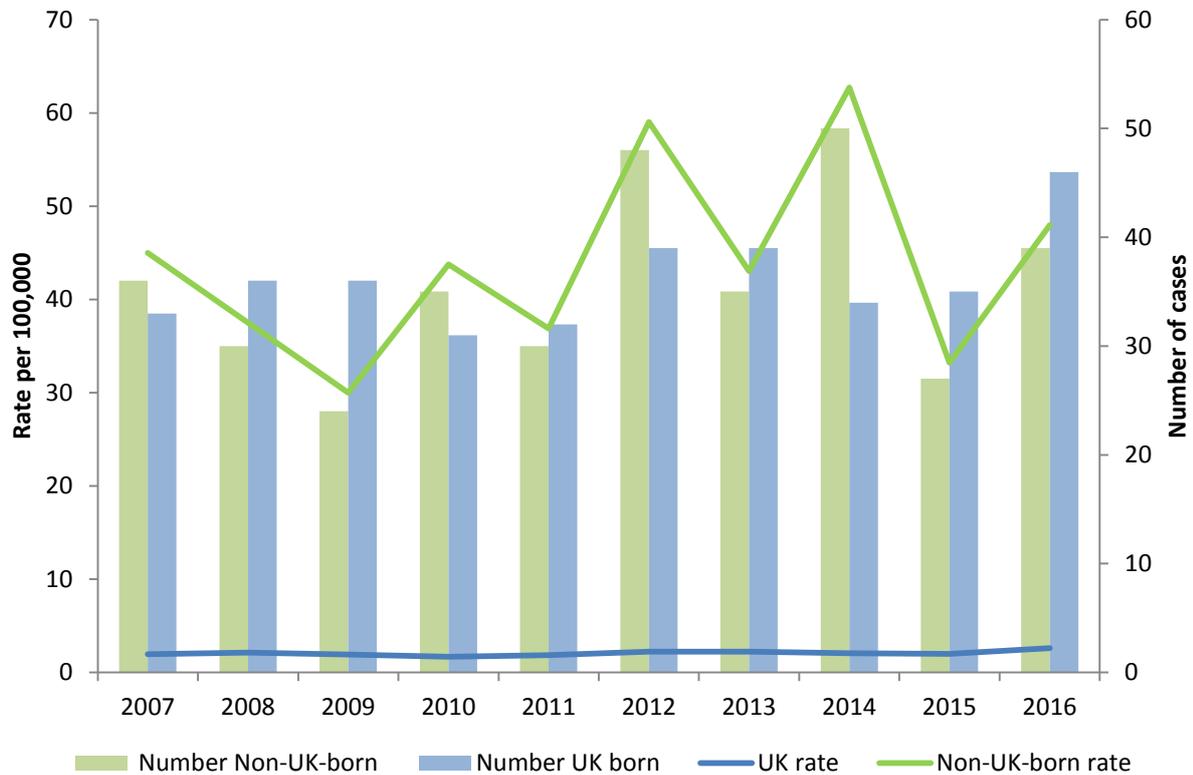


Figure 6: Northern Ireland numbers and rate per 100,000 of UK-born and Non-UK born tuberculosis case reports, 2007-2016

