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Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Health Protection Surveillance Centre

Report on the Epidemiology of Tuberculosis in Ireland 2013 & 2014

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Epidemiology of Tuberculosis in Ireland 2013 and 2014

A Report by the
Health Protection Surveillance Centre

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Acknowledgements

Sincere thanks are extended to all those who participated in the collection of data used in this report. This includes the notifying physicians, public health doctors, surveillance scientists, clinical microbiologists, nurses, laboratory staff and administrative staff.

Report prepared by Sarah Jackson and Joan O'Donnell, HPSC.

Summary of 2013 & 2014 TB notifications

- TB case notifications decreased in 2014 (n=318, rate 6.9/100,000) compared to 2013 (n=372, rate 8.1/100,000). This is the lowest crude notification rate* recorded since TB enhanced surveillance began in 1998.

- Regional variation was noted in TB notification rates ranging from 5.7 in HSE Midland in 2013 and 3.8 in HSE-W in 2014, to 9.9 in HSE South for both years.

- The highest rates were reported by Dublin North Central in HSE East and North Cork and South Lee in HSE South during 2013 while the highest rates in 2014 were reported by Dublin North Central and Dublin North West in HSE East and by North Lee in HSE South.

- In 2013, the highest age-specific rate occurred among those aged 25-34 years old (11.7) while in 2014 it occurred in those aged 65 years and older (13.1). Compared to 2013, the age-specific rate decreased in all age groups during 2014 except among those aged 65 years and older, which increased from 9.3 in 2013 to 13.1 in 2014.

- Rates were higher in males for all age groups in both years except for the 15-24 year age group in 2013 and the 25-34 year age group in 2014.

- In 2013, the highest rates among males were in the 55-64 year age group and in those aged 65 years and older, while in 2014 the highest rates in males were observed in those aged 65 years and older only .

- The highest rates among females were in those aged 15-24 years age group in 2013, while in 2014 the highest rates in females were in the 25-34 years age group and in those aged 65 years and older.

- In 2013, 44.9% of cases were born outside Ireland compared to 43.1% in 2014. There was a notable difference in age between cases born in Ireland (median age 47 years in 2013 and 58 years in 2014) and foreign born cases (median age 35 years in 2013 and 34 years in 2014).

- Pulmonary cases accounted for 66.9% of total TB cases in 2013 and 61.8% in 2014. Of pulmonary cases, 83.1% were culture positive in 2013 and 81.1% were culture positive in 2014. 51.0% of pulmonary cases were smear positive in 2013 and 46.4% in 2014.

- There were three cases of TB meningitis notified in 2013 and two in 2014.

- Treatment outcome data were provided for 79.0% of cases in 2013. Treatment was reported as completed for 61.6% of total cases and for 62.0% of sputum smear positive cases notified. Treatment outcome data for 2014 is not currently available.

- There were 18 deaths reported in 2013, six (33.3%) of which were attributable to TB.

- There were 35 drug-resistant cases in 2013 (including three MDR-TB cases and 1 XDR-TB case) and 20 in 2014 (including two MDR-TB cases).

* All rates are per 100,00 population

Introduction

In 2014, 6.3 million cases of TB were notified by national TB control programmes and reported to the World Health Organization (WHO) (87.0 per 100,000 population). Of these, 2.6 million were new pulmonary sputum smear positive cases. Approximately 1.5 million TB deaths occurred globally in 2014.[1]

In 2014, 329,270 cases of TB were reported by 51 of the 53 countries of the WHO European Region. The overall notification rate averaged at 36.7 cases per 100,000, with a wide variation between countries and an incremental west-to-east gradient.[2] Figure 1 displays a map of TB notification rates in 2014 in the WHO European region.

The lowest rate in the region occurred in Western Europe (EU countries plus Iceland and Norway) at 12.8 per 100,000 population, with rates lower than 10 per 100,000 reported in 17 countries and higher than 20 per 100,000 in Bulgaria, Latvia, Lithuania, Portugal and Romania.

In 2014, 26.8% of reported TB cases in Western Europe were foreign born. This proportion ranged from 0.6% to 100.0% across 29 countries of the EU/EEA. Multidrug-resistance (MDR) remained most frequent in the Baltic States (11.9-25.8%) followed by Romania (6.4%, n=517) and Luxembourg (6.3%, n=1). Other countries reported lower levels of multidrug-resistant TB (MDR-TB) ranging from 0.0-5.0%.

In 2014, 271,262 notifications were reported from 22 of the 23 non-EU European and central Asian countries of which 50.2% were from the Russian Federation. The highest rates per 100,000 population in this region were reported by Kyrgyzstan (127.0), Moldova (113.8) and Georgia (95.4), while the lowest rates were reported by Monaco (0.0), Switzerland (5.8) and Andorra (8.2). The highest burden of MDR-TB cases in the European region is in this area where the prevalence is 31.4% in culture confirmed pulmonary cases, seven times higher than the proportion reported in the EU/EEA countries (4.3%). Overall, the proportion of culture confirmed pulmonary cases with MDR-TB across the entire European region was 25.0%.

In Ireland, national epidemiological data on TB have been collated by the Health Protection Surveillance Centre (HPSC) since 1998. From January 2000, this information has included enhanced surveillance data items based on the minimum dataset reported to the European Centre for Disease Prevention and Control (ECDC). The resulting National Tuberculosis Surveillance System (NTBSS) was set up following consultation with the eight former health boards and the National TB Advisory Committee. The National TB Advisory Committee was reconvened in October 2004 and updated guidelines for TB prevention and control in Ireland were published in April 2010.[3]

This report presents an epidemiological review of all TB cases notified in Ireland in 2013 and 2014. Data for 2013 and 2014 have been validated. Information relating to treatment outcome is presented for 2013 only.

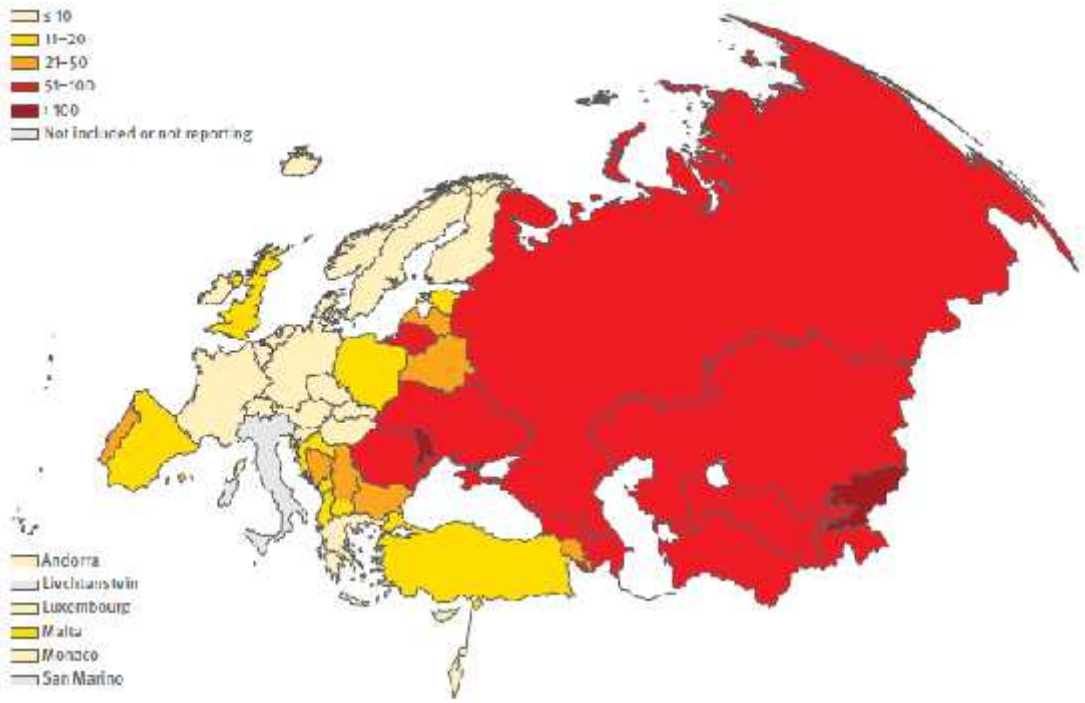

Figure 1: Tuberculosis notification rates per 100,000 population, WHO European region, 2014[2]

Case Definition

The case definition used for the analyses in this report is the Irish TB case definition under SI No. 452/2011 Infectious Diseases (Amendment) Regulations 2011.[4] This case definition is also in harmony with the 2012 EU case definition.

Tuberculosis: (*Mycobacterium tuberculosis* complex including *M*. *tuberculosis, M*. *africanum*, *M*. *bovis*, *M*. *canetti*, *M*. *caprae*, *M*. *microti* and *M*. *pinnipedii*)

Clinical Criteria – Any person with:

- Signs, symptoms and/or radiological findings consistent with active tuberculosis in any site
  AND
- A clinician's decision to treat the person with a full course of anti-tuberculosis therapy

  OR
- A case discovered post-mortem with pathological findings consistent with active tuberculosis that would have indicated anti-tuberculosis antibiotic treatment had the patient been diagnosed before dying

Confirmed case – A person meeting the clinical criteria and at least one of the following two:

- Isolation of *M. tuberculosis* complex (excluding *Mycobacterium. bovis*-BCG) from a clinical specimen

OR

- Detection of *M. tuberculosis* nucleic acid in a clinical specimen
  AND
- Positive microscopy for acid-fast bacilli or equivalent fluorescent staining bacilli on light microscopy

Probable case – A person meeting the clinical criteria and at least one of the following three:

- Microscopy positive for acid-fast bacilli or equivalent fluorescent staining bacilli on light microscopy

OR

- Detection of *Mycobacterium tuberculosis* nucleic acid in a clinical specimen

OR

- Histological appearance of granulomata

Possible case: A person meeting the clinical criteria without laboratory confirmation

Definitions

Pulmonary TB: TB of the lung parenchyma or the tracheo-bronchial tree or the larynx. The WHO defines pulmonary TB, for the purpose of analysis, as any case that has a pulmonary disease component.

Extra-pulmonary TB: TB affecting any site other than pulmonary as defined above. Pleural TB and intra-thoracic lymphatic TB by themselves are considered as extrapulmonary.

Pulmonary and extra-pulmonary TB is a case of TB that meets the previous two definitions

Smear positive case[5]**:** A patient with the presence of at least one acid-fast bacillus (AFB+) in at least one sputum sample in countries with a well functioning external quality assurance (EQA) system

A new case is defined as a patient where no previous history of TB was reported.

A recurrent case is defined as a patient with a documented history of TB prior to their 2013 or 2014 notification

Multidrug-resistant (MDR-TB) is defined as a TB case resistant to at least isoniazid and rifampicin with or without resistance to ethambutol and streptomycin

Extensively drug-resistant TB (XDR-TB) is defined as a TB strain resistant to any fluoroquinolone and at least one of three injectable second-line drugs (capreomycin, kanamycin and amikacin), in addition to MDR-TB. This definition of XDR-TB was agreed by the WHO Global Task Force on XDR-TB in October 2006.[6]

TB Outbreak

In general an outbreak is defined as the occurrence of cases of active TB disease† above the expected level usually over a given period of time‡ in a geographic area, facility or within a specific population group.[3]

The following are examples of situations to report:

- An unexpected increase (significantly above baseline) of newly identified TB§ cases in any setting
- Two or more TB cases on treatment from a congregate (e.g. school or prison) or high risk setting (e.g. HIV positive individuals occurring within a relatively short space of tim
- Three or more TB cases on treatment from a community setting (outside a household) occurring within a relatively short period of time† that may be related.
- Three or more TB cases on treatment in a household
- Two or more cases of MDR-TB (multidrug-resistant TB) or XDR-TB (extensively drug-resistant) that may be related and occur outside a household

When assessing whether a cluster of TB cases represents an outbreak, indicators to consider include:

- Epidemiological links between cases
- Similar unique characteristics among cases
- Matching drug resistance patterns of isolates
- Matching DNA fingerprint patterns of isolates

† This definition of a TB outbreak relates to cases of TB disease only and not to cases of latent TB infection (LTBI).

‡ In general, within 6 months but outbreaks over longer periods may also be considered where epidemiological/microbiological evidence suggests that cases are linked. This should be based on local risk assessment or in consultation with HPSC if deemed appropriate.

§ TB cases as defined by the Irish case definition, see http://www.hpsc.ie/hpsc/NotifiableDiseases/CaseDefinitions/

Methods

Data collection

An enhanced TB notification form was completed by public health doctors for each case of TB notified. These forms summarise all available clinical, microbiological, histological and epidemiological data. Forms were then collated in the regional departments of public health, where data were entered onto the Computerised Infectious Disease Reporting (CIDR) system. Finalised 2013 data (with outcome information) and 2014 data were extracted from CIDR during August 2015.

The introduction of the amendment to the Infectious Disease Regulations 1981 on January 1st 2004, made outbreaks, unusual clusters or changing patterns of illness statutorily notifiable by medical practitioners and clinical directors of laboratories to the medical officer of health. Standard reporting procedures for the surveillance of TB outbreaks were formally agreed in 2007. Outbreak data are collated on the Computerised Infectious Disease Reporting (CIDR) system.

Data analysis

National TB data from 1992 to 1997 were provided by the Department of Health (DoH). National TB data from 1998 to 2010 were obtained from the NTBSS system. Data for 2013 and provisional 2014 data were taken from the Computerised Infectious Disease Reporting (CIDR) system.

Rates for 1991 to 1993 are based on the 1991 population census; rates for 1994, to 1999 are based on the 1996 population census; rates for 2000 to 2003 are based on the 2002 population census; rates for 2004 to 2008 are based on the 2006 population census and rates for 2009 to 2014 are based on the 2011 census.

For the calculation of rates in the Irish-born and foreign-born population, denominator data represent persons usually resident in each province and county, and present in the state on census night. The Irish-born population was defined as those persons who were born in Ireland.[7]

Direct methods of standardisation were used to allow comparison of rates between geographical areas using the 2011 Irish population as the standard population. In order to compare rates between groups of interest, 95% confidence intervals were used.

Three-year moving averages were calculated by applying the formula (a+2b+c)/4 to each three successive points a, b and c (each letter representing a year) in the series. They are useful for smoothing irregularities in trend data and make it easier to discern long-term trends that otherwise might be obscured by short-term fluctuations.

Local health offices (LHOs) came into operation on 1st September 2005, replacing Community Care Areas. LHO denominators are used in this report rather than community care area (CCA) denominators. LHO rates were calculated using Census 2011 LHO denominator data extracted from Health Atlas[8] for all LHOs except HSE-SE, who supplied regionally calculated Census 2011 LHO denominator data.

Data completeness

For the case based dataset, 18 key variables from CIDR were analysed for completeness. Appendix 1 shows the completeness of reporting for these variables during 2013 and 2014.

Results: TB cases in Ireland, 2013 and 2014

Overall cases and rates

There were 372 cases of TB notified in 2013 and 318 cases in 2014. These corresponded to rates of 8.1 and 6.9 per 100,000 population respectively. A summary of the 2013 and 2014 data is shown in table 1.

Table 1: Summary of the epidemiology of TB in Ireland, 2013 and 2014

Parameter	2013			2014		
	Number of cases	CIR	% of total	Number of cases	CIR	% of total
Total number of cases	372	8.1	n/a	318	6.9	n/a
Cases in indigenous population	202	5.4	*54.3*	177	4.7	*55.7*
Cases in foreign-born persons	167	21.8	*44.9*	137	17.9	*43.1*
Culture positive cases	281	6.1	*75.5*	231	5.0	*72.6*
Pulmonary cases	249	5.4	*66.9*	196	4.3	*61.6*
Smear positive pulmonary cases	127	2.8	*34.1*	91	2.0	*28.6*
Multi-drug resistant cases	3	0.07	*0.8*	2	0.04	*0.6*
Extensively drug-resistant cases	1	0.02	*0.3*	0	0.0	*0.0*
Mono-resistant to isoniazid	19	0.4	*5.1*	8	0.2	*2.5*
Deaths attributable to TB	6	0.1	*1.6*	n/a	n/a	*n/a*
Outcomes reported in cases	294	6.4	*79.0*	n/a	n/a	*n/a*
TB meningitis cases	3	0.07	*0.8*	2	0.04	*0.6*

The number and rates of TB cases notified for each of the years from 1991-2014 are shown in table 2. Three-year moving averages for the years 1992-2013 are also shown.

Table 2: Number and rates of notified cases of TB in Ireland, 1991-2014 with 3-year moving averages, 1992-2013

Year	Number of cases	Crude rate per 100,000 population	3-year moving average
1991	640	18.2	
1992	604	17.1	612
1993	598	17.0	581
1994	524	14.5	526
1995	458	12.6	469
1996	434	12.0	436
1997	416	11.5	423
1998	424	11.7	433
1999	469	12.9	439
2000	395	10.1	410
2001	381	9.7	391
2002	410	10.4	402
2003	406	10.4	413
2004	433	10.2	430
2005	448	10.6	448
2006	463	10.9	464
2007	481	11.3	473
2008	467	11.0	474
2009	479	10.4	461
2010	420	9.2	433
2011	413	9.0	401
2012	359	7.8	376
2013	372	8.1	355
2014	318	6.9	

Crude incidence rates by HSE area

The total number of TB cases in each HSE area is shown in table 3 with crude incidence rates and 95% confidence intervals included.

The highest crude rate for both 2013 and 2014 was reported in HSE South (9.9/100,000 for both years) while the lowest rate was reported in HSE Midlands in 2013 (5.7/100,000) and HSE West in 2104 (3.8/100,000).

The crude incidence rates seen in each HSE area from 1992 to 2014 are shown in table 3 while the 3-year moving average TB notification rates for each HSE area from 1992 to 2013 are shown in table 4.

