

# INVASIVE MENINGOCOCCAL DISEASE (IMD), BACTERIAL/VIRAL MENINGITIS & *HAEMOPHILUS INFLUENZAE* INFECTIONS IN IRELAND

A REPORT BY THE HEALTH PROTECTION SURVEILLANCE CENTRE IN COLLABORATION WITH THE IRISH MENINGOCOCCAL AND MENINGITIS REFERENCE LABORATORY AND THE NATIONAL VIRUS REFERENCE LABORATORY



Feidhmeannacht na Seirbhíse Sláinte  
Health Service Executive



Q1-2016

18<sup>th</sup> May 2016

Provisional Figures

## Summary

- 23 invasive meningococcal disease cases (IMD) were notified in Q1-2016, including 15 serotype B, four serotype C and one each of serogroup W135 and non-groupable and two not specified infections. The four serogroup C cases were aged between two months and 17 years: two were unvaccinated and two were complete vaccine failures aged 13 and 17 years, one having received three doses of the meningococcal C conjugate vaccine and the other (who was 17 years of age) having just one dose. Two IMD cases were reported to have died during this quarter, aged between 15-19 and 75-79 years of age. There was one imported case from England.
- Among the other specified cases of bacterial meningitis reported were ten cases of *Streptococcus pneumoniae* and two cases of listeriosis. Four cases of bacterial meningitis, not otherwise specified (NOS), were also notified during this quarter, one of which was attributable to *Escherichia coli*.
- 49 cases of viral meningitis (NOS) were reported with no related deaths or outbreaks.
- 18 cases of *Haemophilus influenzae* were reported, none of which was associated with meningitis. Nine were non-typeable/non-capsulated, one was a type b (aged 6 months and having received two doses of the Hib vaccine), two were type f, two were not typed (PCR only diagnosis) and four were not typed.

## Introduction

Meningococcal disease became a notifiable disease on the 1<sup>st</sup> January 2004. Prior to this, it was notifiable under the category bacterial meningitis (including meningococcal septicaemia).

Most forms of bacterial meningitis are now notifiable under the specific disease pathogen name as listed in the legislation. For bacterial meningitis pathogens not listed, these forms of meningitis are notifiable under the disease termed 'bacterial meningitis (not otherwise specified)'. Since 1<sup>st</sup> January 2012, revised versions of the case definitions of meningococcal disease, bacterial and viral meningitis have come into effect and are detailed in the HPSC Case Definitions for Notifiable Diseases booklet on the HPSC website ([www.hpsc.ie](http://www.hpsc.ie)).

An enhanced surveillance system is in place for [IMD and other forms of bacterial meningitis, not otherwise specified](#). Details of this surveillance system are described in the meningococcal disease chapter of the [HPSC Annual Report 2005](#). In October 2000, the Meningococcal C conjugate (MCC) vaccine was introduced in Ireland to the infant schedule at 2, 4 and 6 months of age. A catch-up campaign targeting those less than 23 years of age was also run at the time. In September 2008 the MenC vaccination schedule was changed for the administration of the vaccine at 4, 6 and 13 months of age. Emerging evidence of waning immunity and the recent increase in MenC cases has led to the routine MenC vaccination programme being changed again. For all babies born on or after July 1<sup>st</sup> 2015 a single dose of MCC will be given at 4 months, 13 months and at 12-13 years (if not previously vaccinated at >10 years of age)

(<http://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/chapter13.pdf>). An enhanced surveillance system is also in place for *Haemophilus influenzae* (invasive) disease, but not for viral meningitis, not otherwise specified. Both the enhanced surveillance forms for IMD (including other forms of bacterial meningitis) and *Haemophilus influenzae* (invasive) disease were updated in early December 2015.

Data presented in this reported were extracted from CIDR on 18<sup>th</sup> May 2016. These figures are provisional. Incidence rates for 2016 were calculated using the 2011 Census of Population as denominator data.