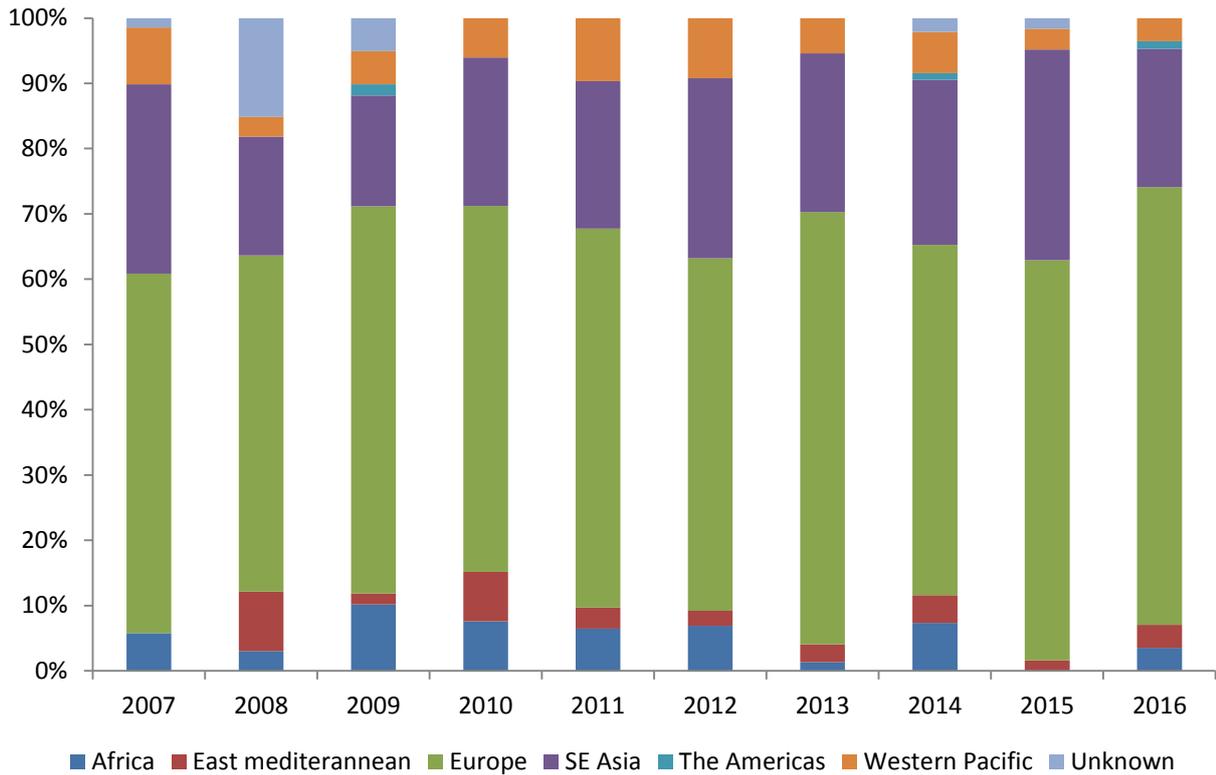


Figure 7: Northern Ireland tuberculosis reports by WHO region of case, 2007-2016

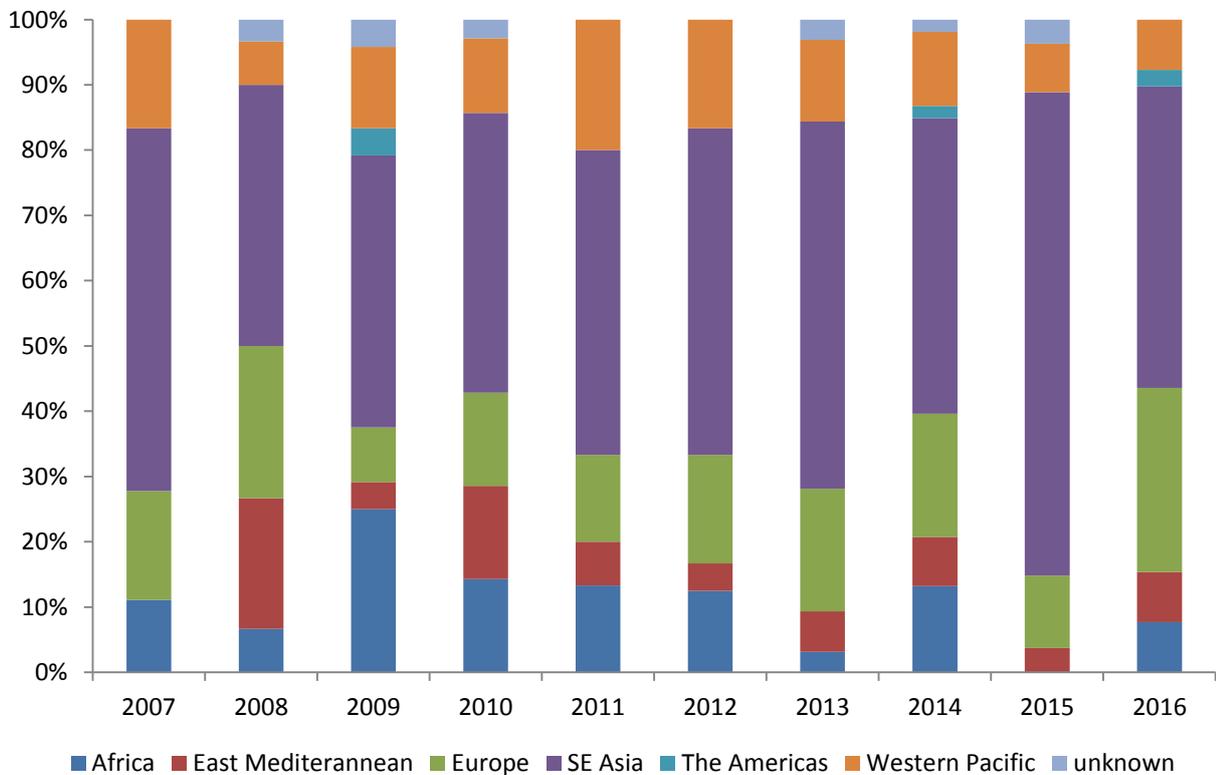


Figure 8: Non-UK Born tuberculosis reports in Northern Ireland by WHO region, 2007-2016

Time from entry to UK to diagnosis

Time from entry into Northern Ireland until TB diagnosis was known for 74% (n=29/39) of cases born outside the UK/Ireland in 2016. Of these, 31% (n=9/29) were diagnosed within two years of entry; 48% (n=14/29) were diagnosed between three and nine years of entry; and the remaining 21% (n=6/29) had been in Northern Ireland for ten years or more before diagnosis.

Social risk factors

In 2016, there were eight (9%) TB cases with reported social risk factors. The risk factors associated with the cases were reported as being homeless and/or a history of alcohol misuse/abuse or were in prison in the last five years. Five of the eight TB cases had alcohol as a principal social risk factor, with four of the five cases born in the UK. However, non-reporting of risk factors may not be indicative of there being no risk factors existing; therefore it is difficult to ascertain the true incidence.

Deprivation

In 2016 the rate of TB in the 20% of the population living in the most deprived areas of Northern Ireland was 8.2 per 100,000 population compared with 2.6 per 100,000 in the 20% of the population living in the least deprived areas. The rates of TB generally increased with increasing deprivation (Figure 9).

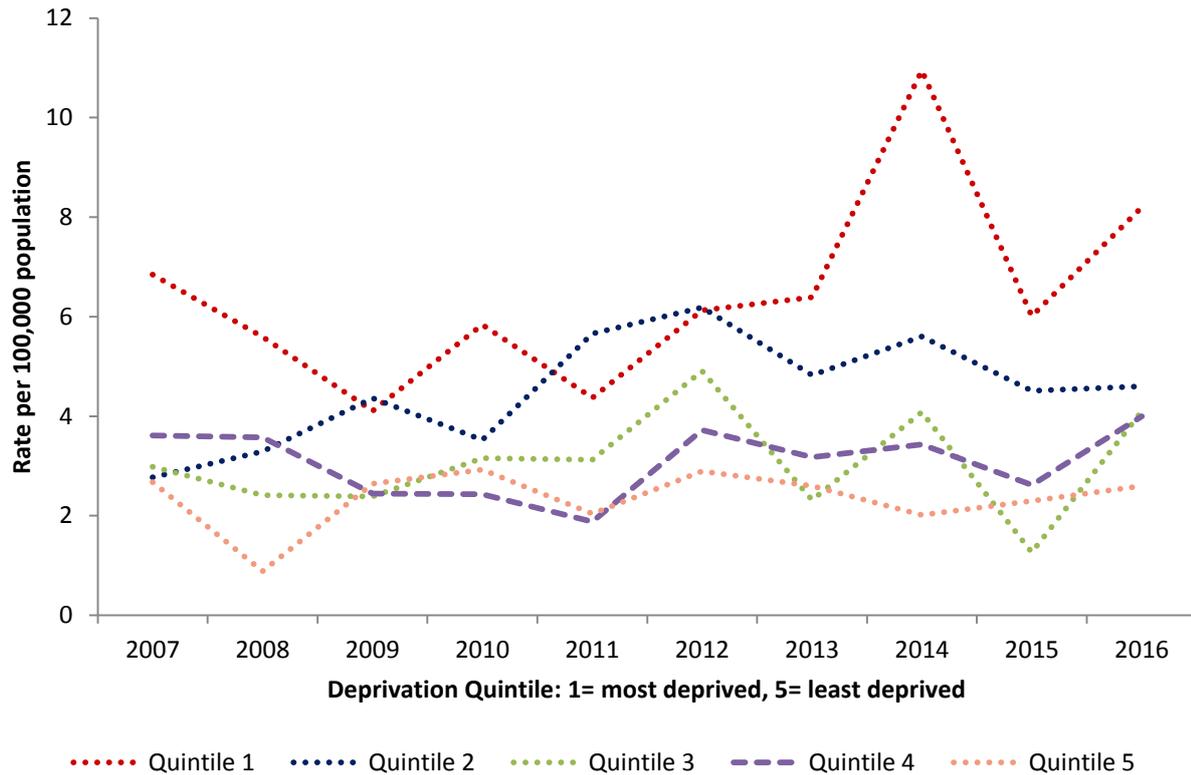


Figure 9: Rate of TB by deprivation, Northern Ireland 2007-2016

The Index of Multiple Deprivation (IMD) 2010, is an overall measure of multiple deprivation experienced by people living in an area and is measured at Super Output (SOA) level. Commissioned output is based on Small Area Population Estimates for 890 Super Output Areas in Northern Ireland. NISRA - Demography and Methodology Branch

Clinical Characteristics

Similar to 2015, 56% (n=48/85) of cases had a pulmonary component in 2016. Eleven cases (13%) of pulmonary disease were reported to have extra-pulmonary disease in at least one additional site.

The rate of pulmonary TB cases in Northern Ireland increased slightly from 1.9 per 100,000 population in 2015 to 2.6 per 100,000 in 2016. The rates of non-pulmonary disease in the region also increased slightly from 1.5 cases per 100,000 in 2015 to 2.0 per 100,000 in 2016 (Figure 10).