Table 3: Crude TB incidence rates per 100,000 population by HSE area, 1992-2014

Year	HSE E	HSE M	HSE MW	HSE NE	HSE NW	HSE SE	HSE S	HSE W	National
1992	16.1	18.7	20.9	10.0	15.9	12.3	21.4	22.2	**17.1**
1993	11.9	10.8	16.1	10.0	37.5	16.7	23.9	23.0	**17.0**
1994	12.9	14.6	17.3	11.4	9.0	11.0	17.4	22.7	**14.5**
1995	11.9	8.8	15.1	8.5	11.4	9.5	20.5	11.1	**12.6**
1996	8.7	8.3	17.7	12.1	7.1	6.9	22.5	13.1	**12.0**
1997	9.9	9.2	12.6	9.1	10.4	12.8	16.5	11.1	**11.5**
1998	11.7	4.9	14.8	9.5	9.0	8.9	14.3	15.3	**11.7**
1999	13.9	7.3	17.0	8.2	9.0	7.9	13.7	19.9	**12.9**
2000	10.2	7.1	13.8	6.1	4.1	9.7	13.8	10.0	**10.1**
2001	12.3	3.1	7.1	11.0	5.9	4.7	12.4	8.9	**9.7**
2002	11.6	8.4	9.7	7.0	5.4	11.6	13.3	8.7	**10.5**
2003	11.9	5.3	12.1	7.5	4.1	8.3	16.0	6.0	**10.4**
2004	12.7	3.6	12.2	5.8	6.7	7.4	12.6	10.4	**10.2**
2005	12.9	6.4	14.7	3.3	6.3	8.0	12.2	10.9	**10.6**
2006	12.7	6.0	10.2	8.4	3.8	11.1	15.3	7.7	**10.9**
2007	14.6	6.4	8.3	6.1	7.2	6.3	16.4	10.6	**11.3**
2008	15.9	9.5	6.9	4.6	5.9	6.5	14.0	7.5	**11.0**
2009	14.5	8.9	7.1	6.1	9.7	7.4	12.3	4.7	**10.4**
2010	11.1	8.5	7.6	6.8	7.4	5.4	13.5	4.7	**9.2**
2011	11.6	6.4	6.3	5.7	5.0	6.0	12.6	7.0	**9.0**
2012	9.1	9.6	5.5	5.4	5.4	5.0	10.2	7.2	**7.8**
2013	9.1	5.7	8.4	6.1	6.2	6.4	9.9	8.1	**8.1**
2014	8.3	5.7	4.2	5.0	6.6	5.8	9.9	3.8	**6.9**

Table 4: 3-year moving average TB notification rate per 100,000 population by HSE area, 1992-2013

Year	HSE E	HSE M	HSE MW	HSE NE	HSE NW	HSE SE	HSE S	HSE W	National
1992	14.7	16.1	20.3	10.1	20.2	21.7	12.6	26	**17.3**
1993	13.2	13.7	17.6	10.4	24.9	14.2	21.6	22.7	**16.4**
1994	12.4	12.2	16.5	10.3	16.7	12.0	19.8	19.9	**14.6**
1995	11.3	10.1	16.3	10.1	9.7	9.2	20.2	14.5	**12.9**
1996	9.8	8.6	15.8	10.5	9.0	9.0	20.5	12.1	**12.0**
1997	10.1	7.9	14.4	10.0	9.2	10.3	17.4	12.6	**11.7**
1998	11.8	6.6	14.8	9.1	9.4	9.6	14.7	15.4	**11.9**
1999	12.4	6.6	15.7	8.0	7.8	8.6	13.9	16.3	**11.9**
2000	11.7	6.2	12.9	7.8	5.8	8.0	13.4	12.2	**10.7**
2001	11.6	5.4	9.4	8.8	5.3	7.7	13.0	9.1	**10.0**
2002	11.9	6.3	9.6	8.1	5.2	9.0	13.7	8.1	**10.3**
2003	12.0	5.7	11.5	7.0	5.1	8.9	14.5	7.8	**10.4**
2004	12.6	4.7	12.8	5.6	6.0	7.8	13.4	9.4	**10.3**
2005	12.8	5.6	12.9	5.2	5.8	8.6	13.1	10.0	**10.6**
2006	13.2	6.2	10.9	6.5	5.3	9.1	14.8	9.2	**10.9**
2007	14.5	7.1	8.4	6.3	6.0	7.5	15.5	9.1	**11.2**
2008	15.2	8.6	7.3	5.3	7.2	6.7	14.2	7.6	**11.0**
2009	14.0	8.9	7.2	5.9	8.2	6.7	13.1	5.4	**10.3**
2010	12.1	8.1	7.2	6.4	7.4	6.1	13.0	5.3	**9.4**
2011	10.9	7.7	6.5	5.9	5.7	5.6	12.3	6.5	**8.7**
2012	9.7	7.8	6.5	5.7	5.5	5.6	10.8	7.4	**8.2**
2013	8.9	6.6	6.7	5.7	6.1	5.9	10.0	6.8	**7.8**

Age and sex distribution

There were 135 (36.5%) cases of TB notified in females in 2013 and 144 (45.3%) in 2014. There were 235 (63.5%) cases of TB notified in males in 2013 and 174 (54.7%) in 2014. This gave a male to female ratio of 1.7:1 in 2013 and 1.2:1 in 2014. Age was unknown for two cases in 2013. Table 5 gives the breakdown of notified TB cases by sex and HSE area.

Table 5: TB cases by HSE area and sex, 2013 and 2014

HSE area	2013				2014			
	Female	Male	M: F ratio	Total	Female	Male	M: F ratio	Total
HSE E	55	90	1.6	**145**	60	75	1.3	**135**
HSE M	4	12	3.0	**16**	7	9	1.3	**16**
HSE MW	8	24	3.0	**32**	9	7	0.8	**16**
HSE NE	12	15	1.3	**27**	8	14	1.8	**22**
HSE NW	5	11	2.2	**16**	8	9	1.1	**17**
HSE SE	13	19	1.5	**32**	13	16	1.2	**29**
HSE S	25	41	1.6	**66**	31	35	1.1	**66**
HSE W	13	23	1.8	**36**	8	9	1.1	**17**
Total	**135**	**235**	**1.7**	**370**	**144**	**174**	**1.2**	**318**

The median age of cases was 39 years (range: 0-88 years) in 2013 and 43 (range: 5-92 years) in 2014.

Table 6 shows the number of cases and the age-specific rates for males and females in 2013 and 2014. The highest age-specific rates in 2013 occurred in the 25-34 year age group (11.7/100,000) while the highest age-specific rate in 2014 occurred among those aged 65 years and older (13.1/100,000).

In 2013, rates in males were higher than or equal to females, in all age groups except in the 15-24 year age group (F 10.0 vs. M 6.2). This was also the highest rate among females in 2013, while the highest rate among males was in the 25-34 year age group (14.9) and in those aged 65 years and older (14.8).

In 2014, rates in males were higher than or equal to females, in all age groups. The highest rate among females in 2014 occurred in the 25-34 year age group (9.8) and in those aged 65 years and older (9.9). The highest rate among males was in those aged 65 years and older (16.9). Figure 2 shows the age-specific rates of TB in Ireland from 2000 to 2014.

Table 6: TB cases and age-specific rates per 100,000 population by sex, 2013 and 2014

Age group (years)	2013						2014					
	Female		Male		Total		Female		Male		Total	
	Cases	Rates	Cases	Rates	Cases	Rate	Cases	Rates	Cases	Rates	Cases	Rate
0-14	5	1.0	5	1.0	10	1.0	3	0.6	4	0.8	7	0.7
15-24	29	10.0	18	6.2	47	8.1	13	4.5	18	6.2	31	5.3
25-34	33	8.5	55	14.9	88	11.7	38	9.8	34	9.2	72	9.5
35-44	32	9.2	44	12.6	76	10.9	22	6.3	36	10.3	58	8.3
45-54	13	4.5	42	14.6	55	9.5	20	6.9	22	7.6	42	7.2
55-64	9	3.9	35	15.1	44	9.5	19	8.2	19	8.2	38	8.2
65+	14	4.8	36	14.8	50	9.3	29	9.9	41	16.9	70	13.1
Total	**135**	**5.8**	**235**	**10.3**	**370**	**8.1**	**144**	**6.2**	**174**	**7.7**	**318**	**6.9**

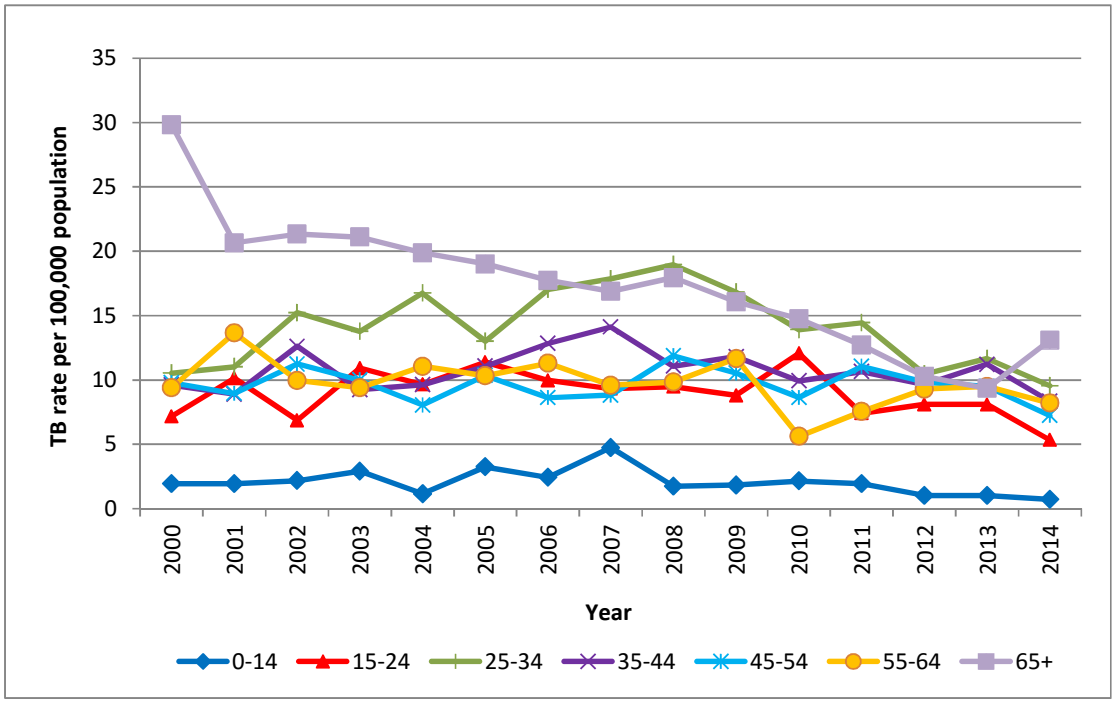

Figure 2: Age-specific rates of TB by year, 2000-2014

Age-standardised TB incidence rates by HSE area

Age-standardised TB incidence rates for 2013 and 2014 by HSE area are presented in figure 3. The highest age-standardised TB incidence rate (per 100,000 population) in 2013 and 2014 was seen in HSE South (9.9 and 10.0) while the lowest rate in 2013 was reported by HSE Midland (5.8) and in 2014 by HSE West (3.9).

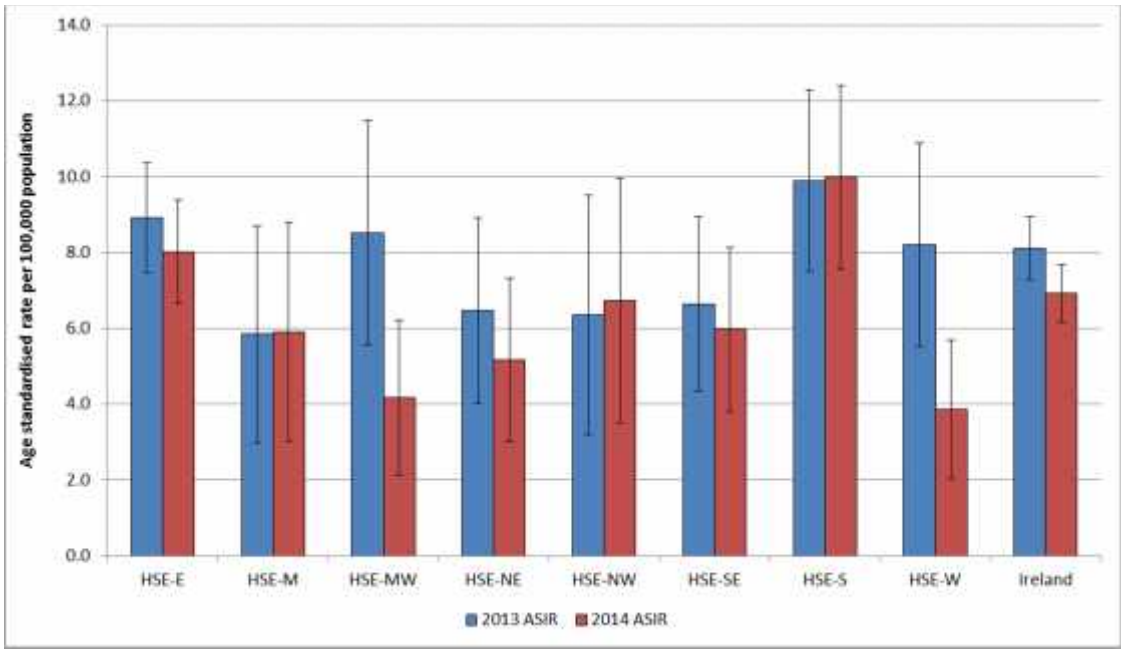

Figure 3: Age-standardised TB incidence rates per 100,000 population by HSE area, 2013 and 2014

Crude incidence rates by Local Health Office (LHO)

Crude incidence rates for each local health office (LHO)** in 2013 and 2014 are shown in table 7. Three-year moving averages for the crude incidence rates are presented in table 8. The highest crude rates (per 100,000 population) were reported by Dublin North Central (17.7) in HSE East and North Cork (14.5) and South Lee (14.1) in HSE South during 2013 while the highest rates were reported by Dublin North Central (19.9) and Dublin North West (11.9) in HSE East and by North Lee (13.8) in HSE South in 2014.

** Note: Local Health Offices (LHOs) came into operation on 1st September 2005, taking over operations from Community Care Areas (CCAs)

Table 7: TB Crude incidence rate per 100,000 population by LHO[††], 2005-2014

HSE area	LHO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
HSE-E	**Total**	**12.9**	**12.7**	**14.6**	**15.9**	**14.5**	**11.1**	**11.6**	**9.1**	**9.1**	**8.3**
	Dublin South	4.0	5.5	8.7	4.7	6.9	4.6	6.1	6.9	6.9	4.6
	Dublin South East	7.2	5.4	10.0	15.4	8.7	6.9	8.7	8.7	5.2	8.7
	Dublin South City	20.1	19.4	29.8	29.8	20.0	17.3	16.6	13.8	12.4	8.3
	Dublin South West	12.2	5.4	14.9	6.8	17.5	12.3	9.1	7.1	8.4	9.1
	Dublin West	18.7	17.9	16.4	28.4	17.8	14.4	28.0	10.9	11.6	10.3
	Dublin Nth West	19.4	21.0	24.7	21.5	25.3	16.4	14.9	16.4	10.9	11.9
	Dublin Nth Central	23.7	26.1	23.7	24.5	22.2	22.9	14.0	15.5	17.7	19.9
	Dublin Nth	9.9	11.7	8.6	9.5	11.5	9.0	8.6	4.9	6.5	4.9
	Kildare/W Wicklow	7.9	6.9	7.4	14.3	6.1	4.8	4.8	5.3	7.0	5.7
	Wicklow	5.5	7.3	2.7	5.5	9.3	3.4	8.4	3.4	5.1	1.7
HSE-M	**Total**	**6.4**	**6.0**	**6.4**	**9.5**	**8.9**	**8.5**	**6.4**	**9.6**	**5.7**	**5.7**
	LD/WH	8.8	5.3	6.2	14.1	8.8	15.2	5.6	9.6	7.2	9.6
	LS/OY	4.4	6.5	6.5	5.8	8.9	3.2	7.0	9.5	4.5	2.5
HSE-MW	**Total**	**14.7**	**10.2**	**8.3**	**6.9**	**7.1**	**7.6**	**6.3**	**5.5**	**8.4**	**4.2**
	Clare	19.8	8.1	7.2	3.6	6.8	8.5	6.8	5.1	8.5	6.8
	Limerick	13.2	14.5	9.3	11.2	8.3	7.8	6.8	6.3	9.4	4.2
	Tipp Nth/E Limerick	11.1	6.1	8.1	4.0	4.3	5.7	4.3	4.3	5.7	0.0
HSE-NE	**Total**	**3.3**	**8.4**	**6.1**	**4.6**	**6.1**	**6.8**	**5.7**	**5.4**	**6.1**	**5.0**
	Cavan/Monaghan	6.7	8.4	5.1	6.7	6.0	6.7	3.7	5.2	3.7	5.2
	Louth/Sth Monaghan	1.8	7.2	8.1	5.4	5.7	7.3	9.0	6.5	9.8	5.7
	Meath	1.8	9.2	5.5	2.5	6.5	6.5	4.9	4.9	5.4	4.3
HSE-NW	**Total**	**6.3**	**3.8**	**7.2**	**5.9**	**9.7**	**7.4**	**5.0**	**5.4**	**6.2**	**6.6**
	Donegal	4.1	2.7	6.8	4.8	8.1	5.6	7.4	5.6	5.6	6.2
	Sligo/Leitrim	9.9	5.5	7.7	7.7	12.3	10.3	1.0	5.1	7.2	7.2
HSE-SE	**Total**	**8.0**	**11.1**	**6.3**	**6.5**	**7.4**	**5.4**	**6.0**	**5.0**	**6.4**	**5.8**
	Carlow/Kilkenny	6.6	7.5	5.8	5.0	3.8	5.4	5.4	6.1	10.7	6.9
	Tipperary South	13.6	20.4	9.0	6.8	9.6	7.4	5.3	4.2	6.4	6.4
	Waterford	9.2	13.3	8.3	9.2	14.9	7.8	8.6	6.3	5.5	7.0
	Wexford	4.6	6.1	3.0	5.3	2.8	2.1	4.8	3.4	3.4	3.4
HSE-S	**Total**	**12.2**	**15.3**	**16.4**	**14.0**	**12.3**	**13.5**	**12.6**	**10.2**	**9.9**	**9.9**
	Kerry	6.4	6.4	6.4	7.2	5.5	4.8	7.6	8.9	6.2	9.6
	North Cork	6.2	8.7	7.4	8.7	13.4	19.0	14.5	10.1	14.5	10.1
	North Lee	21.5	28.0	19.7	22.1	13.8	16.5	16.0	12.7	9.4	13.8
	South Lee	11.7	16.2	30.1	15.6	16.2	18.8	15.2	11.0	14.1	7.8
	West Cork	9.3	5.6	0.0	9.3	10.6	0.0	3.5	3.5	5.3	5.3
HSE-W	**Total**	**10.9**	**7.7**	**10.6**	**7.5**	**4.7**	**4.7**	**7.0**	**7.2**	**8.1**	**3.8**
	Galway	11.2	8.2	13.4	7.8	6.4	6.0	7.6	8.4	9.6	3.6
	Mayo	9.7	7.3	4.8	6.5	2.3	3.1	4.6	7.7	9.2	3.1
	Roscommon	11.9	6.8	11.9	8.5	3.1	3.1	9.4	1.6	0.0	6.2
	Ireland	**10.6**	**10.9**	**11.3**	**11.0**	**10.4**	**9.2**	**9.0**	**7.8**	**8.1**	**6.9**

[††] In some areas, LHO does not always correspond to county

Table 8: TB 3 year moving average rates (per 100,000 population) by local health office[‡‡], 2004-2013