## Results

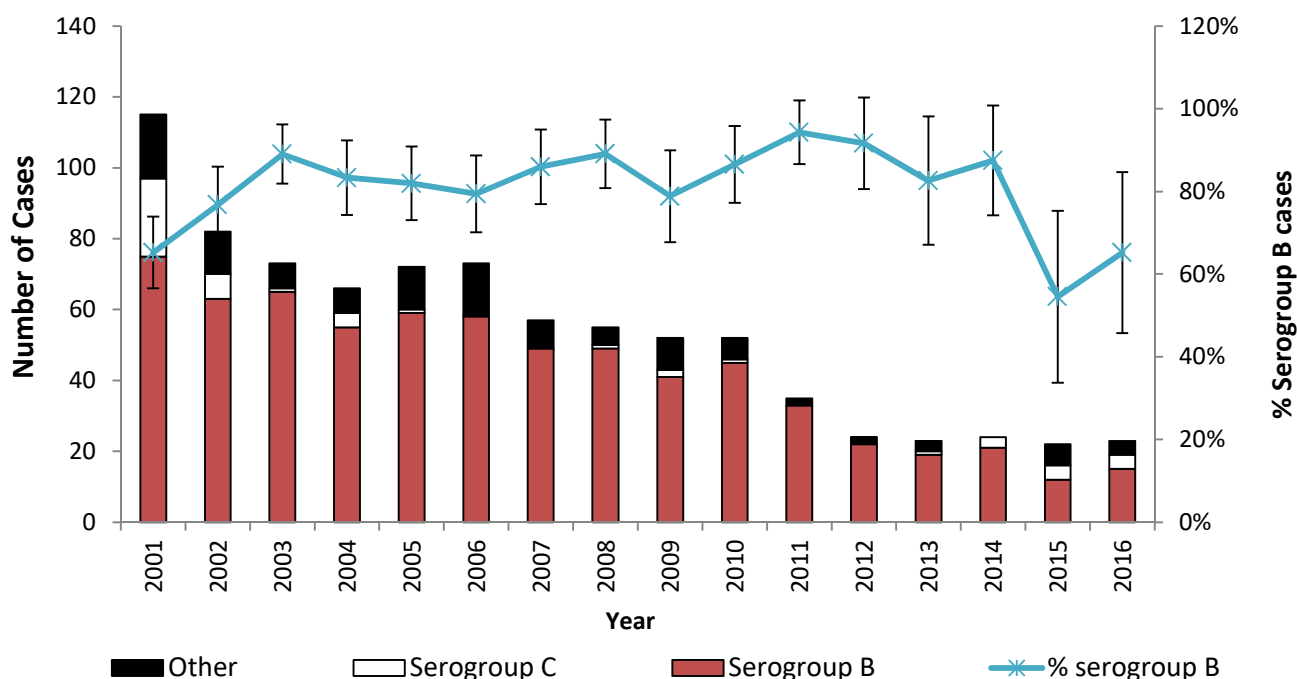
### Meningococcal Disease (invasive) (IMD)

#### IMD Cases by Serogroup & Case Classification

In Q1-2016, 23 cases of IMD were notified, 15 of which were attributable to serogroup B, four were serogroup C (aged between two months and 17 years: two were unvaccinated and two were complete vaccine failures aged 13 and 17 years, one having received three doses of the meningococcal C conjugate vaccine and the other (aged 17 years) having just one dose), one was serogroup W135, another was non-groupable (NG) and two were not specified infections. All cases were classified as confirmed (Table 1).

**Table 1.** Classification of IMD cases notified by Serogroup in Q1-2016

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	15	4	1	0	1	0	2	23
Probable	0	0	0	0	0	0	0	0
Possible	0	0	0	0	0	0	0	0
Not specified	0	0	0	0	0	0	0	0
<b>Total</b>	<b>15</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>23</b>



**Figure 1.** Number of IMD cases notified in Ireland by serogroup in Q1 of each year between 2001 and 2016 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

In Q1-2016 serogroup B disease accounted for 65.2% ( $n=15/23$ ; 95%CI 21.8%-84.7%) of all IMD notifications (Figure 1, Appendix 1). All but two confirmed cases reported on CIDR in Q1-2016 were also included in the electronic listing of laboratory tested *N. meningitidis* isolates/specimens provided to the HPSC on April 18<sup>th</sup> 2016 by the Irish Meningococcal and Meningitis Reference Laboratory (IMMRL). Both of these missing cases were from HSE S.

#### IMD Trends & Outbreaks

The number of IMD cases reported in Q1-2016 ( $n=23$ ) was equal to the average number reported in the same quarter over the previous three years (average= $23$ ; 95%CI 21.8-24.2); for serogroup B the average was 17.3 and for serogroup C it was 2.7 (Figure 1; Appendix 1). The latest Q1 figures appear to reflect a levelling off of cases since 2012 (Figure 1, Appendix 1). First

quarterly IMD cases have fallen by 80% since 2001 (Appendix 2). Since 2001, Q1 serogroup B cases have also declined by 80% and serogroup C cases by 81.8% (Appendix 1). In Q1-2016, four serogroup C cases were reported, compared to eight such cases in all first quarters over the previous four years. No IMD outbreaks or clusters were reported in Q1-2016.