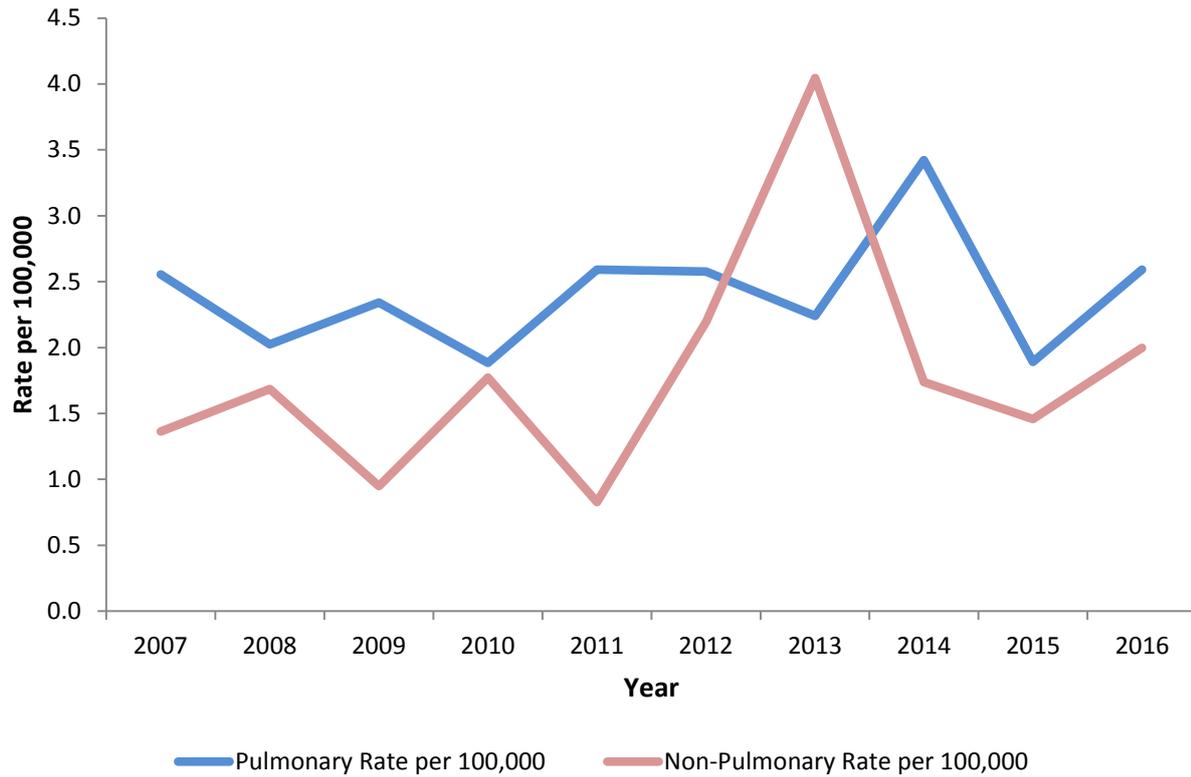


Figure 10: Rates of pulmonary and non-pulmonary tuberculosis, Northern Ireland, 2007-2016

Site of disease-Pulmonary

In 2016, 67% (n=31/46) of cases born in the UK/Ireland had pulmonary disease, compared with 60% in 2015. The proportion of pulmonary disease in those born outside the UK/Ireland continued to decrease from 52% in 2015 to 43% (n=17/39) in 2016 (Figure 11).

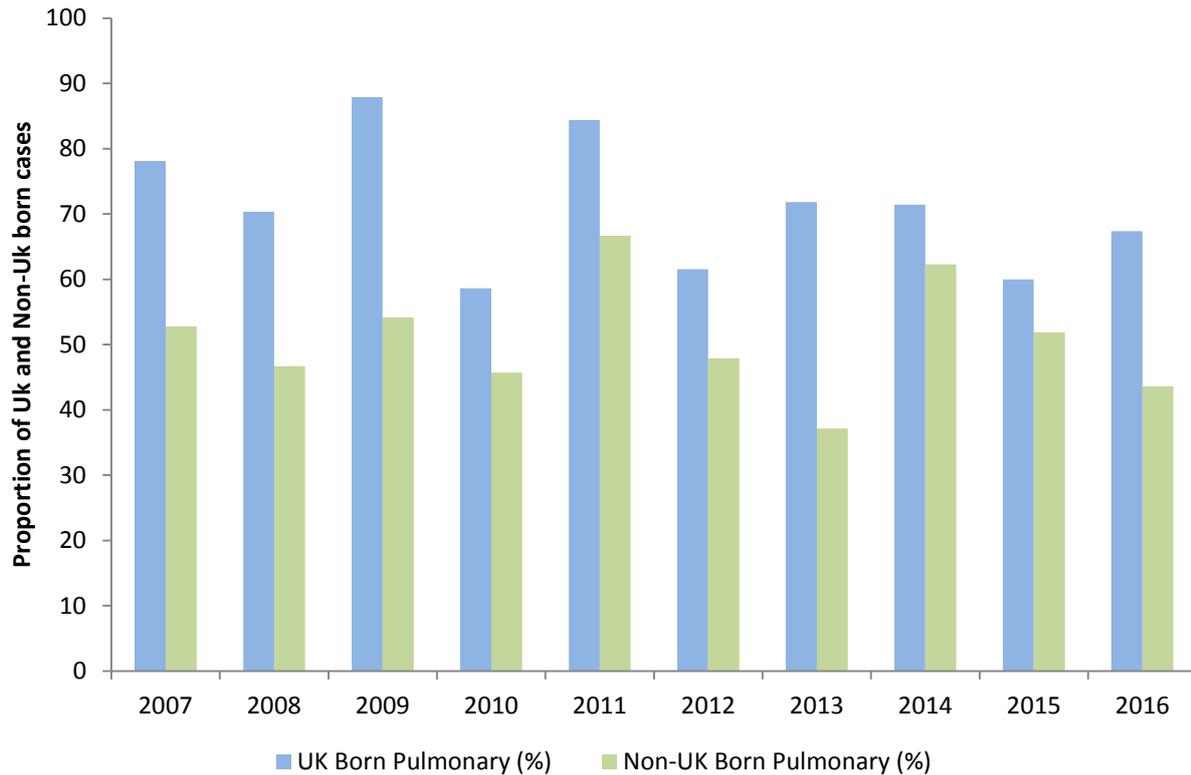


Figure 11: Proportion of UK and Non-UK born tuberculosis cases pulmonary in Northern Ireland 2007-2016

Pulmonary disease rates increased in the elderly age groups in 2016 compared with 2015. In both males and females the highest rates of pulmonary TB disease were in those aged over 65 years at 6.9 and 3.7 per 100,000, respectively. Pulmonary disease rates decreased in those under 44 years compared with 2015 and rates remained lower in females than males (Figures 12 and 13).

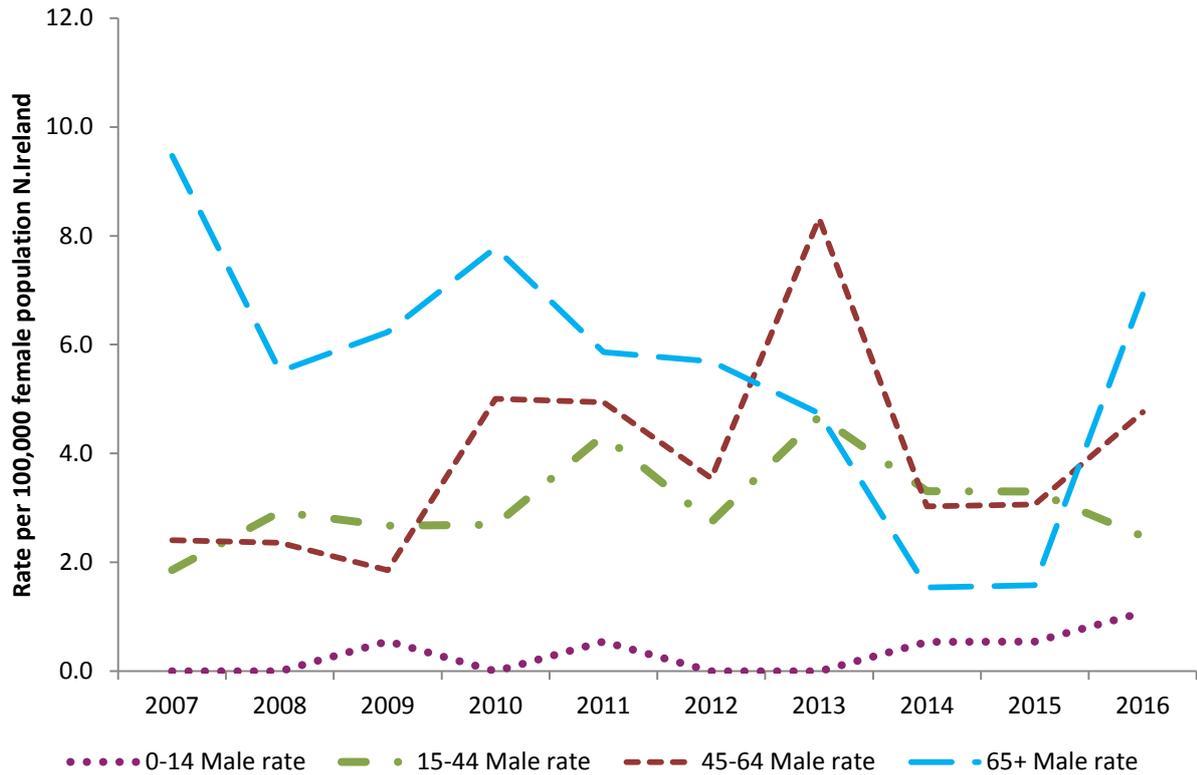


Figure 12: Pulmonary age-specific disease rates in males in Northern Ireland, 2007-2016