HSE area	LHO	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
HSE-E	**Total**	**12.6**	**12.8**	**13.2**	**14.5**	**15.2**	**14.0**	**12.1**	**10.9**	**9.7**	**8.9**
	Dublin South	6.9	5.7	5.9	6.9	6.3	5.8	5.6	5.9	6.7	6.3
	Dublin South East	8.7	7.5	7.0	10.2	12.3	9.9	7.8	8.2	7.8	6.9
	Dublin South City	22.3	20.7	22.1	27.2	27.3	21.8	17.8	16.1	14.2	11.7
	Dublin South West	9.7	9.5	9.5	10.5	11.5	13.5	12.8	9.4	7.9	8.3
	Dublin West	19.5	18.8	17.7	19.8	22.7	19.6	18.6	20.3	15.4	11.1
	Dublin Nth West	15.7	18.2	21.5	23.0	23.3	22.1	18.2	15.6	14.6	12.5
	Dublin Nth Central	24.7	25.1	24.9	24.5	23.7	22.9	20.5	16.6	15.7	17.7
	Dublin Nth	9.6	10.8	10.5	9.6	9.7	10.3	9.5	7.8	6.2	5.7
	Kildare/W Wicklow	6.8	7.0	7.3	9.0	10.5	7.8	5.1	4.9	5.6	6.2
	Wicklow	4.0	5.3	5.7	4.6	5.8	6.9	6.1	5.9	5.1	3.8
HSE-M	**Total**	**4.7**	**5.6**	**6.2**	**7.1**	**8.6**	**8.9**	**8.1**	**7.7**	**7.8**	**6.6**
	LD/WH	6.3	6.8	6.4	7.9	10.8	11.7	11.2	9.0	8.0	8.4
	LS/OY	3.4	4.5	6.0	6.3	6.8	6.7	5.6	6.7	7.6	5.2
HSE-MW	**Total**	**12.8**	**12.9**	**10.9**	**8.4**	**7.3**	**7.2**	**7.2**	**6.5**	**6.5**	**6.7**
	Clare	12.1	14.6	10.8	6.5	5.3	6.4	7.7	6.8	6.4	7.3
	Limerick	12.8	13.2	12.9	11.1	10.0	8.9	7.7	6.9	7.2	7.3
	Tipp Nth/E Limerick	13.5	10.6	7.8	6.6	5.1	4.6	5.0	4.6	4.6	3.9
HSE-NE	**Total**	**5.6**	**5.2**	**6.5**	**6.3**	**5.3**	**5.9**	**6.4**	**5.9**	**5.7**	**5.7**
	Cavan/Monaghan	6.5	6.7	7.2	6.3	6.1	6.4	5.8	4.9	4.5	4.5
	Louth/Sth Monaghan	7.2	4.7	6.1	7.2	6.1	6.0	7.3	7.9	7.9	7.9
	Meath	3.8	4.5	6.4	5.7	4.2	5.5	6.1	5.3	5.0	5.0
HSE-NW	**Total**	**6.0**	**5.8**	**5.3**	**6.0**	**7.2**	**8.2**	**7.4**	**5.7**	**5.5**	**6.1**
	Donegal	5.1	4.4	4.1	5.3	6.1	6.6	6.7	6.5	6.1	5.7
	Sligo/Leitrim	7.2	8.0	7.1	7.1	8.9	10.7	8.5	4.4	4.6	6.7
HSE-SE	**Total**	**7.8**	**8.6**	**9.1**	**7.5**	**6.7**	**6.7**	**6.1**	**5.6**	**5.6**	**5.9**
	Carlow/Kilkenny	7.6	7.0	6.8	6.0	4.9	4.5	5.0	5.6	7.1	8.6
	Tipperary South	9.7	13.9	15.8	11.3	8.0	8.3	7.4	5.6	5.0	5.8
	Waterford	11.9	11.2	11.0	9.8	10.4	11.7	9.8	7.8	6.7	6.1
	Wexford	2.8	4.2	4.9	4.4	4.1	3.2	2.9	3.8	3.8	3.4
HSE-S	**Total**	**13.4**	**13.1**	**14.8**	**15.5**	**14.2**	**13.1**	**13.0**	**12.3**	**10.8**	**10.0**
	Kerry	9.6	7.3	6.4	6.6	6.6	5.7	5.7	7.2	7.9	7.7
	North Cork	10.5	8.4	7.7	8.0	9.5	13.6	16.5	14.5	12.3	12.3
	North Lee	18.4	21.5	24.3	22.4	19.4	16.5	15.7	15.3	12.7	11.3
	South Lee	13.4	12.7	18.5	23.0	19.4	16.7	17.3	15.0	12.8	11.8
	West Cork	6.6	7.9	5.1	3.7	7.3	7.6	3.5	2.7	4.0	4.9
HSE-W	**Total**	**9.4**	**10.0**	**9.2**	**9.1**	**7.6**	**5.4**	**5.3**	**6.5**	**7.4**	**6.8**
	Galway	8.9	10.0	10.3	10.7	8.8	6.6	6.5	7.4	8.5	7.8
	Mayo	8.2	8.5	7.3	5.9	5.0	3.5	3.3	5.0	7.3	7.3
	Roscommon	14.1	12.8	9.4	9.8	8.0	4.5	4.7	5.9	3.1	2.0
Ireland		**10.3**	**10.6**	**10.9**	**10.9**	**10.5**	**10.1**	**9.4**	**8.7**	**8.2**	**7.8**

[‡‡] In some areas, LHO does not always correspond to county

Geographic origin

In 2013, 202 (54.3%) cases were born in Ireland, 167 (44.9%) were born outside Ireland and for the remaining three cases (0.8%), the country of birth was unknown. The crude TB rate in the Irish-born population was 5.4 per 100,000 population while the crude rate in the foreign-born population was 21.8 per 100,000 population.

In 2014, 177 (55.7%) cases were born in Ireland, 137 (43.1%) were born outside Ireland and for the remaining four cases (1.3%), the country of birth was unknown. The crude TB rate in the Irish-born population was 4.7 per 100,000 population while the crude rate in the foreign-born population was 17.9 per 100,000 population.

Figure 4 shows TB cases and rate per 100,000 population by geographic origin, compared to the national rate from 1998 to 2014.

Table 9 shows the breakdown of TB cases by HSE area and geographic origin for 2013 and 2014.

Cases born outside Ireland originated from at least 45 countries in 2013 and 40 countries in 2014. Of the 167 cases born outside Ireland in 2013, 51.5% were born in Asia, 22.2% in Africa, 24.6% in Europe and 1.8% in America. Of the 137 cases born outside Ireland in 2014, 48.2% were born in Asia, 34.1% in Africa, 14.6% in Europe and 5.1% in America. Table 10 shows the breakdown of these cases by country of birth and corresponding continent.

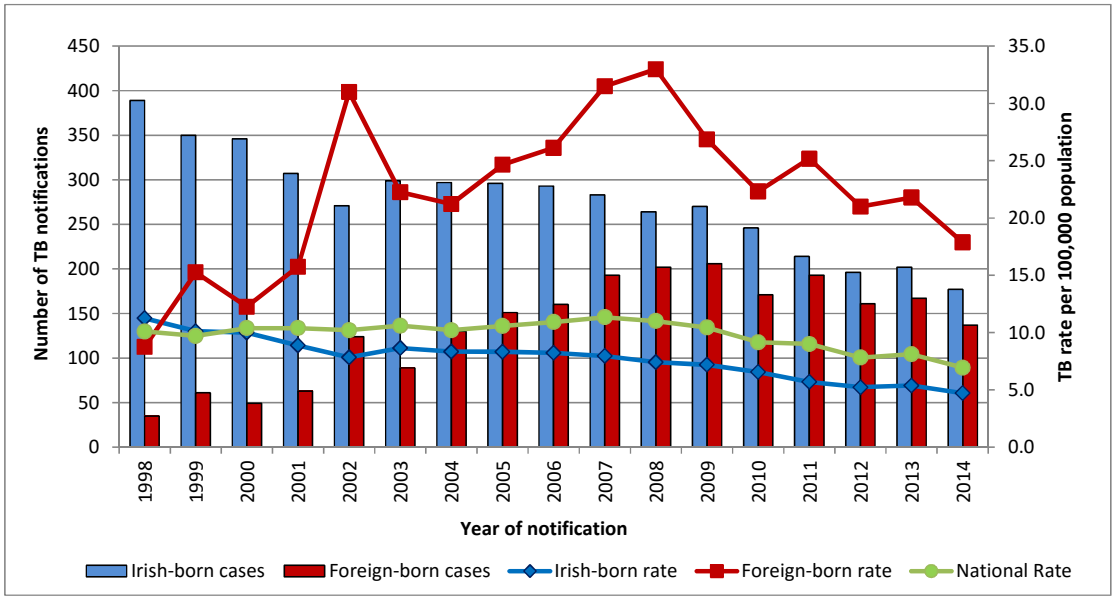

Figure 4: TB cases and rate per 100,000 by geographic origin, 1998-2014

Figure 5 illustrates the interval between arrival and notification for foreign-born TB cases with year of arrival reported between 2002 and 2014. More than half of foreign born cases are notified within three years of their arrival in Ireland (52.4%). Data completeness levels varied during this time period with a marked increase in data completeness from 2011 onwards (range: 0.0% in 2004 to 69.3% in 2014, mean: 29.0%).

Table 9: TB cases and rates per 100,000 population by HSE area and geographic origin, 2013 and 2014

HSE Area	2013								2014							
	Irish-born			Foreign-born			Unk	Total	Irish-born			Foreign-born			Unk	Total
	N	*%*	*CIR*	*N*	*%*	*CIR*			*N*	*%*	*CIR*	*N*	*%*	*CIR*		
HSE-E	61	41.5	4.7	86	58.5	28.5	0	**147**	67	49.6	5.2	67	49.6	22.2	1	**135**
HSE-M	7	43.8	2.9	9	56.3	21.7	0	**16**	8	50.0	3.3	8	50.0	19.3	0	**16**
HSE-MW	16	50.0	5.0	16	50.0	30.3	0	**32**	10	62.5	3.1	4	25.0	7.6	2	**16**
HSE-NE	19	70.4	5.2	6	22.2	7.9	2	**27**	9	40.9	2.5	13	59.1	17.2	0	**22**
HSE-NW	11	68.8	5.4	5	31.3	9.8	0	**16**	12	70.6	5.9	5	29.4	9.8	0	**17**
HSE-SE	22	68.8	5.1	10	31.3	14.9	0	**32**	19	65.5	4.4	10	34.5	14.9	0	**29**
HSE-S	46	69.7	8.3	20	30.3	19.9	0	**66**	46	69.7	8.3	20	30.3	19.9	0	**66**
HSE-W	20	55.6	5.5	15	41.7	19.7	1	**36**	6	35.3	1.7	10	58.8	13.2	1	**17**
Total	**202**	**54.3**	**5.4**	**167**	**44.9**	**21.8**	**3**	**372**	**177**	**55.7**	**4.7**	**137**	**43.1**	**17.9**	**4**	**318**

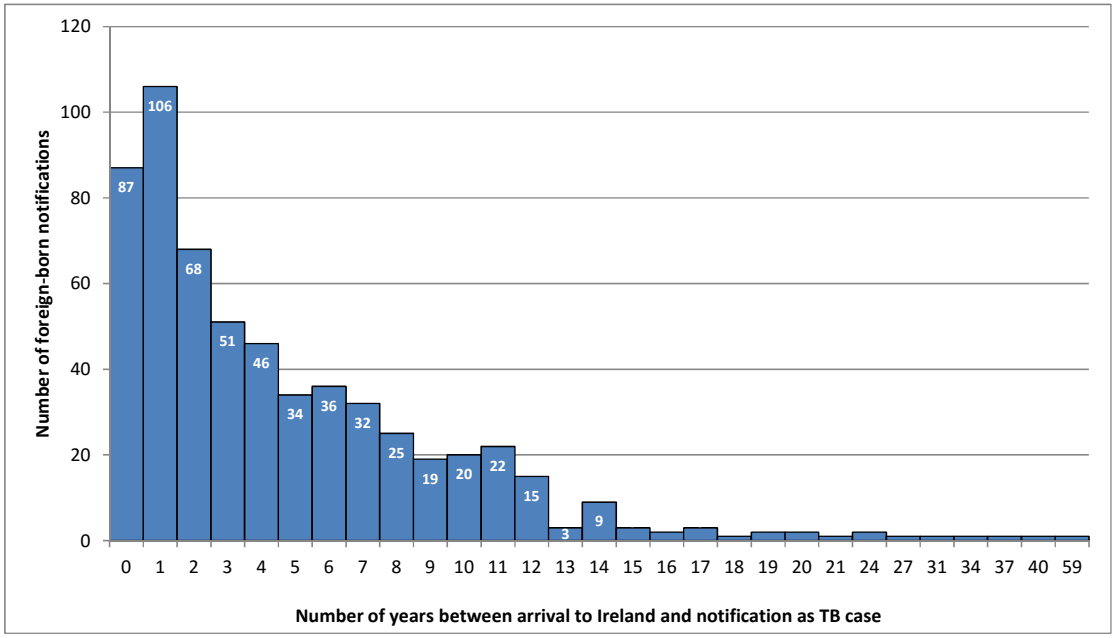

Figure 5: Interval between arrival & notification for foreign-born cases with year of arrival reported: 2002-2014

Table 10: Countries of origin of foreign-born patients with TB, 2013 and 2014

Continent	2013	2014	Country	2013	2014
Africa	37	44	Algeria	1	2
			Botswana	0	3
			Cameroon	0	1
			Cape Verde	1	1
			Congo	1	0
			Congo, the Democratic Republic of the	3	0
			Ethiopia	1	1
			Kenya	2	0
			La Reunion	1	0
			Madagascar	1	0
			Malawi	1	4
			Mauritius	1	1
			Morocco	1	0
			Nigeria	6	15
			Somalia	5	4
			South Africa	8	8
			Sudan	2	0
			Uganda	1	1
			Zambia	0	1
			Zimbabwe	1	2
America	3	7	Bolivia	0	1
			Brazil	2	2
			Canada	0	1
			United States	1	1
			Venezuela	0	2
Asia	86	66	Afghanistan	0	1
			Bangladesh	3	3
			China	3	1
			Georgia	1	0
			Hong Kong	2	1
			India	30	26
			Indonesia	1	0
			Iran, Islamic Republic of	1	0
			Korea, Republic of	1	0
			Malaysia	0	3
			Mongolia	0	1
			Nepal	0	3
			Pakistan	21	12
			Philippines	19	7
			Saudi Arabia	1	1
			Syrian Arab Republic	0	1
			Thailand	2	3
			Viet Nam	1	3
Europe	41	20	Belgium	1	0
			Bulgaria	0	2
			Czech Republic	1	0
			Hungary	0	1
			Latvia	2	2
			Lithuania	5	1
			Norway	0	1
			Poland	8	8
			Portugal	1	0
			Romania	11	2
			Russian Federation	2	0
			Serbia	2	0
			Spain	1	0
			Turkey	1	0
			United Kingdom	6	3
Total				**167**	**137**

Table 11 shows number of cases and age-specific rates by geographic origin during 2013 and 2014. In both 2013 and 2014, the highest age-specific rates in foreign-born cases were in the 25-34 year age group (27.7, 27.2). In 2013, the highest age-specific rates in Irish-born cases were in the 20-24 year age group (9.2) and in those aged 65 years and older (9.1). In 2014, the highest age-specific rates in Irish-born were in those aged 65 years and older (12.6).

The median age for Irish-born cases was 47 years and 35 years for foreign-born cases in 2013, and 58 years for Irish-born and 34 years for foreign-born cases in 2014.

Table 11: TB cases and age-specific rates by geographic origin, 2013 and 2014

Age group (years)	2013				2014			
	Irish-born		Foreign-born		Irish-born		Foreign-born	
	cases	rate	cases	rate	cases	rate	cases	rate
0-14	7	*0.8*	3	*3.2*	5	*0.6*	2	*2.1*
15-19	4	*1.7*	7	*15.6*	6	*2.6*	4	*8.9*
20-24	21	*9.2*	15	*25.2*	10	*4.4*	10	*16.8*
25-34	29	*5.4*	58	*27.7*	15	*2.8*	57	*27.2*
35-44	31	*6.0*	46	*26.7*	23	*4.5*	34	*19.7*
45-54	32	*6.9*	23	*21.9*	22	*4.7*	20	*19.0*
55-64	33	*8.0*	11	*24.3*	34	*8.3*	4	*8.8*
65+	45	*9.1*	4	*11.0*	62	*12.6*	6	*16.5*
Total	**202**	***5.4***	**167**	***21.8***	**177**	**4.7**	**137**	**17.9**

Site of disease

In 2013, 222 (59.7%) were pulmonary, 123 (33.1%) were extrapulmonary and 27 (7.3%) were pulmonary and extrapulmonary. In 2014, 171 (53.9%) were pulmonary, 121 (38.2%) were extrapulmonary and 25 (7.9%) were pulmonary and extrapulmonary. One case did not report site of infection during 2014. TB cases by site of disease and HSE area are shown in table 12.

Table 12: TB cases by site of disease and HSE area, 2013 and 2014

HSE area		Pulmonary		Extrapulmonary		P+E	
		Number	%	Number	%	Number	%
2013	HSE-E	91	*61.9*	43	*29.3*	13	*8.8*
	HSE-M	7	*43.8*	8	*50.0*	1	*6.3*
	HSE-MW	14	*43.8*	14	*43.8*	4	*12.5*
	HSE-NE	17	*63.0*	8	*29.6*	2	*7.4*
	HSE-NW	8	*50.0*	8	*50.0*	0	*0.0*
	HSE-SE	21	*65.6*	7	*21.9*	4	*12.5*
	HSE-S	43	*65.2*	20	*30.3*	3	*4.5*
	HSE-W	21	*58.3*	15	*41.7*	0	*0.0*
2013 Total		**222**	***59.7***	**123**	***33.1***	**27**	***7.3***
2014	HSE-E	79	*58.5*	48	*35.6*	8	*5.9*
	HSE-M	11	*68.8*	4	*25.0*	1	*6.3*
	HSE-MW	9	*60.0*	5	*33.3*	1	*6.7*
	HSE-NE	13	*59.1*	7	*31.8*	2	*9.1*
	HSE-NW	6	*35.3*	10	*58.8*	1	*5.9*
	HSE-SE	13	*44.8*	14	*48.3*	2	*6.9*
	HSE-S	33	*50.0*	25	*37.9*	8	*12.1*
	HSE-W	7	*41.2*	8	*47.1*	2	*11.8*
2014 Total		**171**	***53.9***	**121**	***38.2***	**25**	***7.9***

Pulmonary TB cases

The WHO defines pulmonary TB, for the purpose of analysis, as any case that has a pulmonary disease component. There were 249 cases reported with a pulmonary disease component in 2013 (66.9%) and 196 (61.8%) in 2014. Sputum smear and culture results for these cases are shown in table 13.

Sputum microscopy results were available for 172 (69.1%) of the 249 cases and for 131 (66.8%) in 2014. This compares to a mean of 73.2% between 2002 and 2012.

Of pulmonary cases, 127 (51.0%) were sputum positive for AFB by microscopy in 2013 and 91 (46.4%) in 2014. This compares to a mean of 44.7% positive for AFB by microscopy between 2002 and 2012.

Of pulmonary cases, 207 (83.1%) were culture positive in 2013 and 159 (81.1%) in 2014. This compares to a mean of 73.5% positive by culture between 2002 and 2012.