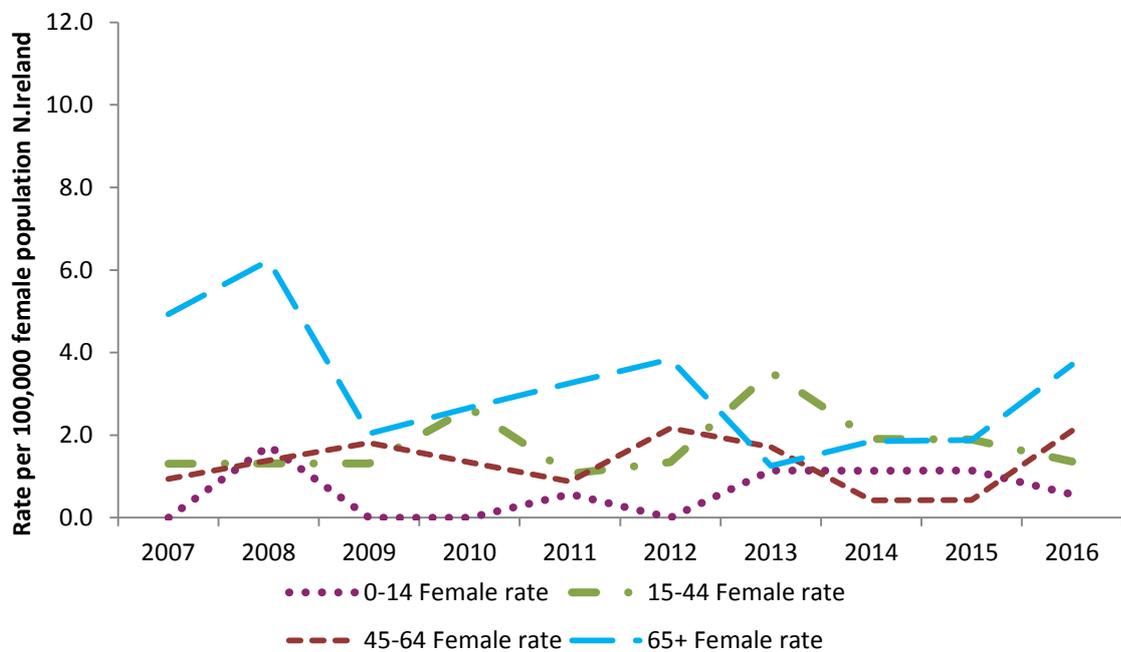


Figure 13: Pulmonary age-specific disease rates in females in Northern Ireland, 2007-2016

Similar to last year the SHSCT had the highest rate of TB in 2016 with a pulmonary component at 4.8 cases per 100,000 population, with TB pulmonary infection accounting for 60% (n=18/30) of all TB cases reported in this HSCT (Figure 14). Similar to 2014 and 2015, the WHSCT had the highest proportion of pulmonary cases in 2016, with 77% (n=10/13) of all cases in this Trust having a pulmonary component, eight of these ten cases were born in the UK/Ireland (Figure 14).

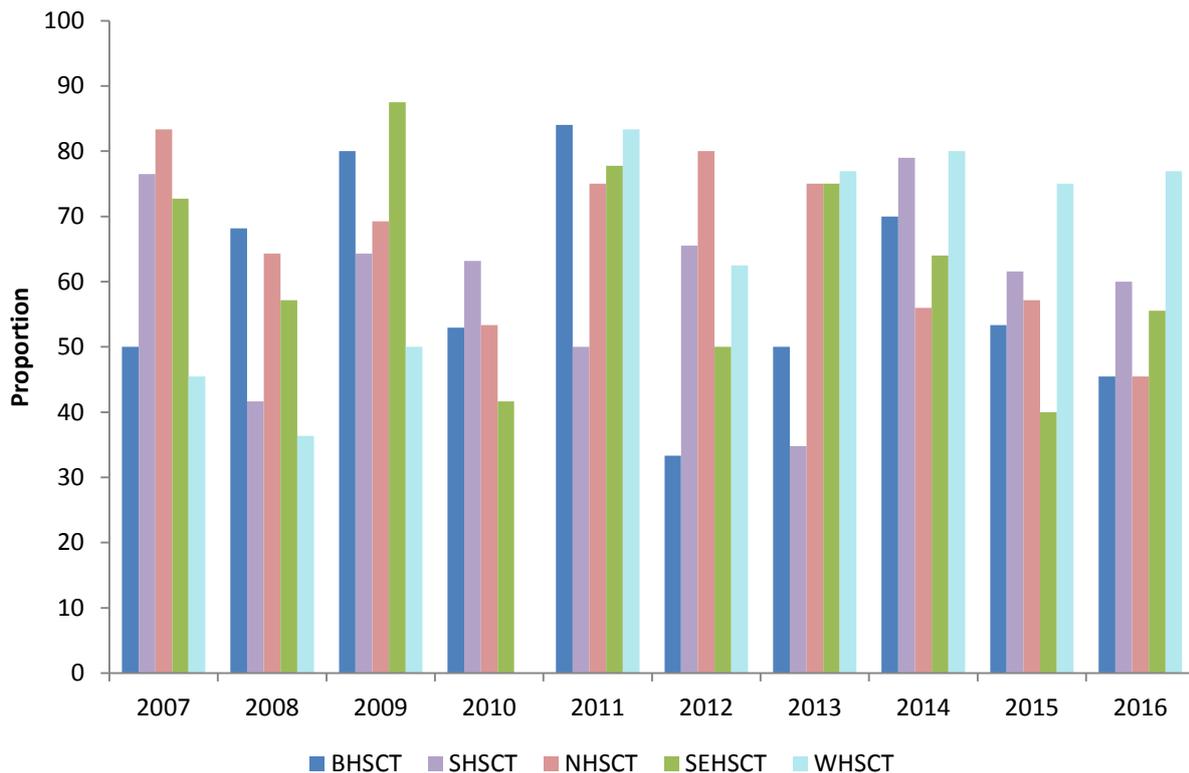
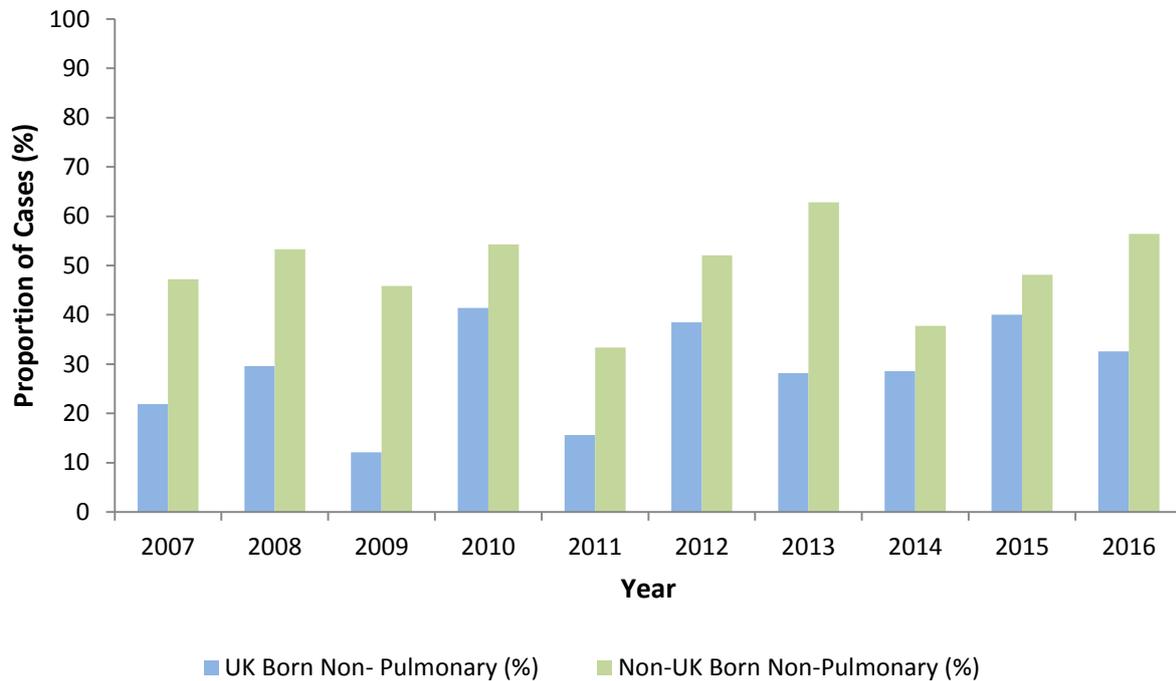


Figure 14: Proportion of TB cases in Northern Ireland HSCTs with pulmonary infection, 2007-2016

Site of disease - Non-pulmonary

Of the 85 cases notified in 2016, 37 cases were diagnosed with non-pulmonary TB (44% of all cases notified), which is a similar proportion to 2015. The proportion of cases born outside the UK/Ireland that presented with non-pulmonary TB increased again this year from 38% in 2014 to 48% in 2015 to 59% (n=22/37) in 2016 (Figure 15).



** Cases only included where place of birth was known

Figure 15: Proportion of UK and Non-UK born tuberculosis cases Extra-pulmonary in Northern Ireland 2007-2016

BHSCT had the highest rate of extra-pulmonary TB at 3.4 cases per 100,000 population and accounted for 55% (n=12/22) of all TB cases reported in this HSCT in 2016 (Figure 16).

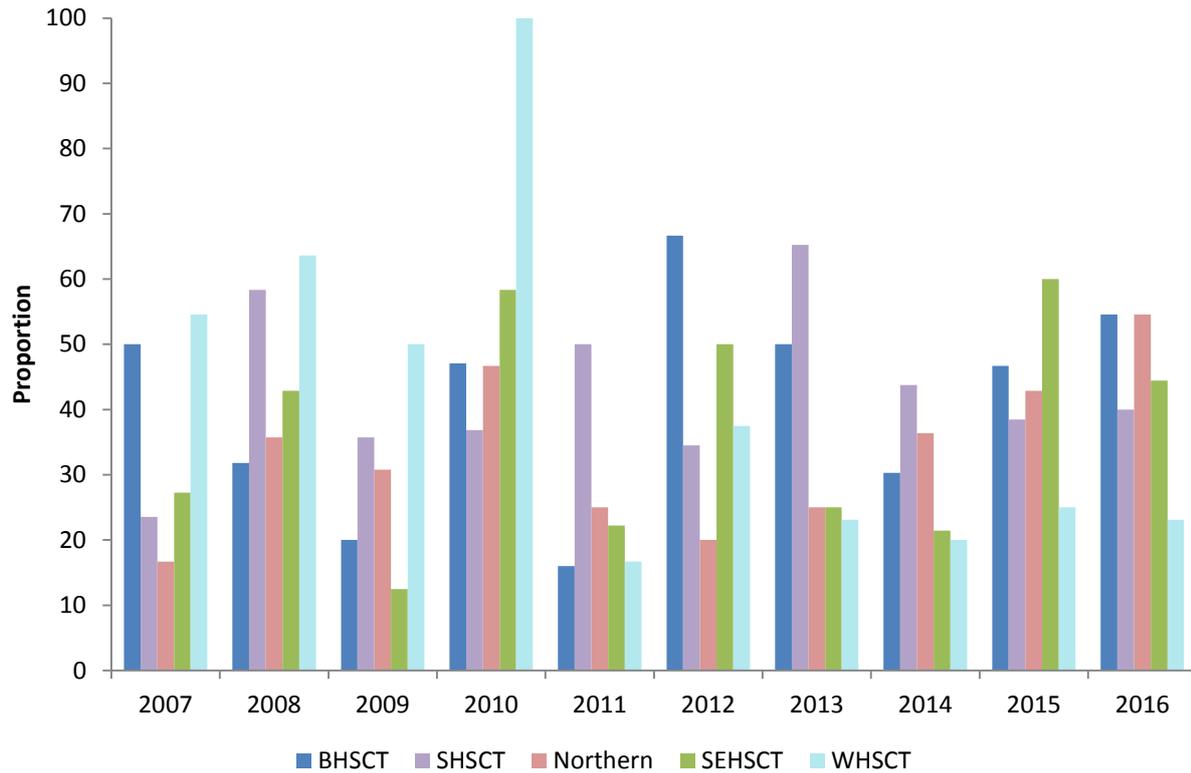


Figure 16: Proportion of TB cases in Northern Ireland HSCs with non-pulmonary infection, 2007-2016

Of the 37 non-pulmonary cases of TB notified during 2016, 18 cases were male and 19 were female. The average age of pulmonary disease cases was slightly older at 50.1 years compared to non-pulmonary disease cases at 45.4 years. The highest age-specific rate of non-pulmonary cases was in males aged 15-44 years at 3.3 per 100,000 population, while the highest age specific rate of pulmonary cases was in older males aged over 65 years at 6.9 cases per 100,000 (Figures 17 and 18).