The proportion of pulmonary cases (with or without an extrapulmonary site) was higher in persons born in Ireland (77.7% in 2013 and 66.7% in 2014) compared to those born abroad (54.5% in 2013 and 54.7% in 2014).

Table 13: Sputum smear and culture status for pulmonary TB cases, 2013 and 2014

Culture		Sputum smear result				
		Positive	Negative	Not done	Unknown	Total
2013 culture results	Positive	122	31	36	18	**207**
	Negative	0	11	9	2	**22**
	Not done	0	0	1	0	**1**
	Not known	5	3	7	4	**19**
	Total	**127**	**45**	**53**	**24**	**249**
2014 culture results	Positive	89	31	24	15	**159**
	Negative	0	5	12	2	**19**
	Not done	0	0	0	0	**0**
	Not known	2	4	6	6	**18**
	Total	**91**	**40**	**42**	**23**	**196**

Extra-pulmonary TB cases

In 2013, 123 cases (33.1%) had exclusively extrapulmonary TB, of whom 74 (60.2%) were culture confirmed and 26 (21.1%) were histology positive. In 2014, 121 cases (38.2%) had exclusively extrapulmonary TB, of whom 72 (59.5%) were culture confirmed and 40 (33.1%) were histology positive.

Extrapulmonary disease components were reported in 150 cases (40.3%) in 2013 and in 146 cases (45.9%) in 2014. The extrapulmonary sites reported are shown in table 14. The most frequent sites of extrapulmonary disease reported were extra-thoracic lymph nodes and pleural. There were three cases of TB meningitis in 2013 and two cases in 2014.

Table 14: Extrapulmonary disease sites in notified cases, 2013 and 2014[§§]

Site	2013		2014	
	Number	%	Number	%
Lymphatic extrathoracic	48	32.0	38	26.0
Pleural	29	19.3	29	19.9
Lymphatic intrathoracic	20	13.3	24	16.4
Other	11	7.3	14	9.6
Peritoneal/digestive	13	8.7	10	6.8
Spine	9	6.0	7	4.8
Genito-urinary	4	2.7	9	6.2
Bone/joint other than spine	3	2.0	5	3.4
Disseminated	3	2.0	5	3.4
Meningeal	3	2.0	2	1.4
Unknown	4	2.7	1	0.7
EP site not reported	2	1.3	2	1.4
Central nervous system	1	0.7	0	0.0
Total	**150**	**100.0**	**146**	**100.0**

[§§] Includes extrapulmonary (E) and pulmonary plus extrapulmonary cases (P + E)

TB meningitis

There were three cases of TB meningitis reported in 2013 and two in 2014, giving incidence rates of 0.07 and 0.04 per 100,000 population respectively. A profile of these cases is provided in table 15. Four cases were exclusively extrapulmonary. Three cases were reported as culture confirmed, one isolate was *M. tuberculosis* and two were *M. africanum*. Four cases were in adults, two of whom were foreign-born. One case was vaccinated while BCG status was not reported for the remaining four cases.

Table 15: TB meningitis cases in Ireland, 2013 and 2014

Year	HSE Area	Age group (years)	History of BCG	Culture Status	Species	Case classification
2013	HSE-E	45-54	Unknown	Positive	*M. africanum*	Confirmed
2013	HSE-E	35-44	Unknown	Positive	*M. tuberculosis*	Confirmed
2013	HSE-E	25-34	Unknown	Unknown	Unknown	Probable
2014	HSE-NE	25-34	Unknown	Unknown	Unknown	Possible
2014	HSE-S	05-14	Yes	Positive	*M. africanum*	Confirmed

Between 1998 and 2014, a total of 96 cases of TB meningitis have been reported (figure 6). The cumulative incidence rates of TB meningitis in each HSE area and in Ireland for 1998-2014 are shown in table 16. The highest cumulative rate of TB meningitis between 1998 and 2014 is in HSE South (4.0 per 100,000).

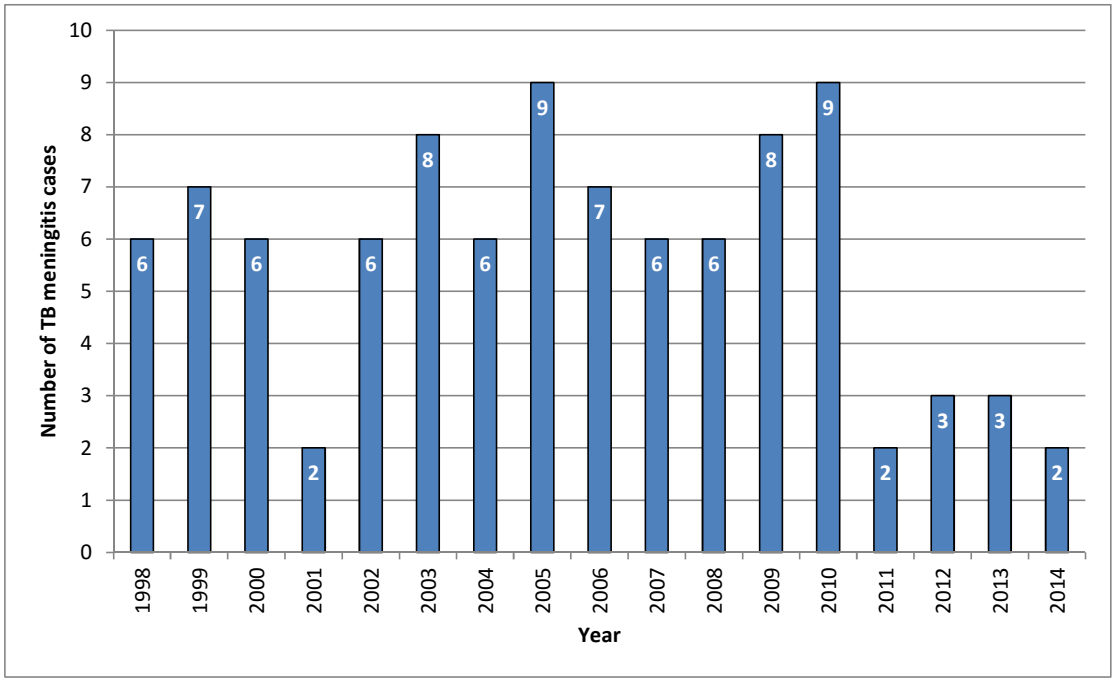

Figure 6: Number of TB meningitis cases, 1998-2014

Table 16: Cumulative incidence rate of TB meningitis in Ireland, 1998-2014

HSE area	Cases 1998 to 2014	Cumulative incidence rate (per 100,000)***	95% CI
HSE-E	34	2.3	1.5 - 3
HSE-M	0	0.0	0 - 0
HSE-MW	8	2.2	0.7 - 3.8
HSE-NE	12	3.0	1.3 - 4.8
HSE-NW	4	1.7	0 - 3.3
HSE-SE	7	1.5	0.4 - 2.6
HSE-S	25	4.0	2.4 - 5.6
HSE-W	6	1.4	0.3 - 2.6
Ireland	**96**	**2.3**	**1.8 - 2.7**

The highest cumulative age specific rates of TB meningitis between 1998 and 2014 were reported in the 25-34 year age group (3.6/100,000) followed by those aged 65 years and older (3.0/100,000) while the lowest rates were reported in the 45-54 year age group (1.0/100,000) and the 5-9 year age group (1.0/100,000). Figure 7 shows the number of TB meningitis cases by age group and cumulative age specific rate between 1998 and 2014.

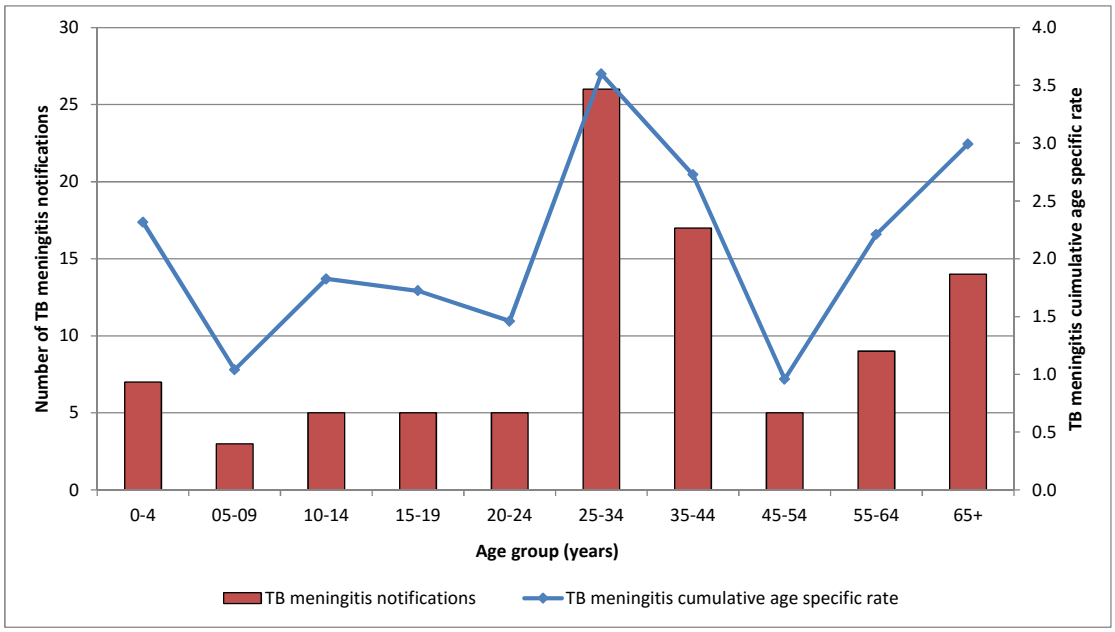

Figure 7: Cumulative number of TB meningitis notifications by age group and cumulative age specific rate, 1998-2014

*** *Note: Calculations based on 2006 census figures*

Bacteriological results

Cases are reported as being laboratory confirmed where culture, PCR, microscopy or histology was reported as positive.

In 2013, 321 (86.3%) were laboratory confirmed by culture, PCR, microscopy or histology while in 2014, 270 (84.9%) were laboratory confirmed.

Of cases with a pulmonary component, 224 (90.0%) were laboratory confirmed in 2013 while 171 pulmonary cases (87.2%) were laboratory confirmed in 2014.

Of cases with exclusively extrapulmonary disease, 97 (78.9%) were laboratory confirmed in 2013, while 98 cases with exclusively extrapulmonary disease (81.0%) were laboratory confirmed in 2014.

Culture

In 2013, 281 (75.5%) of all TB cases notified were culture positive while in 2014, 231 (72.6%) of cases were culture positive. Table 17 shows a breakdown by culture status and HSE area of TB cases notified in 2013 and 2014 while figure 8 shows the number of TB notifications and percentage culture positive by year, 2002 to 2014.

Of cases with a pulmonary component, 207 (83.1%) were culture confirmed in 2013 and 159 (81.1%) were culture confirmed in 2014. For new[†††] cases with a pulmonary component, 141 (87.6%) were culture confirmed in 2013 and 124 (83.2%) were culture confirmed in 2014.

Of the cases with exclusive extrapulmonary disease, 74 (60.2%) were culture confirmed in 2013 and 72 (59.5%) were culture confirmed in 2014.

Table 17: Culture status of TB cases by HSE area, 2013 and 2014

HSE area		Positive	Negative	Not done	Unknown	Total	%
2013	HSE-E	112	7	2	26	**147**	76.2
	HSE-M	8	6	2	0	**16**	50
	HSE-MW	27	3	2	0	**32**	84.4
	HSE-NE	22	2	0	3	**27**	81.5
	HSE-NW	15	1	0	0	**16**	93.8
	HSE-SE	27	4	0	1	**32**	84.4
	HSE-S	43	19	1	3	**66**	65.2
	HSE-W	27	8	0	1	**36**	75
	Ireland	**281**	**50**	**7**	**34**	**372**	**75.5**
2014	HSE-E	105	6	0	24	**135**	77.8
	HSE-M	11	3	1	1	**16**	68.8
	HSE-MW	10	2	0	4	**16**	62.5
	HSE-NE	20	0	0	2	**22**	90.9
	HSE-NW	10	5	1	1	**17**	58.8
	HSE-SE	20	4	1	4	**29**	69
	HSE-S	43	16	1	6	**66**	65.2
	HSE-W	12	4	0	1	**17**	70.6
	Ireland	**231**	**40**	**4**	**43**	**318**	**72.6**

[†††] "New" cases are defined as cases where previous history of TB was reported as "No"

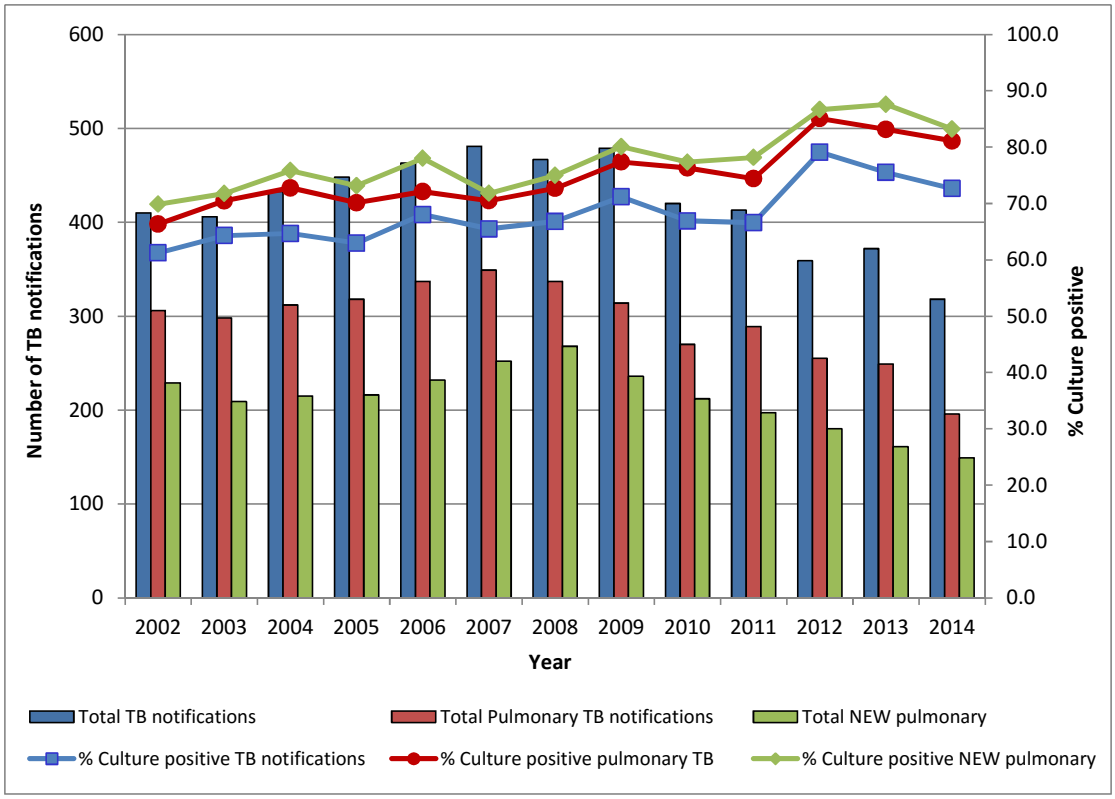

Figure 8: Number of TB notifications and percentage culture positive by year, 2002-2014

Species

Table 18 shows the number and percentage of culture positive TB cases by species and year.

Of the eight *M. bovis* cases notified during 2013 and 2014, none had a previous history of TB reported and seven were born in Ireland. Four cases reported having one or more risk factor for TB. Three cases reported having received BCG vaccination. Cases were aged between 0-84 years. All cases were pansensitive.

Table 18: Number and percentage of culture positive TB notifications by species 2002-2014

Year	*M. africanum*		*M. bovis*		*M. canettii*		*M. tuberculosis*		*M. tuberculosis* complex		Species unknown	
	N	%	N	%	N	%	N	%			N	%
2002	0	*0.0*	7	*2.8*			234	*93.2*			10	*4.0*
2003	1	*0.4*	3	*1.1*			250	*95.8*			7	*2.7*
2004	0	*0.0*	5	*1.8*			269	*96.1*			6	*2.1*
2005	1	*0.4*	4	*1.4*			274	*97.2*			3	*1.1*
2006	1	*0.3*	5	*1.6*			307	*97.5*			2	*0.6*
2007	2	*0.6*	6	*1.9*			305	*96.8*			2	*0.6*
2008	0	*0.0*	12	*3.8*			295	*94.6*			5	*1.6*
2009	1	*0.3*	8	*2.3*			328	*96.2*			4	*1.2*
2010	3	*1.1*	12	*4.3*			265	*94.3*			1	*0.4*
2011	0	*0.0*	6	*2.2*	0	*0.0*	254	*88.2*	14	*4.9*	-	-
2012	4	*1.4*	4	*1.4*	1	*0.4*	272	*94.8*	3	*1.0*	-	-
2013	4	*1.4*	6	*2.1*	0	*0.0*	270	*96.1*	1	*0.4*	-	-
2014	3	*1.3*	2	*0.9*	0	*0.0*	226	*97.8*	0	*0.0*	-	-

Anti-TB drug resistance[‡‡‡]

Information on the results of drug sensitivity testing (DST) was reported for 272 (96.8%) of the 281 culture confirmed cases in 2013 and 230 (99.6%) of 231 culture confirmed cases in 2014.

The proportion of culture confirmed cases with DST results reported for new pulmonary cases was 99.3% in 2013 and 100.0% in 2014.

The proportion of culture confirmed cases with DST results with a previous history of TB was 87.5% for cases in 2013 and 100.0% in 2014.

Table 19 details the percentage of culture positive TB notifications with DST results available by previous history of TB and year.

[‡‡‡] Resistance to pyrazinamide has not been reported in *M. bovis* cases as *M. bovis* is innately resistant to pyrazinamide.

Table 19: Percentage of culture positive TB notifications with DST results available by previous history of TB and year 2002-2014

Year	% Culture pos with DST results – Total notifications	% Culture pos with DST results - New pulmonary	% Culture pos with DST results - Previous history of TB reported	% Culture pos with DST results - Previous TB treatment reported
2002	94.0	95.6	94.7	90.9
2003	96.9	98.0	96.2	100.0
2004	94.6	96.9	83.3	90.0
2005	97.5	98.1	100.0	100.0
2006	94.3	96.7	89.3	100.0
2007	95.2	93.9	100.0	100.0
2008	96.8	97.5	100.0	100.0
2009	96.8	95.2	97.0	100.0
2010	98.6	100.0	100.0	100.0
2011	91.3	94.2	93.3	87.5
2012	98.2	98.1	100.0	100.0
2013	96.8	99.3	87.5	88.9
2014	99.6	100.0	100.0	100.0
Mean	**96.2**	**97.2**	**95.5**	**96.7**

Of the cases where sensitivity results were reported, resistance was documented in 35 cases in 2013 and 23 cases in 2014 (table 20). There were four cases of MDR-TB in 2013 (including one case of XDR-TB) and two cases in 2014. Mono-resistance to isoniazid was recorded in 19 cases in 2013 and eight cases in 2014.