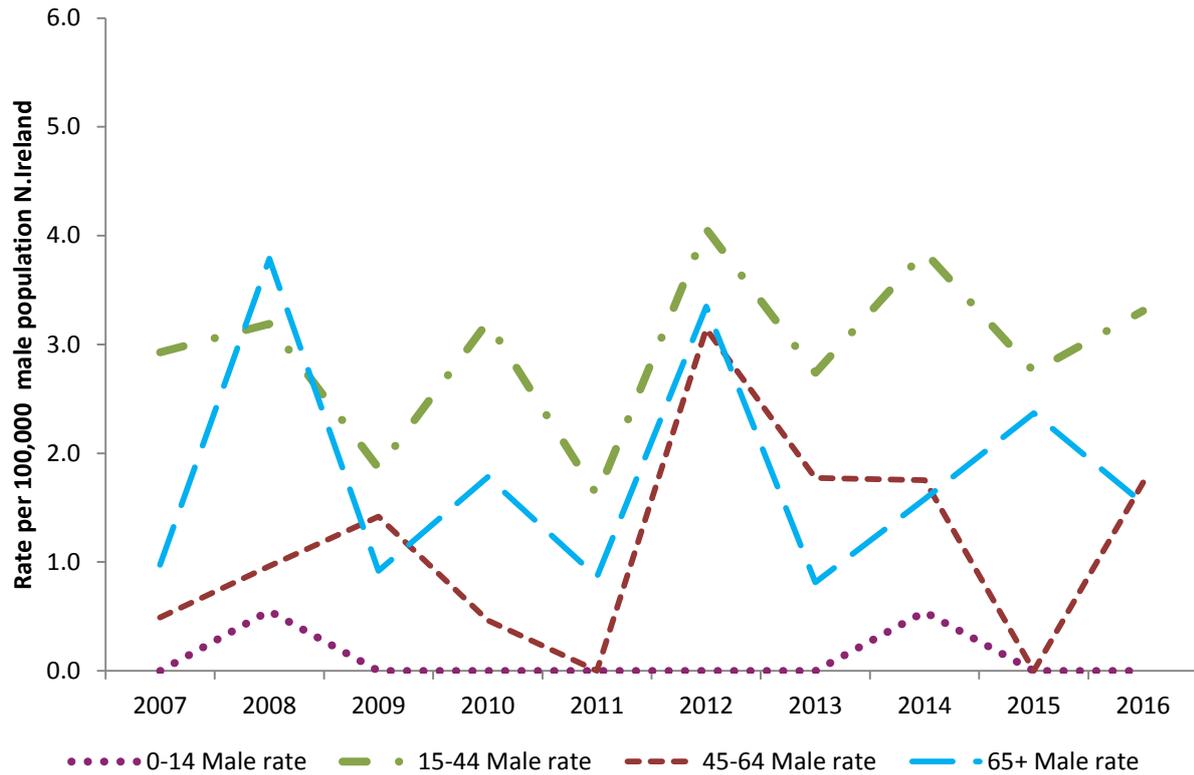


Figure 17: *Non-pulmonary age-specific rates in males in Northern Ireland, 2007-2016*

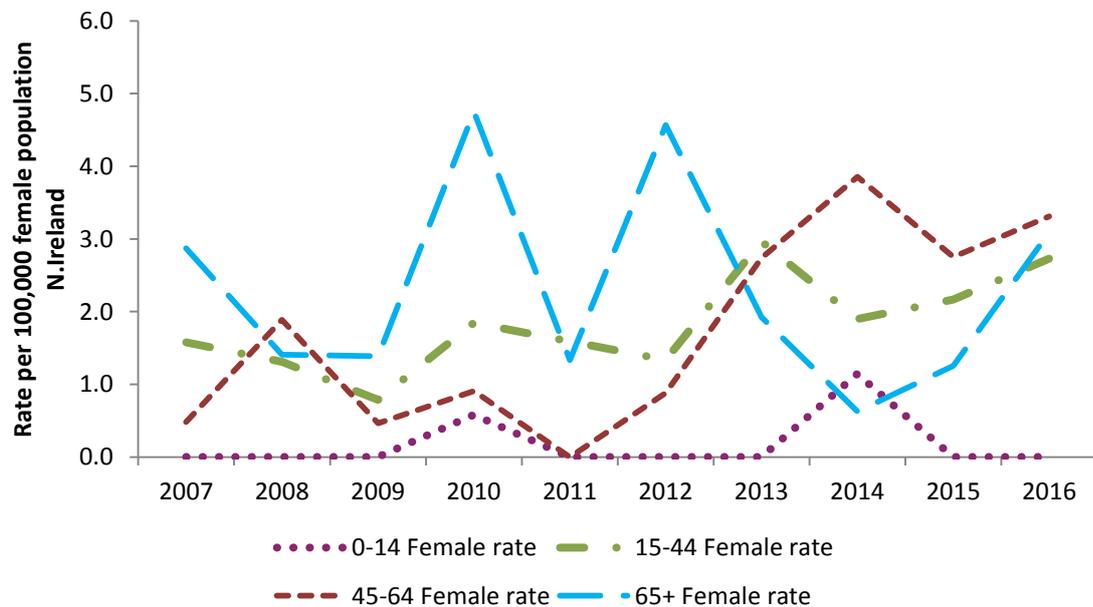


Figure 18: *Non-pulmonary age-specific rates in females in Northern Ireland, 2007-2016*

The site(s) of disease for the tuberculosis cases in 2016 is available in Table 1.

Table 1: Tuberculosis case reports by site of disease, Northern Ireland, 2016

Site of Disease	Number of cases	Proportion of all cases
Pulmonary	48	56%
Extra-thoracic lymph nodes	24	28%
Intra-thoracic lymph nodes	6	7%
CNS meningitis	5	6%
Gastrointestinal	3	4%
Pleural	3	4%
Miliary	2	2%
Bonejoint-spine	2	2%
Genitourinary	2	2%
Bonejoint-other	1	1%
CNS other	1	1%
Cryptic disseminated	1	1%
Laryngeal	0	0%

Note: Total percentage exceeds 100% due to infections at more than one site.

Previous diagnosis of tuberculosis

In 2016 seven cases reported a previous history of TB. Five of these cases had pulmonary disease of which three reported having TB more than 30 years ago, with the remaining two cases reporting having TB between 7 and 10 years ago.

Time symptomatic

The time between onset of symptoms and starting treatment was known for 79 (93%) cases in 2016. Of the 79 cases: 34% (n=27) were treated within two months of onset of symptoms with a median time frame of 38 days (IQR 21-48); an additional 15% (n=12) of cases were treated within two to four months of onset with a median time period of 79 days (IQR 69-101); and the remaining 51% (n=40) of cases reported a treatment period from onset of symptoms greater than four months with a median time period of 228 days (IQR 149-611).

The time between onset of symptoms and starting treatment was known for 43 (90%) of the 48 pulmonary cases in 2016. The overall median time period from onset of symptoms to treatment was 91 days (IQR 45-166). This period was lower than for non-pulmonary cases where the median time period from onset to treatment was 151 days (IQR 61 to 304) (Table 2).

Table 2: Time between onset of symptoms and start of treatment (days)

All cases	Number	Median	IQR
0-2 months	27	38	21-48
2-4 months	12	79	69-101
>4 months	40	228	149-611
All	79	129	47-228
Pulmonary cases			
0-2 months	17	39	22-47
2-4 months	07	86	70-100
>4 months	19	196	139-316
All pulmonary	43	91	45-166
Non-pulmonary			
0-2 months	10	34	21-43
2-4 months	05	72	66-98
>4 months	21	269	175-960
All non-pulmonary	36	151	61-304

Microbiology

In 2016, 65% (n=55/85) of TB cases were culture confirmed, slightly lower than the proportion in 2015 (68%). Of the 55 isolates culture confirmed, 52 were identified as having *Mycobacterium tuberculosis* infection and three were *Mycobacterium bovis*. The additional 30 cases were notified on the basis of clinical or non-culture diagnosis and response to anti-tuberculosis therapy. Of these 30 cases, 10 (33%) were confirmed by histology.

Of the 48 pulmonary cases in 2016, 79% (n=38) were culture positive. Sputum smear results were known for 36 (75%) of the 48 pulmonary infection cases. Seventeen (35%) pulmonary cases were sputum smear positive at notification, of which all were confirmed by culture. An additional 18 (38%) pulmonary infection cases were sputum smear negative of which 12 were later confirmed by culture as *M. tuberculosis* and one as *M. bovis*. Of the 13 (27%) pulmonary cases where sputum smear status was not known or not done, eight were culture confirmed (Table 3).

Of the 37 extra pulmonary cases in 2016, 46% (n=17) were culture positive, 30% (n=11) were culture negative and the remaining nine cases were not cultured.