Of the drug resistant cases, including MDR-TB cases, 26 (74.3%) were foreign born in 2013 and 18 (90.0%) in 2014 (figure 9). Of the drug resistant cases in 2013, none had a previously recorded history of TB while two resistant cases in 2014 had a previous history of TB. Previous TB history was unknown for seven drug resistant cases in 2013 and for one resistant case in 2014 (figure 10).

One case of XDR-TB was reported in Ireland during 2013 in a foreign-born case with an unknown previous history of TB. No cases of XDR-TB were reported in 2014.

A summary of drug resistance in 2013 and 2014 is shown in table 20 and the drug sensitivity results of the MDR-TB cases in 2013 and 2014 are shown in table 21 while figure 11 shows the number and percentage (of cases with DST results) of MDR-TB and XDR-TB notifications by year: 2000-2014.

Table 20: Summary of drug resistant TB cases in Ireland, 2013 and 2014

DST results	2013		2014	
	Number	% of culture confirmed cases	Number	% of culture confirmed cases
Cases with DST results	272	*96.8*	230	*99.6*
Resistant cases	35	*12.5*	23	*10.0*
MDR-TB	3	*1.1*	2	*0.9*
XDR-TB	1	*0.4*	0	*0.0*
Mono-resistance to isoniazid	19	*6.8*	8	*3.5*
Mono-resistance to rifampicin	0	*0.0*	0	*0.0*
Mono-resistance to pyrazinamide	1	*0.4*	5	*2.2*
Mono-resistance to ethambutol	0	*0.0*	1	*0.4*
Mono-resistance to streptomycin	7	*2.5*	5	*2.2*
Cases resistant to isoniazid and streptomycin	3	*1.1*	0	*0.0*
Cases resistant to isoniazid, pyrazinamide & streptomycin	1	*0.4*	0	*0.0*

Table 21: Sensitivity results of MDR and XDR-TB cases, 2013 and 2014

Year	Diagnosis	Isolate	Isoniazid	Rifampicin	Pyrazinamide	Ethambutol	Streptomycin
2013	Pulmonary	M.TB	**R**	**R**	**R**	S	**R**
	Pulmonary	M.TB	**R**	**R**	S	**R**	**R**
	Pulmonary	M.TB	**R**	**R**	**R**	S	**R**
	Pulmonary	M.TB	**R**	**R**	**R**	**R**	**R**
2014	Pulmonary	M.TB	**R**	**R**	**R**	Unk	**R**
	Pulmonary	M.TB	**R**	**R**	**R**	**R**	**R**

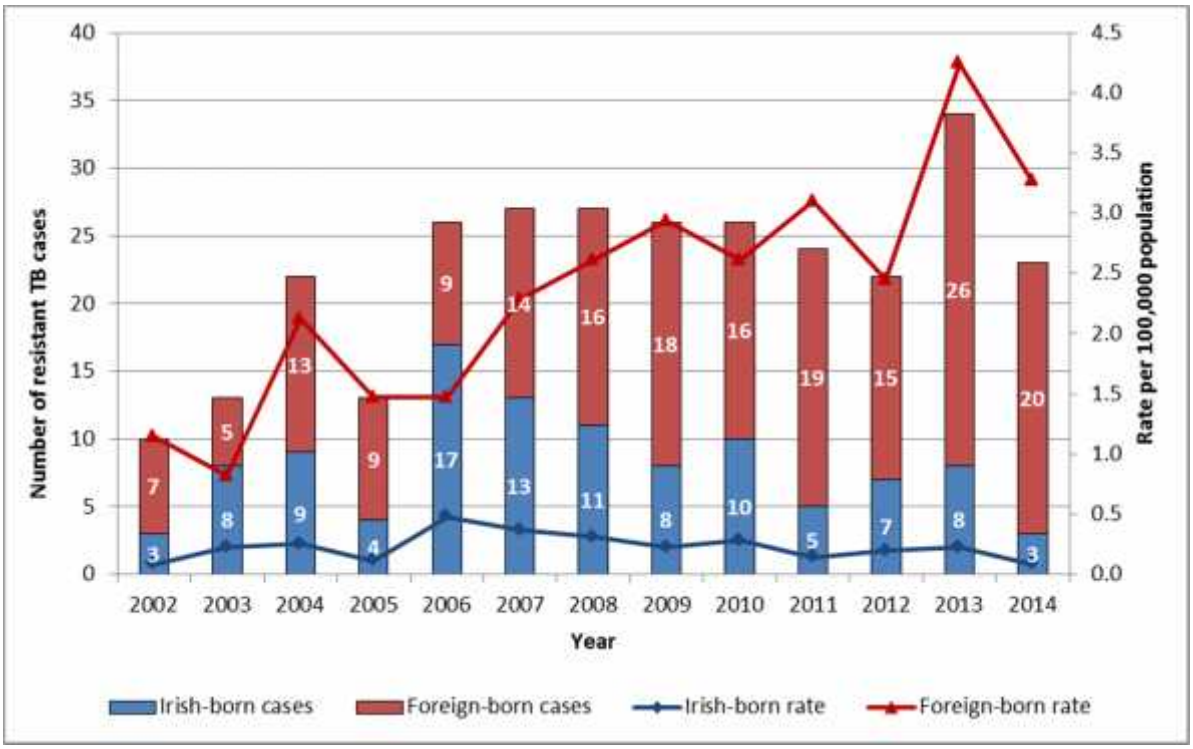

Figure 9: Number and rate of TB notifications with resistance to any first line anti-TB drug by geographic origin[§§§] and year 2002-2014

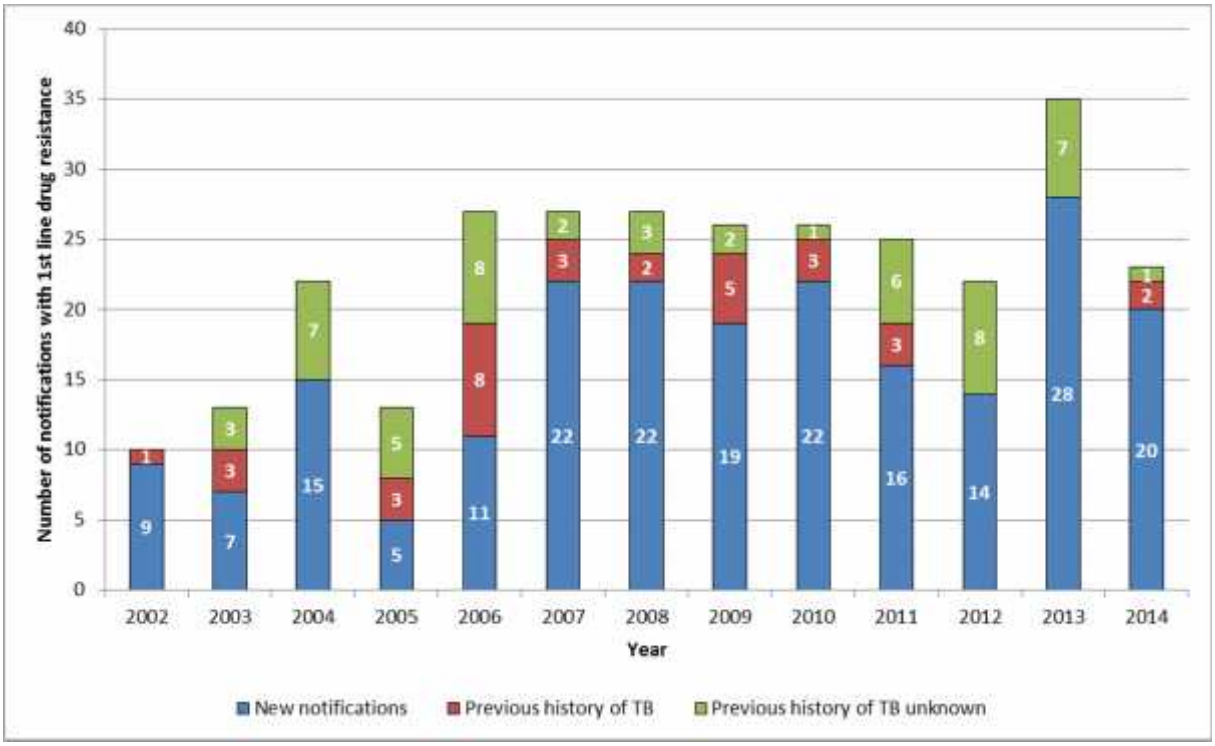

Figure 10: Number of TB notifications with resistance to any first line anti-TB drug by previous history of TB and year 2002-2014

[§§§] Country of birth missing for 1 resistant case in 2013.

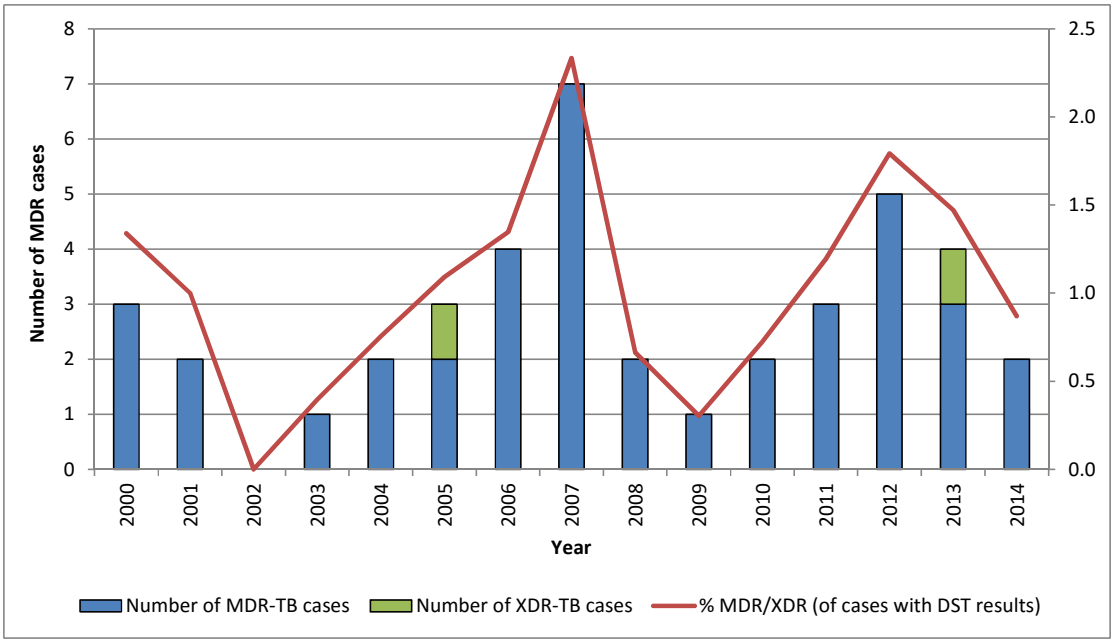

Figure 11: Number of MDR-TB and XDR-TB cases and percentage MDR/XDR-TB cases by year: 2000-2014

Case classification

Using the case definitions (described in the Methods section), TB cases notified can be classified into confirmed, probable and possible cases as outlined in Table 22.

Table 22: Case classification of TB cases by site of disease, 2013 and 2014

Site of disease		Confirmed		Probable		Possible		Total
		Cases	%	Cases	%	Cases	%	
2013	Pulmonary	185	83.3	14	6.3	23	10.4	**222**
	Pulmonary + Extrapulmonary	22	81.5	3	11.1	2	7.4	**27**
	Extrapulmonary	80	65.0	17	13.8	26	21.1	**123**
	Total	**287**	**77.2**	**34**	**9.1**	**51**	**13.7**	**372**
2014	Pulmonary	141	82.5	7	4.1	23	13.5	**171**
	Pulmonary + Extrapulmonary	21	84.0	2	8.0	2	8.0	**25**
	Extrapulmonary	74	61.2	24	19.8	23	19.0	**121**
	Unknown	0	0.0	1	100.0	0	0.0	**1**
	Total	**236**	**74.2**	**34**	**10.7**	**48**	**15.1**	**318**

Treatment outcome: 2013 cases**

Outcome was recorded for 294 (79.0%) of the 372 cases notified in 2013 (table 23, figure 12). Treatment was reported as completed for 229 cases, 18 cases died, 16 were recorded as being lost to follow up, 14 cases were transferred, treatment was interrupted in seven cases and 10 cases were still on treatment at the time of reporting. Treatment outcome was not reported for the remaining 78 cases. Of the 18 deaths reported, six (1.6% of total cases) were attributed to TB.

Outcome was reported for 100 (77.5%) of the 129 smear positive cases. Of the 100, 80 completed treatment, three died, seven were lost to follow up and six cases were transferred while four cases were still on treatment at the time of reporting. Treatment outcome was unknown for the remaining 29 smear positive cases. Of the three deaths among smear positive cases, two were attributed to TB.

Details on treatment outcome for all cases and for smear positive cases only are shown in table 23 while treatment outcome by HSE area is shown in table 24.

Of the 35 drug-resistant cases, 18 (51.4%) were reported as having completed treatment, five cases were transferred, treatment was interrupted in one case and one case was still on treatment at the time of reporting. Treatment outcome was not reported for the remaining 10 resistant cases.

Of the five MDR-TB cases reported in 2012, four were reported as treatment completed and one case died. Treatment outcomes for the MDR-TB cases reported during 2013 are not yet available, due to the extended treatment period.

Figure 13 shows TB notifications by treatment success and year while figure 14 shows the number of MDR-TB notifications by treatment outcome and percentage treatment success by year.

Table 23: Treatment outcome for all cases and smear positive cases, 2013

Treatment outcome	Total		Smear Positive	
	Number	%	Number	%
Completed - cured	186	50.0	73	56.6
Completed - failed	0	0.0	0	0.0
Completed - status unknown	43	11.6	7	5.4
Died (attributed to TB)	6	1.6	2	1.6
Died (cause unknown)	2	0.5	0	0.0
Died (not attributed to TB)	10	2.7	1	0.8
Lost to follow up	16	4.3	7	5.4
Still on treatment	10	2.7	4	3.1
Transferred	14	3.8	6	4.7
Treatment interrupted	7	1.9	0	0.0
Unknown	78	21.0	29	22.5
Total	**372**	**100.0**	**129**	**100.0**

**** Treatment outcome for 2014 not available at the time of publication.

Table 24: Treatment outcome by HSE area, 2013

		Outcome known	Outcome unknown	Lost to follow up	Total
HSE E	**Number**	79	60	8	**147**
	%	*53.7*	*40.8*	*5.4*	*100.0*
HSE M	**Number**	15	0	1	**16**
	%	*93.8*	*0.0*	*6.3*	*100.0*
HSE MW	**Number**	30	1	1	**32**
	%	*93.8*	*3.1*	*3.1*	*100.0*
HSE NE	**Number**	19	5	3	**27**
	%	*70.4*	*18.5*	*11.1*	*100.0*
HSE NW	**Number**	16	0	0	**16**
	%	*100.0*	*0.0*	*0.0*	*100.0*
HSE SE	**Number**	31	0	1	**32**
	%	*96.9*	*0.0*	*3.1*	*100.0*
HSE S	**Number**	55	9	2	**66**
	%	*83.3*	*13.6*	*3.0*	*100.0*
HSE W	**Number**	33	3	0	**36**
	%	*91.7*	*8.3*	*0.0*	*100.0*
National	**Number**	**278**	**78**	**16**	**372**
	%	***74.7***	***21.0***	***4.3***	***100.0***

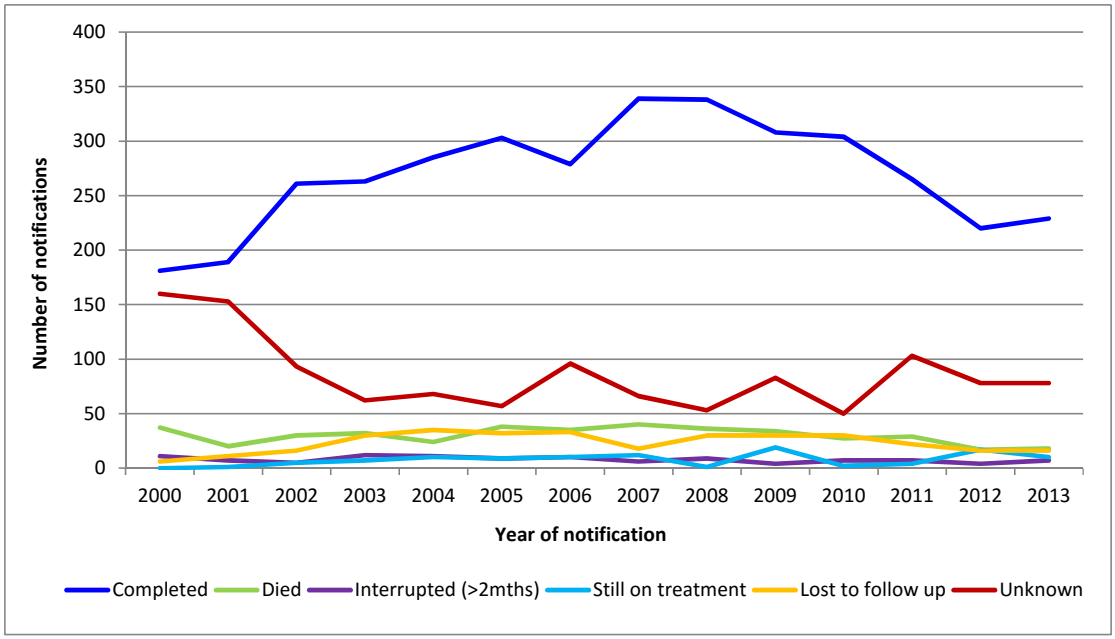

Figure 12: TB notifications by treatment outcome and year 2000-2013

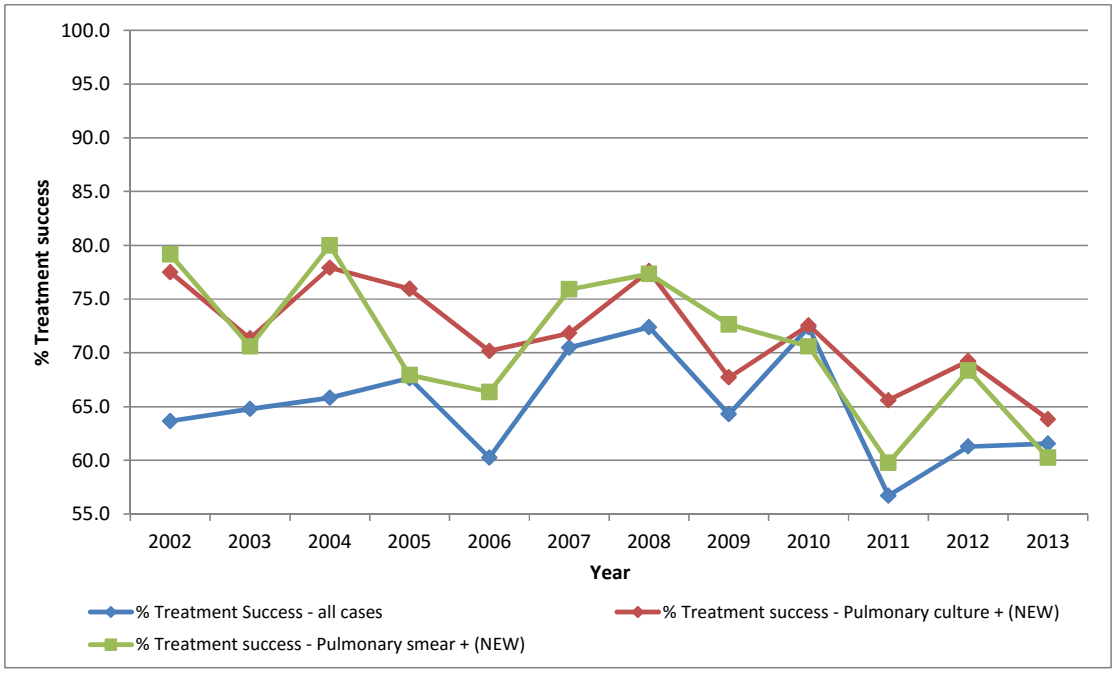

Figure 13: TB notifications by treatment success and year 2002-2013

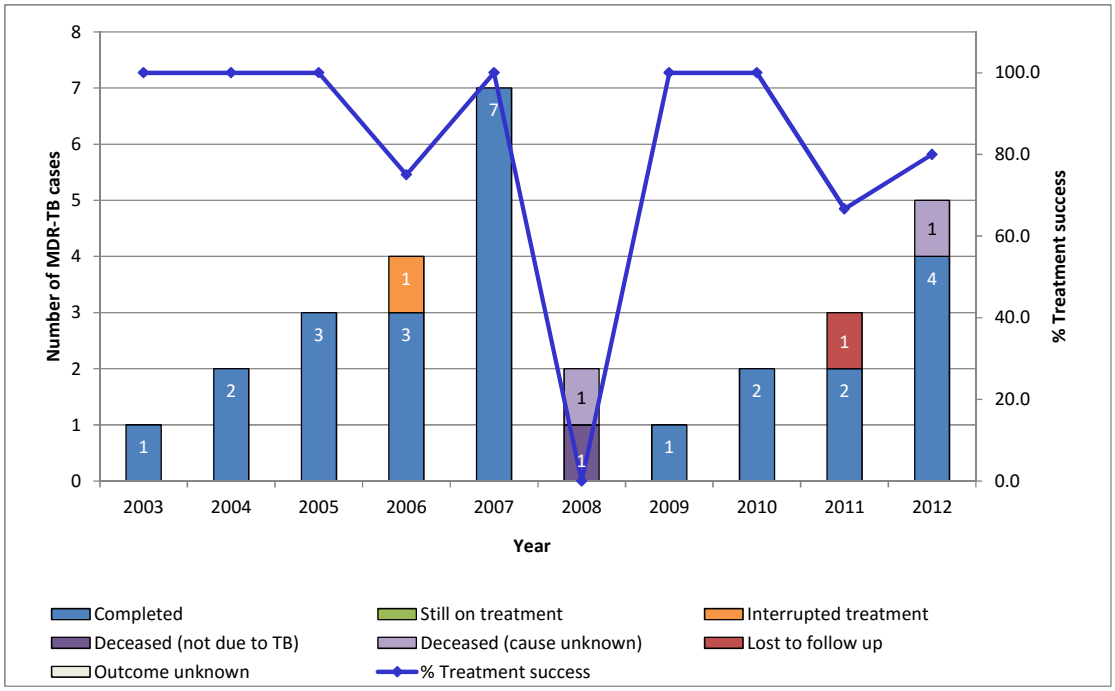

Figure 14: Number of MDR-TB notifications by treatment outcome and percentage treatment success by year, 2003-2012

Case ascertainment

Table 25 summarises the method by which cases notified in 2013 and 2014 were found. The majority of cases in both years presented as a case.

Table 25: Method of case finding, 2013 and 2014

Case found by	2013		2014	
	Number	Percentage	Number	Percentage
Presenting as case	305	82.0	263	82.7
Contact tracing	28	7.5	21	6.6
Other	13	3.5	15	4.7
Immigrant screening	0	0.0	1	0.3
Post-mortem diagnosis	5	1.3	0	0.0
Pre-employment screening	2	0.5	2	0.6
Unknown	19	5.1	16	5.0
Total	**372**	**100.0**	**318**	**100.0**

Previous history of TB

During 2013 and 2014, 25 (6.7%) and 20 (6.3%) of cases respectively were reported to have a previous history of TB. The previous year of diagnosis was provided for 23 cases in 2013 and 14 in 2014. Year of previous diagnosis ranged from 1934 to 2012 in 2013 and from 1950 to 2012 in 2014. Fifteen cases (60.0%) in 2013 and seven cases (35.0%) in 2014 were reported to have had TB in the previous ten years.

Of previously diagnosed cases, previous treatment was reported for 16 (64%) cases in 2013 and 10 (50%) cases in 2014. Of the cases who were previously treated for TB, all cases were reported as having completed treatment in both 2013 and 2014. Figure 15 shows the number of TB notifications by previous history of TB disease and year.

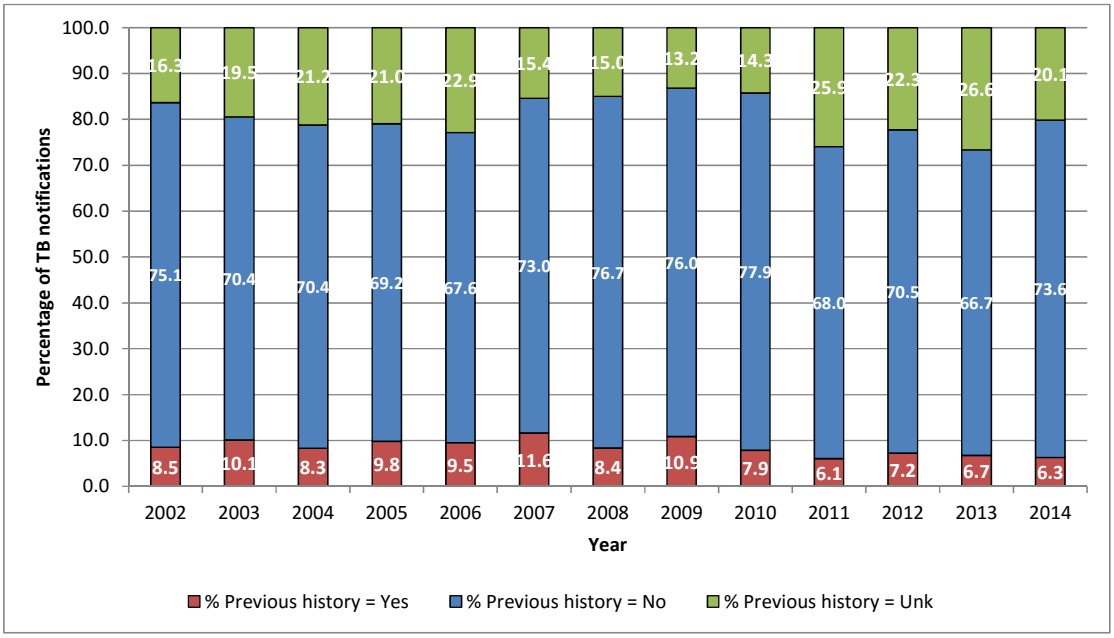

Figure 15: TB notifications by previous history of TB disease and year 2002-2014

TB Risk groups

Figure 16 shows the breakdown of TB cases with a reported risk factor by type of risk factor and year.

Information on TB risk factors was reported for 287 (77.2%) cases in 2013 and 252 (79.2%) in 2014. One or more risk factors for TB were reported by 57.5% in 2013 and 61.0% in 2014.

During 2013 and 2014, the most commonly reported risk factors were being from a country of high TB endemicity[††††], followed by residence in an area of high endemicity and contact with a case of TB.

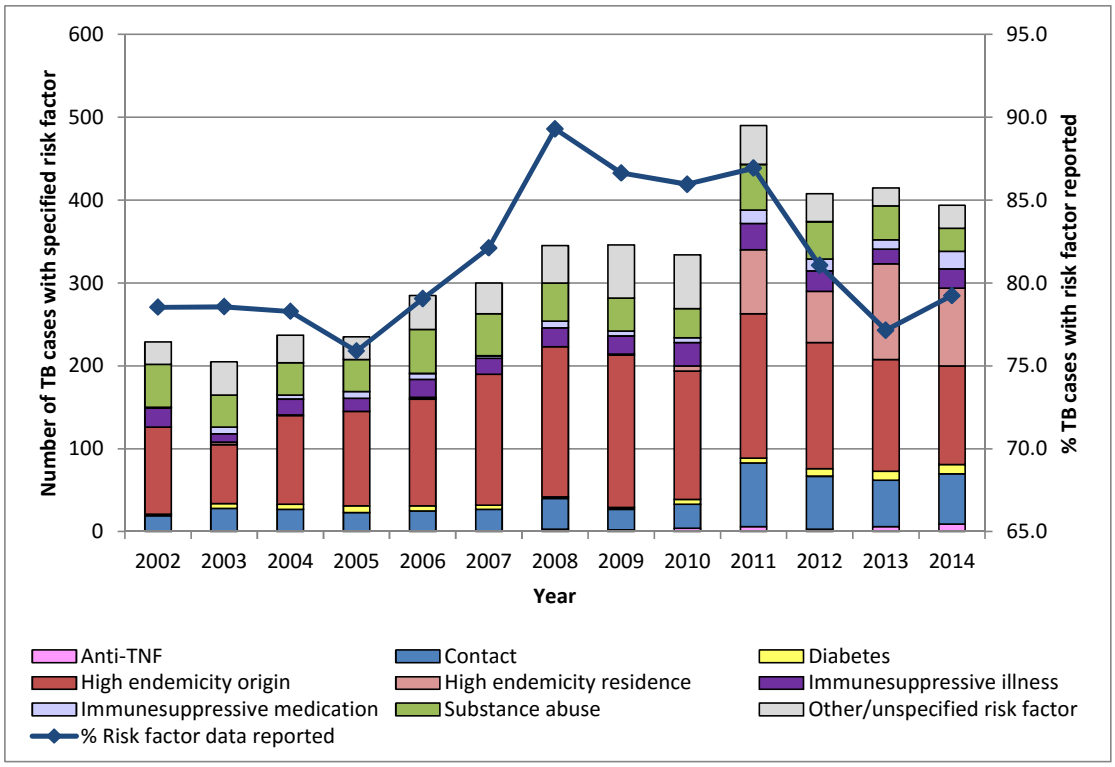

Figure 16: Number of TB notifications with a TB risk factor reported and percentage of TB cases with risk factor data reported, 2002-2014

[††††] Countries with an annual TB notification rate of ≥ 40 cases per 100,000 population are considered areas of high endemicity.

HIV status

HIV status was reported for 121 (32.5%) TB cases in 2013 and 92 (28.9%) cases in 2014. Where HIV status was known, nine cases (7.4%) were reported as HIV positive in 2013 and 15 cases (16.3%). Figure 17 illustrates the trends in the percentage of TB notifications by HIV status and year, 1998-2014.

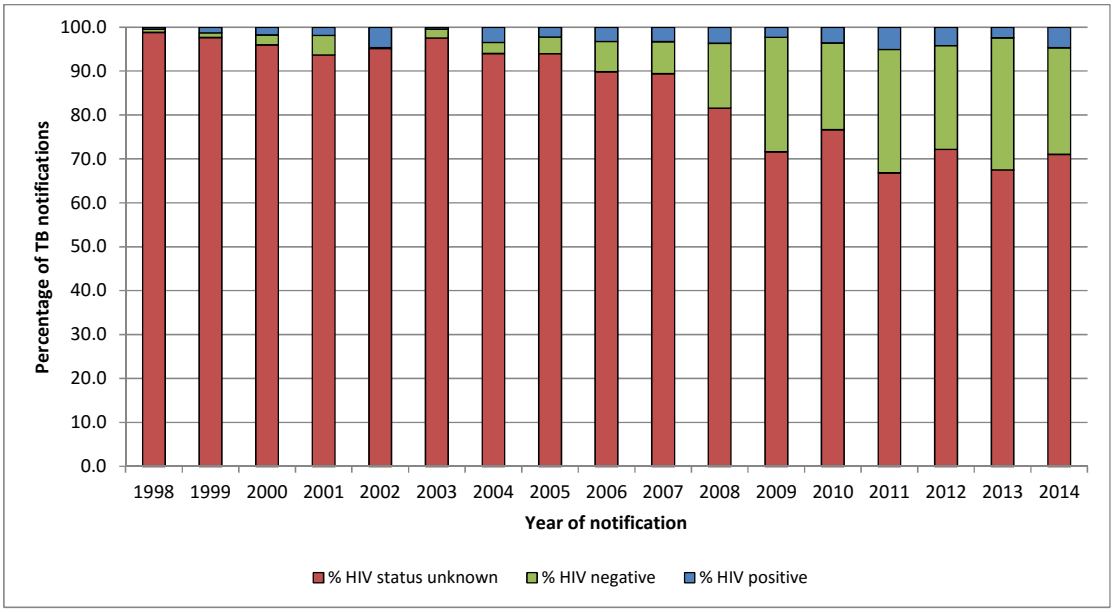

Figure 17: Percentage of TB notifications by HIV status and year, 1998-2014

Outbreaks:

The introduction of the amendment to the Infectious Disease Regulations 1981 on January 1st 2004‡‡‡‡, made outbreaks, unusual clusters or changing patterns of illness statutorily notifiable by medical practitioners and clinical directors of laboratories to the medical officer of health. Standard reporting procedures for surveillance of TB outbreaks were formally agreed in 2007.

During 2013, 12 outbreaks of TB were reported to HPSC. These outbreaks comprised 46 associated active TB cases, 174 cases of latent TB infection (LTBI), 17 hospitalisations and one death (figure 18). During 2014, five outbreaks of TB were reported to HPSC. These outbreaks reported 20 associated active TB cases and 10 cases of latent TB infection (LTBI).

During 2013, three outbreaks each were reported by HSE-E, –S and -W, two were reported by HSE-MW and one was reported by HSE-SE. During 2014, three outbreaks were reported by HSE-S and one each was reported by HSE-E and –NE (figure 19).

In 2013, there were seven general outbreaks, four occurred in community settings, and one each occurred in a third level education facility, a workplace and a residential facility. There were also five family outbreaks, three of which occurred across extended families and two occurred in private houses

In 2014, there were two general outbreaks, one occurred in a community setting and one in a public house. There were also three family outbreaks, one of which occurred across an extended family and two in private houses (figure 20).