Table 3: Pulmonary, Culture positive and Sputum Smear positive tuberculosis cases, Northern Ireland, 2007-2016

Year	Pulmonary Cases	Culture Positive (%)	Culture and Sputum Smear Positive (%)
2007	45	93%	51%
2008	36	83%	39%
2009	42	86%	33%
2010	34	97%	59%
2011	47	81%	40%
2012	47	77%	36%
2013	41	66%	32%
2014	63	68%	41%
2015	35	83%	37%
2016	48	79%	35%
Total	438	80%	39%

Table 4. Non-Pulmonary, culture positive tuberculosis cases, Northern Ireland, 2007-2016

Year	Non-Pulmonary Cases	Culture Positive (%)
2007	24	63%
2008	30	70%
2009	17	76%
2010	32	69%
2011	15	67%
2012	40	45%
2013	33	55%
2014	32	66%
2015	27	41%
2016	37	46%
Total	287	60%

Drug resistance

Isoniazid, rifampicin, ethambutol and pyrazinamide are first-line drugs for treatment of TB in the UK. Drug susceptibility test results were available for all 55 culture confirmed cases of TB in Northern Ireland in 2016.

In 2016, there was one multi-drug resistant case of TB recorded with an additional three TB cases resistant to Isoniazid at the start of treatment, representing 7% of all culture confirmed cases. Three of the four cases were born outside the UK/Ireland with none of the four cases having a previous diagnosis of TB. All three *M. bovis* cases were also resistant to pyrazinamide (Figure 19).

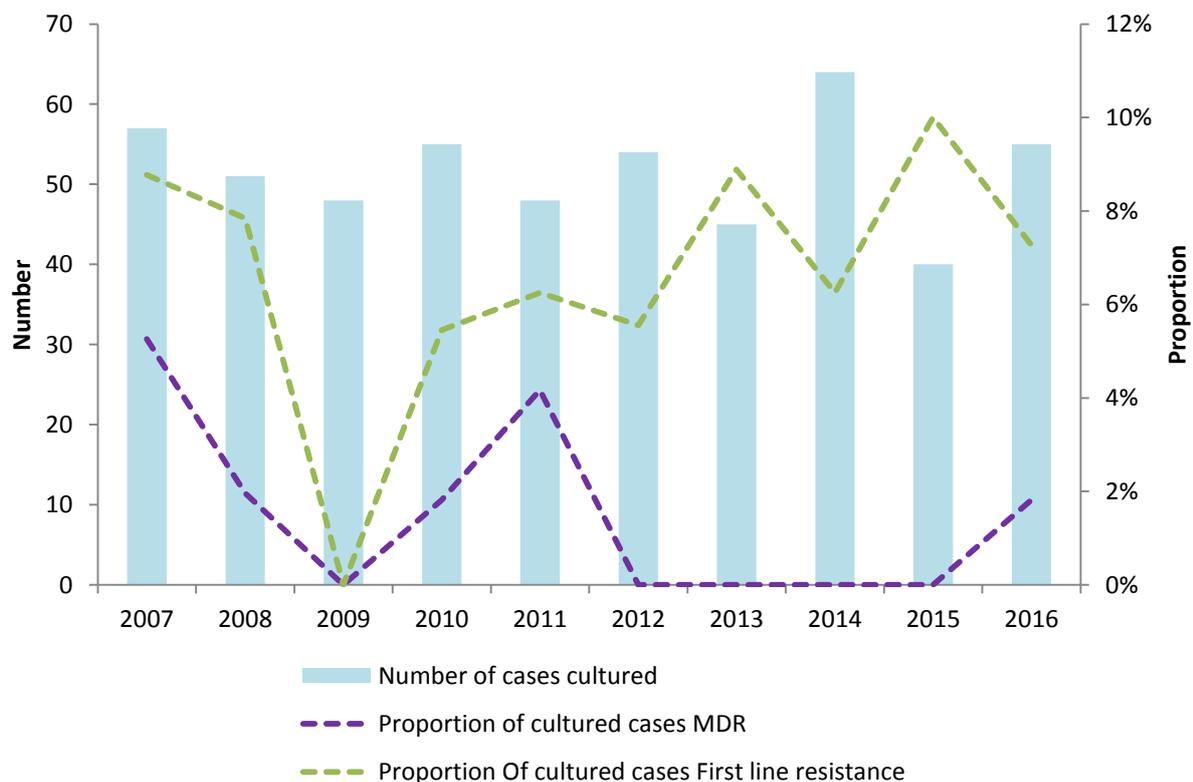


Figure 19: Number and proportion of drug resistant cases of tuberculosis in Northern Ireland, 2007-2016

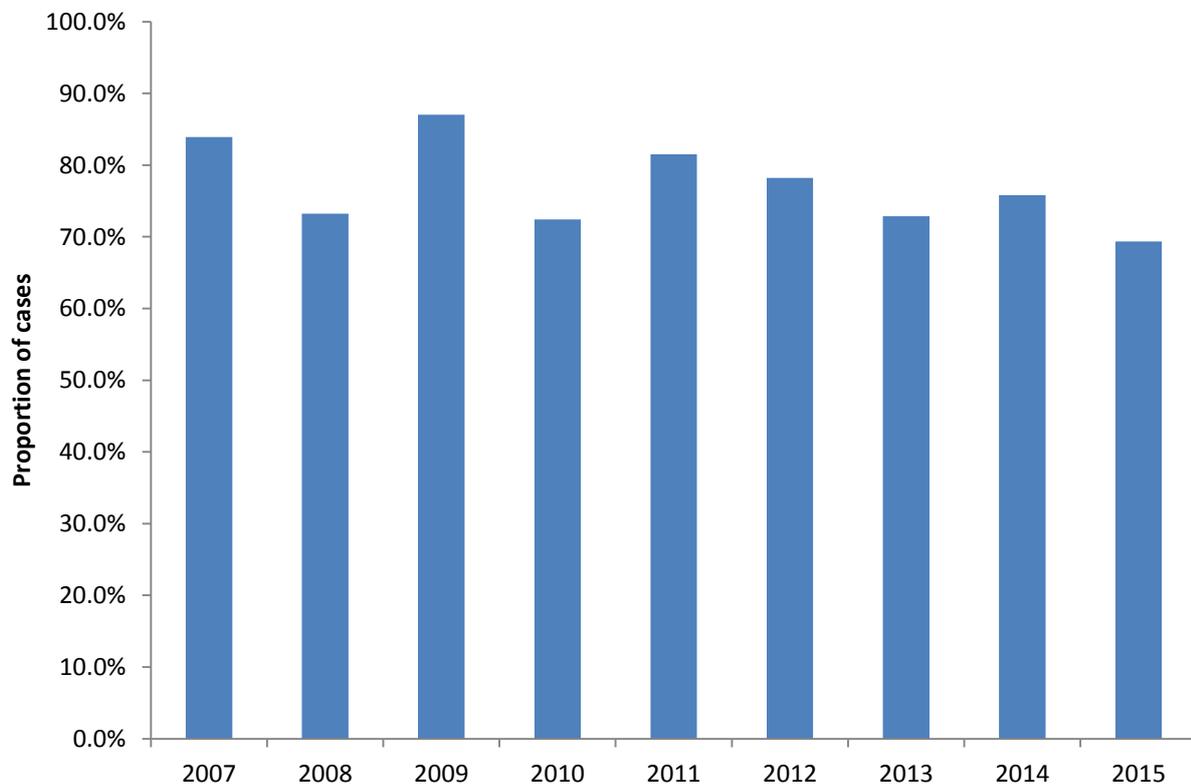
Treatment Outcomes

TB patient outcomes are reported a year after treatment commences and in accordance with the World Health Organization (WHO) treatment outcome definitions¹. Under these definitions, treatment outcome at 12 months reporting is defined as all TB cases, diagnosed in 2015 with drug sensitive TB, excluding those with rifampicin resistant TB or MDR-TB. In this report, treatment outcomes for drug sensitive TB cases are reported separately for the following groups:

Cohort 1: For cases with an expected duration of treatment less than 12 months, treatment outcomes at 12 months (excluding Rifampicin and multi-drug resistance).

Cohort2: For cases with an expected duration of treatment less than 12 months, excluding Rifampicin and Multi-drug resistance AND cases with CNS, spinal, cryptic disseminated or miliary disease.