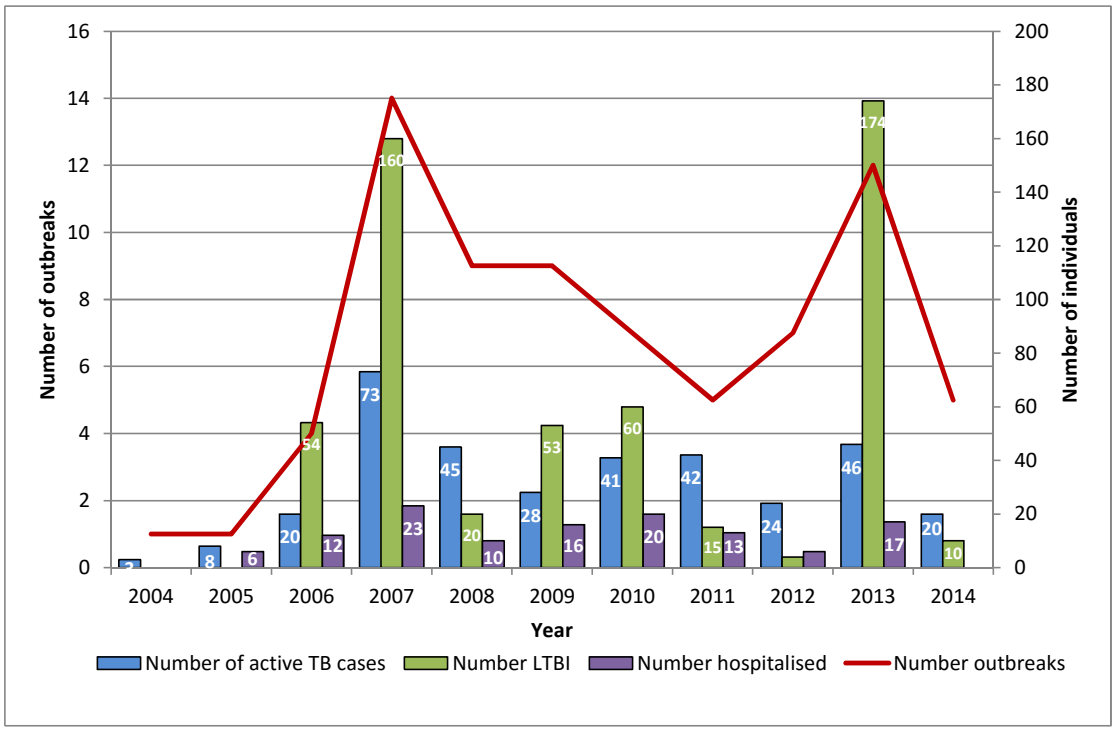

Figure 18: TB outbreak summary by year, 2004-2014

‡‡‡‡ http://www.irishstatutebook.ie/eli/2003/si/707/made/en/print

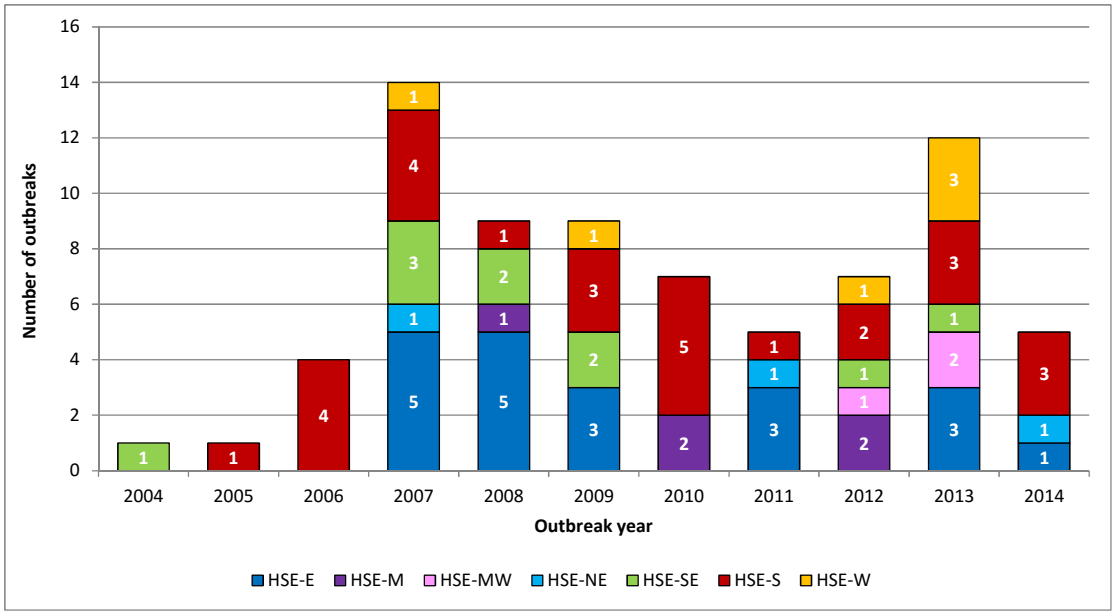

Figure 19: Number of TB outbreaks by HSE area and year, 2004-2014

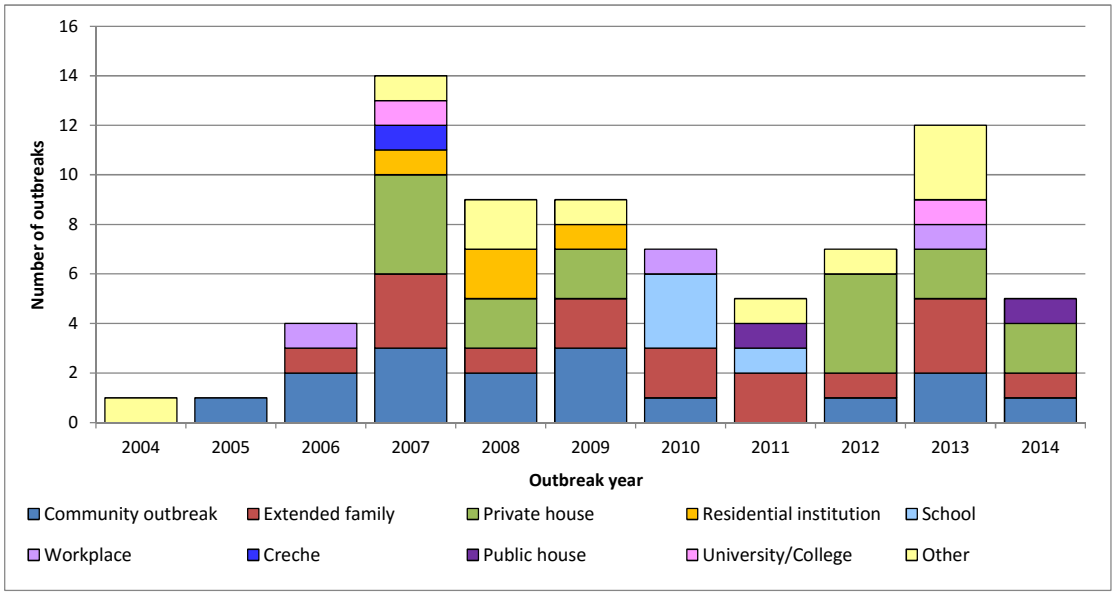

Figure 20: Number of TB outbreaks by location and year, 2004-2014

WHO and ECDC TB elimination target indicators

World Health Organization - Stop TB

The Stop TB partnership was established in 2000 as a global movement to work towards TB elimination. The Stop TB partnership aims to reduce the global incidence of TB to less than one case (any type) per million population by 2050, which will eliminate the disease as a global health problem.

In 2010 the World Health Organization (WHO) launched the Global Plan to Stop TB 2011-2015 with updated targets for TB control programmes.[9] Table 26 compares the surveillance related Stop TB targets for 2015 with the case based enhanced surveillance data reported on the Irish TB notifications in 2013 and 2014.

Table 26: WHO Stop TB target summary

WHO Stop TB target summary	2013 Irish notifications (%)	2014 Irish notifications (%)	2015 WHO Target (%)
Percentage of patients with DST results – new cases[§§§§]	77.4	74.4	100.0
Percentage of patients with DST results – previously treated cases[*****]	56.0	70.0	100.0
Treatment success rate – total notifications	61.6	n/a	90.0
Percentage of cases with a HIV test result	32.5	28.9	100.0

ECDC - Framework Action Plan to Fight TB in the EU

In November 2010, the European Centre for Disease Prevention and Control (ECDC) published a special report entitled *Progressing towards TB elimination a Follow-up to the Framework Action Plan to Fight TB in the EU*.[11] This report contains key operational and epidemiological monitoring targets to help EU member states work towards the goal of TB elimination.

Table 27 compares the surveillance related ECDC framework monitoring core operational indicator targets with the case based enhanced surveillance data reported on the Irish 2013 and 2014 cohort.

[§§§§] *Roadmap to prevent and combat drug resistant tuberculosis,*[10] Annex 2, Indicator 2.1.7. Denominator = all new cases, including culture negative, not done and unknown.

[*****] *Roadmap to prevent and combat drug resistant tuberculosis,*[10] Annex 2, Indicator 2.1.8. Denominator = all previously treated cases, including culture negative, not done and unknown.

Table 27: ECDC Monitoring Framework Action Plan Target Operational Indicator summary

ECDC Monitoring Framework Action Plan target summary	2013 Irish notifications (%)	2014 Irish notifications (%)	ECDC Target (%)
Percentage of new pulmonary cases culture confirmed	87.6	83.2	80.0
Percentage of new pulmonary culture confirmed cases with DST results	99.3	100.0	100.0
Treatment success rate – new pulmonary culture confirmed cases	63.8	n/a	85.0
Percentage of cases with a HIV test result	32.5	28.9	100.0

The ECDC document *Progressing towards TB elimination - a Follow-up to the Framework Action Plan to Fight TB in the EU* also contains four epidemiological monitoring indicators which are outlined below and compared to the current Irish TB data. These indicators assist in monitoring the levels of TB transmission taking place in a country and help to assess progress towards TB elimination.

1. Percentage annual change in TB crude notification rate

ECDC Target: A mean declining trend in the case notification rate over the previous five years allowing for annual random variation in a context where case finding remained constant or increased.

Current Irish status: Between 2010 and 2014, the mean annual percentage change in the TB crude notification rate in Ireland was -4.9%. Further analysis showed that the decline in the crude incidence rate during this period is statistically significant (figure 21). When stratified by country of birth, the decline in the crude notification rate was significant in Irish-born cases but not in foreign-born cases. The crude notification rate in foreign-born cases remained stable during this period.

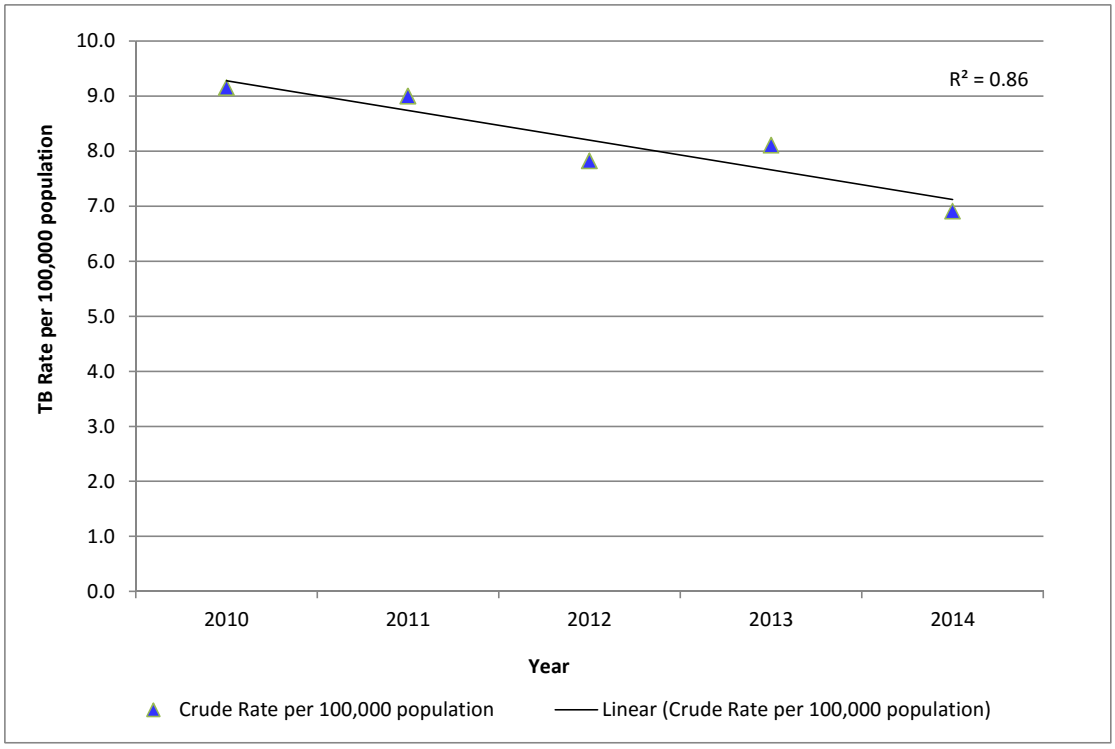

Figure 21: Trend in national crude incidence rate (CIR), 2011-2014

2. Mean age of TB cases

ECDC Target: An increasing trend in the mean age of TB cases over the previous 10 years

Current Irish status: Between 2005 and 2014, the Irish mean annual percentage change in the mean age of total TB notifications was 0.7 (figure 22). Further analysis showed that the mean age in all cases remained relatively stable in this time period. However an increase in the mean age of foreign-born case was significant. The mean age in Irish-born cases remained relatively stable in this time period.

When mean age was stratified by country of birth, it was found to be increasing among the foreign-born notifications but stable among Irish-born notifications. The reason for this increasing trend among the foreign-born is unclear. Possibilities include an aging settled immigrant population or an older immigrant population arriving in recent years.

The low mean age observed in 2007 was heavily influenced by an outbreak of 21 cases of active TB associated with a childcare facility in HSE-S while the second lowest mean age occurred in 2010 when three school outbreaks were reported (2 in HSE-S and 1 in HSE-M).

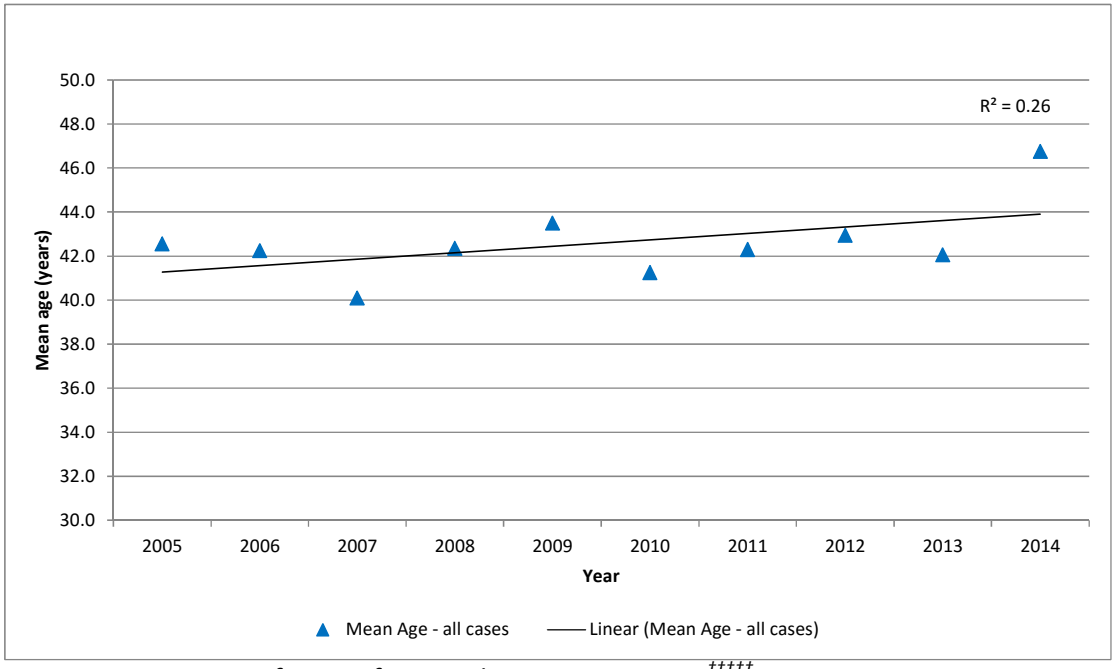

Figure 22: Mean age of TB notifications by year, 2005-2014[†††††]

[†††††] 2013 data are provisional

3. Trend in paediatric to adult TB notification rate ratio

ECDC Target: A mean declining trend in the ratio of the notification rate in children to adults over the previous ten years allowing for random variation.

Current Irish status: The mean annual percentage change in the paediatric to adult rate ratio for Irish TB cases between 2005 and 2014 was 15.8%. Further analysis showed that the decline in the notification rate in children to adults during this period is statistically significant (figure 23).

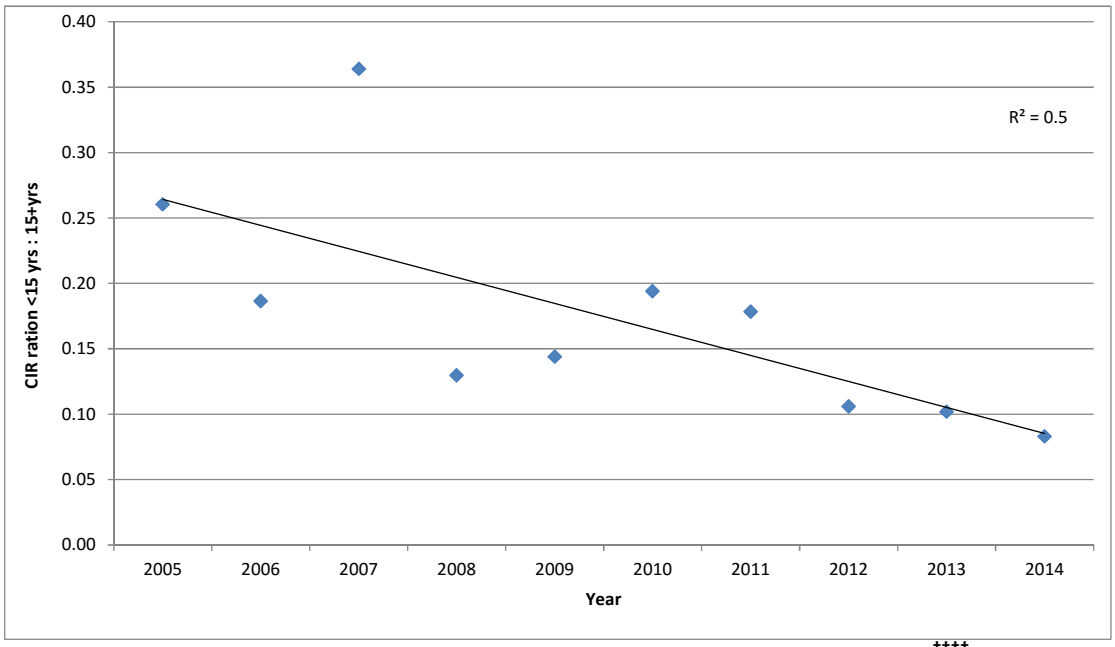

Figure 23: Ratio of paediatric to adult TB notification rates by year, 2005-2014‡‡‡‡

4. MDR-TB notification rate

ECDC Target: A mean declining trend in MDR TB case notification rate over the previous five years allowing for annual random variation in the context where MDR case-finding efforts remained constant or increased.

Current Irish status: Between 2010 and 2014, the mean annual percentage change in the Irish MDR-TB notification rate was 29.3% (figure 24). However, further analysis showed that this was not statistically significant. Data for 2013 and 2014 indicate that numbers of MDR-TB cases have stabilised since 2010 to a low level with an average of three cases per annum. Due to the very small numbers involved, these data should be interpreted with caution.

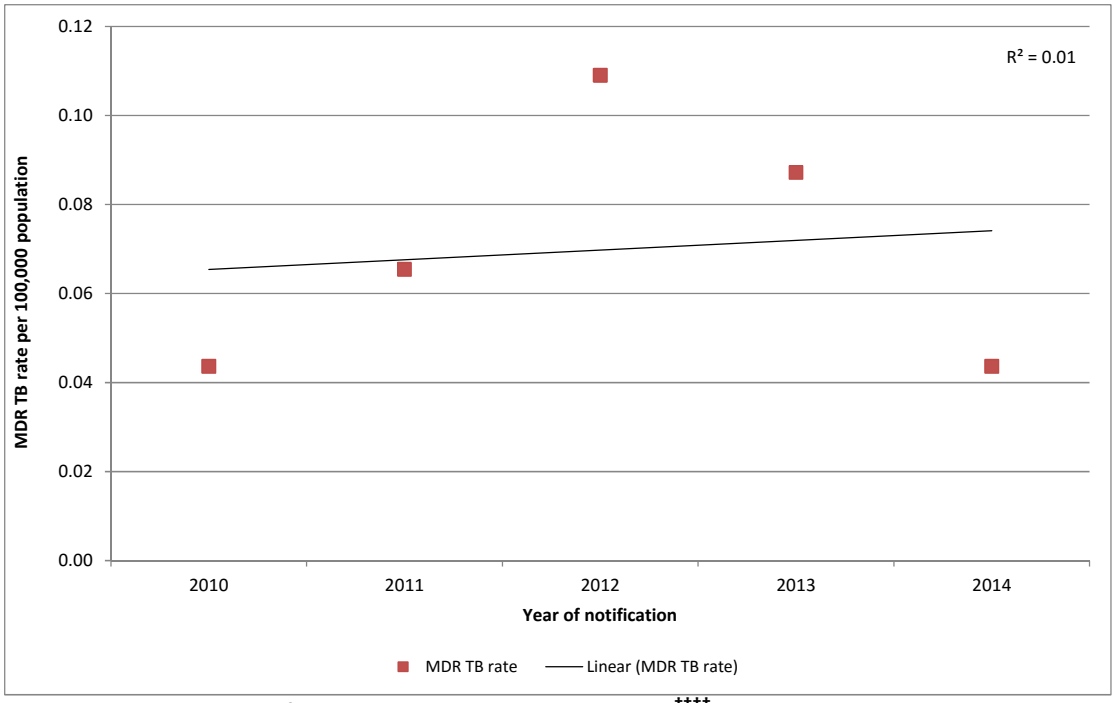

Figure 24: MDR-TB notification rates by year, 2010-2014‡‡‡‡

Conclusion:

Application of the above epidemiological monitoring indicators to the Irish TB data demonstrates that Ireland has not as yet achieved all of the ECDC targets. This highlights the need to adopt a focused approach to reduce TB transmission in order to reach the TB elimination goal of less than one case per million population by 2050. However, due to the fluctuating trends and/or small numbers involved, these data should be interpreted with caution.

Discussion

In 2014, 318 cases of TB were notified to HPSC, a national crude incidence rate of 6.9 per 100,000 population. This is a decrease compared to 2013 (8.1 per 100,000) and is the lowest crude incidence rate recorded since TB surveillance began in 1998. Ireland is classified as a low incidence country by WHO criteria, i.e. TB notification rate of less than 10 per 100,000.[12] The overall notification rate in countries of the EU and Western Europe who report to ECDC was 12.8 per 100,000 population in 2014, ranging from 2.5 per 100,000 population in Iceland to 79.7 per 100,000 in Romania.[2]

Differences in age-standardised TB incidence rates persist between HSE areas. The highest age-standardised TB incidence rate (per 100,000 population) in both 2013 and 2014 was seen in HSE South (9.9 and 10.0 respectively) while the lowest rate in 2013 was reported by HSE Midland (5.8) and in 2014 by HSE West (3.9).