TB treatment outcomes for cases notified from 2007 to 2015 under these definitions have been calculated to allow for trends to be monitored (Figure 20).



*Excludes rifampicin resistant TB and MDR-TB cases and those with CNS, spinal, miliary or cryptic disseminated TB

Figure 20: Treatment completion at 12 months for drug sensitive cases with expected treatment <12 months, 2007-2015

In 2015, 62 TB cases were notified in Northern Ireland; there was only one case recorded as being resistant to rifampicin and no cases that were multi-drug resistant. Thus 61 cases are included in cohort 1. Twelve cases had CNS, spinal, miliary or cryptic disseminated disease and are excluded from the outcomes presented in cohort 2 (Table 5).

Table 5: Outcome of cohorts 1 and 2 2015 TB cases

Outcome	Cohort 1 (n=61)	%	Cohort 2 (n=49)	%
Completed	50	82	43	88
Died	3	5	2	4
Lost to Follow up	3	5	2	4
Still on Treatment	5	8	2	4
Stopped	0	0	0	0
Not evaluated*	0	0	0	0
Total	61		49	

*transferred out/unknown/missing

The proportion of cases notified in 2015 with expected treatment of less than 12 months who completed treatment within 12 months was 69% (n=43/62), compared with 76% (n=72/95) in 2014 (Figure 20).

In 2015, of the 49 cases expected to complete treatment within 12 months, completion was higher among cases born in the UK (86%, n=30/35) compared with non-UK born cases (70%, n=19/27). Similarly the proportion of females completing at 12 months was marginally higher (89%, n=24/27) than males (71%, n=25/35).

The proportion of cases in cohort 2 who completed treatment within 12 months was 88% (n=43/49), an increase compared with 2014 when completion was 83% (n=72/87). Of the two cases that were still on treatment at 12 months, both completed after the 12 months period.

Three patients died in 2015 giving a CFR of 4.8%, remaining well below the 10 year average (2005-2014) of 8.5% (Figure 21). One case was diagnosed post-mortem. Of the three cases, TB was cited as causing the death of two cases and contributing to the death of the third case. All three cases were born in the UK/Ireland. The average age of those who died was 83 years with an age-range from 76-93 years.

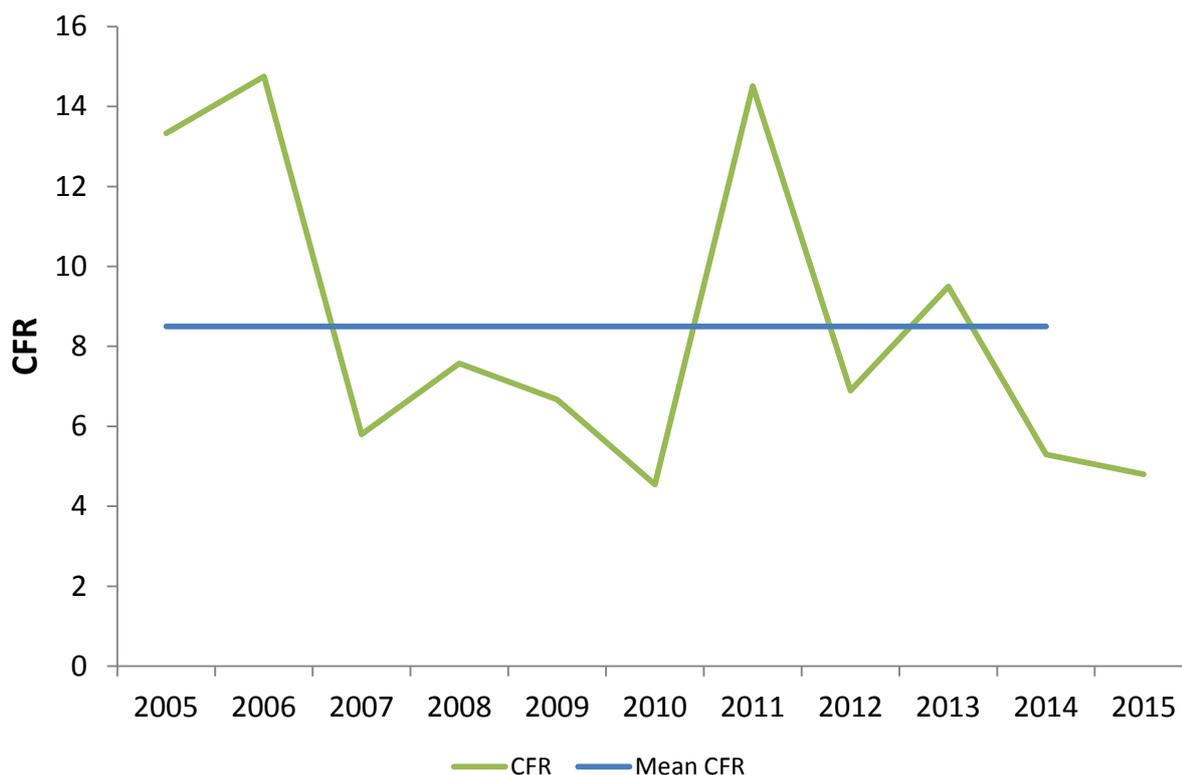


Figure 21: Case-Fatality Rate of tuberculosis notifications, Northern Ireland 2005-2015.

Discussion

The incidence of TB in Northern Ireland remains at relatively low levels. However, rates of the disease increased slightly from 3.4 to 4.6 per 100,000 population in 2016. While lower than England (10.2 per 100,000), Scotland (5.7 per 100,000) and the Republic of Ireland (7.0 per 100,000), Northern Ireland rates of TB were higher than Wales (3.7 per 100,000)^{3,4,5,6}.

TB rates in the UK-born population remain low and stable compared with the non-UK born population where rates increased from 33.2 per 100,000 in 2015 to 48.0 per 100,000

population in 2016. In 2016, 46% of all TB cases in Northern Ireland occurred in individuals born outside of the UK/Ireland, many of which are from countries with a high burden of TB.

In the last few years both the numbers and rates of TB continued to increase in the SHSCT area, with the majority (60%) of cases in this Trust born outside of the UK/Ireland.

In 2015 there were four cases of TB reported in children. A similar number were recorded in 2016 showing evidence of transmission of the disease occurring. Seven of the eight children were born in the UK/Ireland.

ECDC targets² recommend that at least 80% of pulmonary TB cases be culture confirmed in order to have optimal detection of infectivity and drug resistance. In 2016, 79% of pulmonary cases were culture confirmed in Northern Ireland, just falling short of the recommendation. This compares with 83% in 2015.

The proportion of cultured cases of TB with first line drug resistance in 2016 was 7%, a decrease from 2015 when 10% showed resistance. There was one multi-drug resistant case reported in 2016. It is encouraging that the proportion of drug sensitive TB cases that were expected to complete treatment by 12 months, an indicator of the quality of the TB services, has improved again with 86% of 2015 cases completing treatment in this time frame compared with 83% in 2014.

The proportion of pulmonary TB cases that had a delay of greater than 4 months between symptom onset and treatment start was 40% in 2016, an increase compared to 33% in 2015. This suggests a significant number of pulmonary cases still have a substantial delay before treatment, increasing the likelihood of infectivity. While we do not know the reasons behind the delay it highlights the need to continue raising awareness of TB.

Northern Ireland joined the National MIRU-VNTR strain typing scheme in 2011 which has been used to aid assessments of clustering. In 2017 the National centre has rolled-out Whole Genome Sequencing (WGS) which has been incorporated into their routine service, eventually replacing MIRU-VNTR typing for TB. The move to WGS will better inform cluster

analysis and focus on clusters where public health action is likely to have a more direct impact on reducing transmission.

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