Certain local health offices (LHOs) were found to have particularly high rates of TB incidence during 2013 and 2014, including Dublin North Central and Dublin North West in HSE East and North Cork, North Lee and South Lee in HSE South. According to the 2011 Census, between 23-27% of the population in Dublin city belong to social class 6 and 7 (see Appendix 2 for descriptions of social class).[7] This shows that the main burden of TB disease remains concentrated in large urban areas in Ireland, which is also observed elsewhere in Europe where large cities have notification rates twice as high as rates seen in other parts of the country.[13]

During 2014, 43.1% of TB cases notified were foreign born. This is a small decrease compared to the proportion reported in 2013 (44.9%). In 2014, among countries in the EU and Western Europe who reported data to ECDC, 26.8% of notifications were in foreign-born patients. In Austria, Slovenia and Sweden, where crude incidence rates are similar to those reported in Ireland, the percentage of cases of foreign origin in 2014 ranged from 25.5-91.8%.[2]

The crude rate of TB notifications in the Irish-born population decreased in 2014 compared to 2013. The crude rate in foreign-born cases also decreased during 2014 compared to the rate reported in 2013. The rate in the foreign-born continues to decrease since peaking in 2008 at 33.0 per 100,000.

The highest age-specific rates in 2014 occurred among those aged 65 years and older while in 2013 they occurred in the 25-34 year age group. 2013 was the fifth consecutive year a decline was observed in those aged 65 years and older. However this decrease was reversed in 2014 and age specific rates decreased in all other age groups except in those aged 65 years and older.

In 2013, rates in males were higher than or equal to females, in all age groups except in the 15-24 year age group. This was also the highest rate among females in 2013, while the highest rate among males was in the 25-34 year age group and in those aged 65 years and older.

In 2014, rates in males were higher than or equal to females, in all age groups. The highest rate among females in 2014 occurred in the 25-34 year age group and in those aged 65 years and older. The highest rate among males was considerably higher than females in those aged 65 years and older.

The male to female ratio (1.2:1) reported in 2014 was lower than the rate reported in 2013 (1.7:1) and also lower than the mean ratio observed between 2009 and 2013 (1.6:1). Males are predominant among TB cases in nearly all European countries with an overall M:F ratio of 1.6:1 in 2014.[2]

There was a notable difference in age between Irish and foreign-born cases of TB. In both 2013 and 2014, the highest ASIRs in foreign-born cases were in the 25-34 year age group and the 35-44 year age group. In both 2013 and 2014, the highest ASIRs in Irish-born cases were in those aged 65 years and older. However, during 2013 the Irish born ASIR in the 20-24 years age group equalled those aged 65 years and older. In 2013, the median age for Irish-born cases was 47 years and 35 years for foreign-born cases, while in 2014 it was 58 years for Irish-born and 34 years for foreign-born cases. In both 2013 and 2014, the majority of foreign-born cases were from Asia (52.1%, 48.2%) and Africa (21.8%, 32.1%).

There were three cases of TB meningitis in 2013 and two cases in 2014, corresponding to a crude rate of 0.7 and 0.4 per million population respectively. All of the 2013 cases were adults, while one case in 2014 was in the 0-14 years age group. Between 1998 and 2014, seven cases of TB meningitis were reported among 0-4 year olds.

The Health Protection Surveillance Centre *Guidelines on the prevention and control of tuberculosis in Ireland 2010* recommends that the cessation of neonatal BCG vaccination should be considered if certain criteria are met.[3] One of these criteria is that the average annual notification rate of TB meningitis in children under five years of age should be less than one case per 10 million general population over the previous five years. Between 2010 and 2014, no cases of TB meningitis reported in children aged less than five years. The criteria for discontinuation of BCG vaccination and how they apply to Ireland are outlined in Appendix 3.[14]

In this context the Health Information and Quality Authority (HIQA) undertook a Health Technology Assessment (HTA) of a selective BCG vaccination programme in 2015 at the request of the Chief Medical Officer in the Department of Health on foot of a recommendation from the National Immunisation Advisory Committee and the National Tuberculosis Advisory Committee to move to a selective BCG vaccination programme. In Europe, only Ireland and Portugal continue to have universal BCG vaccination programmes.

The HTA recommended moving from a universal to selective BCG vaccination programme in Ireland. This recommendation was based on evidence in relation to declining TB incidence in Ireland, International Union Against TB and Lung Disease criteria for discontinuing universal BCG vaccination (Appendix 3), and the incidence of BCG reactions reported. Between 2002 and 2014 there were no TB deaths reported in Ireland in children aged less than 15 years.

Selective BCG vaccination would focus resources on those who are at higher risk of contracting TB. The HTA indicated that one in eight newborns will continue to be eligible for the vaccine. This includes infants born in, or whose parents are from, a country with a high incidence of TB (≥40 TB cases per 100,000 per annum), those in contact with patients with active respiratory TB, and members of an at-risk group, such as the Traveller community in Ireland. It would be important to consult with groups at higher risk to determine the most acceptable and efficient way to identify those eligible for vaccination.

The HTA also states that any change of vaccination strategy should be supported by a clear commitment of sufficient resources for TB control. A change in emphasis from protection to prevention requires a coherent plan for changes to other TB control measures. That plan must clearly outline the requirements, resources, and steps to ensure that TB control in Ireland is consistent with the requirements for TB elimination.[15]

Cases with a pulmonary component accounted for 61.8% of total TB cases in 2014, a decrease compared to 66.9% in 2013. This is the third consecutive year that a decrease in the proportion of pulmonary cases has been reported. In 2014, sputum microscopy results were available for 66.8% of pulmonary cases, a decrease compared to 69.1% in 2013. Sputum smear positivity was 46.4% in 2014 (2.0/100,000), a decrease compared to 51.0% of pulmonary cases in 2013 (2.8/100,000).

Culture confirmation of specimens and identification of *Mycobacterium tuberculosis* complex (MTC) is the most accurate method of confirming active tuberculosis. Trends in the proportion of culture confirmed pulmonary TB cases are an indicator of the performance of a TB control programme. Of pulmonary cases, 81.1% were culture positive in 2014, a decrease compared to 83.1% pulmonary culture positive in 2013. The proportion of new pulmonary cases that were culture confirmed fell to 83.2% in 2014, from 87.6% in 2013. However, 2014 was the third consecutive year that Ireland has exceeded the EU monitoring framework target of ≥ 80% culture confirmation among new pulmonary TB cases and every effort must be maintained to sustain this.[11] Among countries in the EU and Western Europe who reported data to ECDC, the culture confirmed proportion ranged from 39.2% (Hungary) to 88.2% (Slovenia).[2]

During 2014, 14.8% of all TB cases reported to HPSC were either culture unknown (43 cases) or culture not done (4 cases). This is an increase compared to 2013, when 11.0% of all TB cases reported to HPSC were either culture unknown (34 cases) or culture not done (7 cases). It is crucial that we endeavour to improve the quality of data relating to the culture status of TB cases in the coming years as this assists in measuring the performance of the TB control programme.

The number of *M. bovis* detections among culture confirmed cases decreased in 2014, with two cases (0.9% of culture confirmed cases) notified. This compares to six cases (2.1%) notified during 2013. Between 2002 and 2014, *M. bovis* detections accounted for 2.1% of all culture confirmed cases, with a mean of six *M. bovis* cases notified annually.

The proportion of new culture confirmed pulmonary cases with reported drug sensitivity testing (DST) results increased from 99.3% in 2013 to 100.0% in 2014, meeting the EU monitoring framework action plan target of 100% of new culture confirmed pulmonary cases with DST results for the first time.[11] ECDC has adopted the culture and DST monitoring targets as a measurement to assess both diagnostic laboratories' and physicians' capabilities to correctly diagnose TB. They recommend that Member States also use these to monitor progress towards TB elimination. The WHO Stop TB strategy also includes a target of 100% DST results for all previously treated cases irrespective of culture status.[9] Ireland achieved this target in 2014, with 100% of culture positive cases that were previously treated for TB having DST results. It is important that we continue to improve the quality of data relating to DST results in order to accurately assess the performance of the TB control programme.

Of the resistant cases reported, four cases (11.4%) were MDR-TB in 2013 (including one XDR-TB case) and two cases (10.0%) were MDR-TB in 2014. This remains stable in comparison

with a mean number of three MDR-cases per year reported between 2002 and 2012. MDR-TB cases represented 1.1% of total cases in 2013 and 0.9% in 2014. Cases resistant to isoniazid represented 7.5% of total cases in 2013 and 3.5% in 2014. In 2014 the proportion of cases with MDR-TB was 4.0%, ranging from 0.0-25.8% in the EU and Western Europe.[2] MDR-TB or XDR-TB is more likely to be reported in patients previously treated for TB or in immigrants from countries with a high burden of MDR-TB. One case of XDR-TB was reported in Ireland during 2013 in a foreign-born individual. This was the second case of XDR-TB ever reported in Ireland, with the first case reported in 2005.

The rate of resistance was higher in foreign-born than in Irish-born cases, with a mean proportion of 73.4% of resistant cases occurring in foreign-born individuals between 2010 and 2014. The rate of resistance in foreign-born cases has steadily increased since 2006, while the rate of resistance in Irish-born cases has remained stable during the same period. The majority of resistant cases in Ireland in 2013 and 2014 had no previous history of TB disease reported.

In October 2006, the World Health Organization (WHO) expressed concern over the emergence of XDR-TB and called on countries to strengthen and implement measures to prevent the global spread of these drug resistant strains of TB.[6] In this context, focus on the surveillance, prevention and treatment of drug resistance needs to be strengthened in all countries.

In recent years, the quality of the data, and in particular, data on treatment outcome, had greatly improved. However, in 2013 treatment outcome was provided for only 79.0% of total cases notified. This compares to a mean of 82.9% with treatment outcome reported since 2002. This may be explained by the fact that information on treatment outcome was unavailable for 40.8% of cases within one region and for 18.5% in another region. It is extremely important to maintain and improve on the provision of treatment outcome data. A concerted effort is required by clinicians and Public Health involved in TB treatment and control to prioritise the provision of these data

As part of the WHO Stop TB strategy and the ECDC Framework Action Plan to Fight TB in the EU, three TB treatment outcome monitoring targets are currently in place. WHO have set a target of 90% treatment success rate in all TB cases and a treatment success rate of 75% for MDR-TB cases while ECDC have set a target of 85% treatment success for new pulmonary culture confirmed cases.[9, 11]

The proportion of total cases where outcome was reported as completed (61.6%) remained stable during 2013 compared to 2012 (61.3%) (range: 59.6%-72.4%). This also falls short of the WHO Stop TB target of above 90% reported treatment success for all TB cases.[9]

The proportion of new culture confirmed pulmonary TB cases where outcome was reported as treatment completed was 63.8%, which was a decrease compared to 2012 (69.2%). This is also below the ECDC EU target of successfully treating 85% or more of all new culture confirmed pulmonary TB cases.[11] The scope of this indicator is to measure the ability of a TB control programme's ability to retain patients through a complete course of chemotherapy with a favourable clinical result.

Treatment outcome was not reported for 10 (28.6%) resistant cases in 2013. The treatment success rate for the MDR-TB cases treated in the 2012 cohort (n=5) was 80.0% as one case died. This further reiterates the need for more complete outcome data to actively guide TB

control in Ireland. Between 2003 and 2013, 83.3% of MDR-TB cases successfully completed treatment, meeting the WHO Stop TB target of 75% treatment success for MDR-TB cases.[9] We must endeavour to sustain reaching this target.

It is important that every endeavour is made to improve the completeness and timeliness of submission of reports of treatment completion which are essential for efficient TB programme management.

Information on risk factors was reported by 79.2% of cases in 2014 and 77.2% in 2013. Where risk factor information was reported, 77.0% of the cases in 2014 reported having one or more TB risk factors, a slight increase compared to 74.6% in 2013. The three most commonly reported risk factors were being from a country of high TB endemicity (annual TB notification rate of ≥ 40 cases per 100,000 population), followed by residence in a country of high TB endemicity and contact with a TB case. These data are important as they provide information to guide policy for targeting prevention and control interventions in relation to TB disease and latent TB infection in the relevant groups.

The proportion of TB cases where HIV status was reported remains notably low at 28.9% of cases during 2014, a decrease on the proportion reported in 2013 (32.5%). This percentage has steadily increased since 2003 when HIV status was reported for only 2.5% of total cases. Both the WHO Stop TB strategy and the ECDC Framework Action Plan to Fight TB in the EU have set targets of 100% of all TB cases having HIV status reported.[9, 11] The objective of this indicator is to reduce the burden of TB/HIV co-infection by strengthening the collaboration between TB and HIV/AIDS programmes within a health service. The scope of this indicator is to measure the extent to which HIV-positive TB patients are identified and to demonstrate the extent to which HIV testing has been incorporated into the national TB control programme. We must strive to improve the completeness of TB-HIV data in the coming years, particularly as HIV became notifiable in 2012. Work is ongoing in this regard.

Outbreak reporting assists in the assessment of the burden of TB disease and latent TB infection and also will assists in guiding the appropriate use of resources for the TB control programme.

Application of the ECDC epidemiological monitoring indicators to the Irish TB data demonstrates that Ireland has not yet achieved all of the ECDC targets. This highlights the need to adopt a focused approach to reduce TB transmission in order to reach the "***The Stop TB Partnership"*** TB elimination goal of less than one case per million population by 2050. However, regarding the MDR-TB indicator, data for 2013 and 2014 indicate that the numbers of MDR-TB cases have stabilised since 2008 to a low level with approximately three cases per annum. Due to the very small numbers involved, these data should be interpreted with caution.

Ireland now meets the criterion (TB notification of < 10 cases per 100,000) as set out by the WHO for a low incidence TB country. In November 2014 the WHO published an action framework for low incidence countries towards TB elimination which includes targets and a strategy.[12] The framework states that low incidence countries need to progress further towards "pre-elimination" (< 1 case per 100,000) by 2035 and to elimination (< 1 case per million) by 2050. Close collaboration will be needed between countries with high and low incidences of TB in order to reach these targets. To achieve the aforementioned goals, a multi-sectoral approach is required. This will include better access to high-quality diagnosis

and TB care and more effective TB prevention including addressing the social determinants of TB with special attention to groups at highest risk of TB.

The importance of good surveillance data cannot be underestimated in this context. Such data will help guide where resources should be directed e.g. identification of risk groups, areas with high TB notification rates in order to implement effective TB prevention and control strategies in Ireland and to reach the global “pre-elimination” and elimination targets by 2035 and 2050 respectively.

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Appendix 1: Completeness of data, 2013 and 2014

Completeness of data reported for 2013 and 2014 notifications ranged from 100.0% (diagnostic type and isolate for culture positive cases) to 28.9% (HIV status) depending on the variable analysed. Of the 16 key variables analysed, 11 had completeness levels of 90% or more in 2013 and eight in 2014. Table A3 shows the completeness of reporting for 16 key variables during 2013 and 2014.

Table A1: Completeness of reported data by variable

Variable	% Complete	
	2013	2014
Age	99.5	100.0
Sex	99.5	100.0
Diagnostic type	100.0	99.7
Country of birth (all notifications)	99.2	98.7
Sputum smear result (pulmonary cases)	90.4	88.3
Culture result	90.9	86.5
Isolate (Culture positive cases)	99.6	100.0
Drug susceptibility result (Culture positive cases)	96.8	99.6
Case finding method	94.9	95.0
Treatment outcome	79.0	77.5
Risk group	77.2	79.2
Previous history of TB (all cases)	73.4	79.9
Previous year of TB diagnosis (previously diagnosed cases)	92.0	70.0
Previous TB treatment history (previously diagnosed cases)	80.0	55.0
Previous TB treatment outcome (previously treated cases)	100.0	100.0
HIV status	32.5	28.9

Appendix 2: Social Class (Source: CSO 2011)

Social Class

The entire population is classified into one of the following social class groups (introduced in 1996) which are defined on the basis of occupation:

1 Professional workers
2 Managerial and technical
3 Non-manual
4 Skilled manual
5 Semi-skilled
6 Unskilled
7 All others gainfully occupied and unknown

The occupations included in each of these groups have been selected in such a way as to bring together, as far as possible, people with similar levels of occupational skill. In determining social class no account is taken of the differences between individuals on the basis of other characteristics such as education. Accordingly social class ranks occupations by the level of skill required on a social class scale ranging from one (highest) to seven (lowest). This scale combines occupations into six groups by occupation and employment status following procedures similar to those outlined above for the allocation of socio-economic group. A residual category “All others gainfully occupied and unknown” is used where no precise allocation is possible.

Appendix 3: BCG vaccination

The Health Protection Surveillance Centre *Guidelines on the prevention and control of tuberculosis in Ireland 2010*,[3] based on the recommendations of the International Union Against Tuberculosis and Lung Disease (IUATLD),[13] recommends that the cessation of neonatal BCG vaccination should be considered if certain criteria are met.

Criterion 1

There is a well functioning tuberculosis control programme.

Ireland: The tuberculosis control programme is currently being reviewed and it is likely that recommendations will be made for strengthening the programme.

Criterion 2

There has been a reliable reporting system over the previous five or more years, enabling the estimation of the annual incidence of active tuberculosis by age and risk groups, with particular emphasis on tuberculosis meningitis and sputum smear positive pulmonary tuberculosis.

Ireland: Yes. National data enabling a detailed epidemiological analysis for the country as a whole were first presented by the HPSC in the 1998 National TB Report. The 2013 and 2014 report is the sixteenth national TB report produced by the HPSC.

Criterion 3

Due consideration has been given to the possibility of an increase in the incidence of tuberculosis resulting from the epidemiological situation of AIDS in that country.

Ireland: Yes

Criterion 4

The average annual notification rate of sputum smear positive pulmonary tuberculosis should be 5 per 100,000 population or less during the previous three years.

Ireland: Yes. In 2014, the national rate for sputum smear positive pulmonary TB was 2.0 per 100,000 population while in 2013 and 2012 the rates were 2.8 and 2.6 per 100,000 population respectively.

Criterion 5

The average annual notification rate of TB meningitis in children under five years of age should be less than one case per ten million general population over the previous five years.

Ireland: Between 2010 and 2014, there were no cases of TB meningitis in children under five years of age.

Criterion 6

The average annual risk of tuberculosis infection should be 0.1% or less.

Ireland: Not applicable.

When considering the importance of neonatal BCG vaccination, it is worth considering the practice in other European countries. For example, Sweden discontinued routine neonatal BCG vaccination in 1975 when they had a total notification rate of 20 per 100,000 population and an age-specific incidence rate for children aged 0-14 years of 0.3 per 100,000. While the national crude rate in Ireland is less than 20.0 per 100,000 population, the 2014 age-specific incidence rate for children 0-14 years was 0.7 per 100,000 and 1.0 per 100,000 in 2013.

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