### IMD Cases by HSE Area and Age Group

The crude incidence rate in Q1-2016 was 0.5 cases per 100,000 population ranging from the lowest (0.19/100,000) in HSE E to the highest (2.3/100,000) in HSE NW (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group and in Q1-2016 the incidence rate in this age group was 8.3 cases per 100,000 population, followed by 1.8 cases/100,000 in the 15-19 year age group (Appendix 4).

### IMD associated deaths

Two IMD related deaths were reported in Q1-2016, one of whom was a foreign born, a 15-19 year old with a type B infection and the other was a 75-79 year old whose infection was not serogrouped. This compares to a total of two deaths in the same quarter between 2013 and 2015 (Appendix 5).

### Other Forms of Bacterial Meningitis

#### *Streptococcus pneumoniae* meningitis

In Q1-2016, ten cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was between 30-34 and 75-79 years (Appendix 6). There was one IPD meningitis-related death reported in this quarter with no risk factor recorded. Details of the vaccination status, age group, risk factor, and serotype associated with these 10 cases are presented in Table 2 below.

**Table 2.** Vaccination status, age and risk factors, and serotype details of the *Streptococcus pneumoniae* meningitis cases reported in Q1-2016

Case. No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	30-34	No	Unvaccinated	Not specified	Not specified
2	35-34	Yes	Unvaccinated	Unvaccinated	6C*
3	40-44	Not specified	Unvaccinated	Not specified	Not specified
4	55-59	Yes	Unvaccinated	Unvaccinated	Not specified
5	60-64	No	Unvaccinated	Unvaccinated	Not specified
6†	60-64	No	Unvaccinated	Unvaccinated	Not specified
7	65-69	Yes	Unvaccinated	Unvaccinated	Not specified
8	70-74	Yes	Not specified	Unvaccinated	Not specified
9	70-74	Not known	Not specified	Unvaccinated	Not specified
10	75-79	No	Unvaccinated	Unvaccinated	Not specified

\* Serotype 6C is not covered by the PCV7, PCV13 or PPV23 vaccines; †Died from the infection

For further information on *Streptococcus pneumoniae* notifications please refer to the latest report available at <http://www.hpsc.ie/A-Z/VaccinePreventable/PneumococcalDisease/Publications/QuarterlyReportsonInvasivePneumococcalDisease/>

### Bacterial meningitis by other specified notifiable diseases (excluding *Haemophilus influenzae* and *S. pneumoniae*)

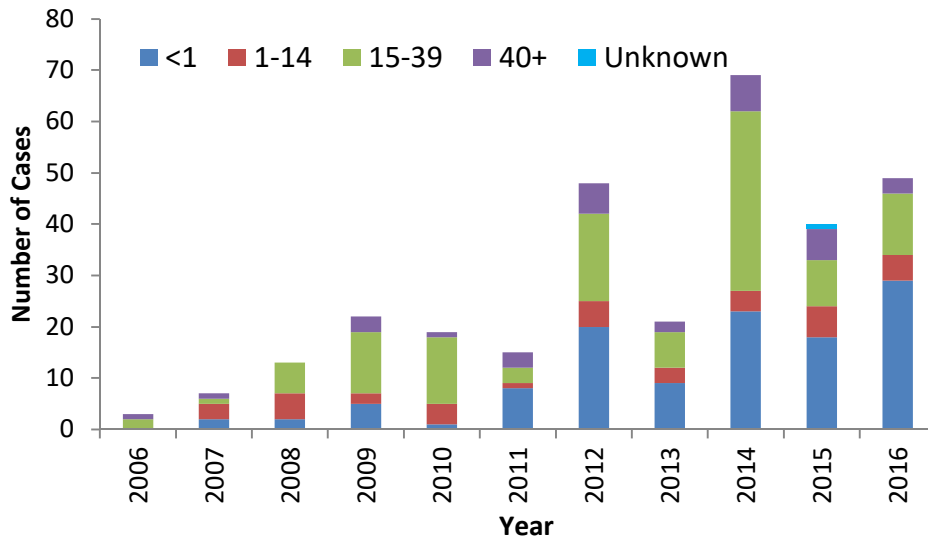
In Q1-2016, there were two cases of listeriosis, one in a 70-74 year old female with encephalitis and the other in a 55-59 year old female with an underlying medical condition. Even though there were no cases of *Streptococcus agalactiae* meningitis, five CSF PCR positive cases with this infection were reported in the same quarter, but were not labelled as having clinical meningitis or any other clinical description.

### Bacterial meningitis (not otherwise specified)

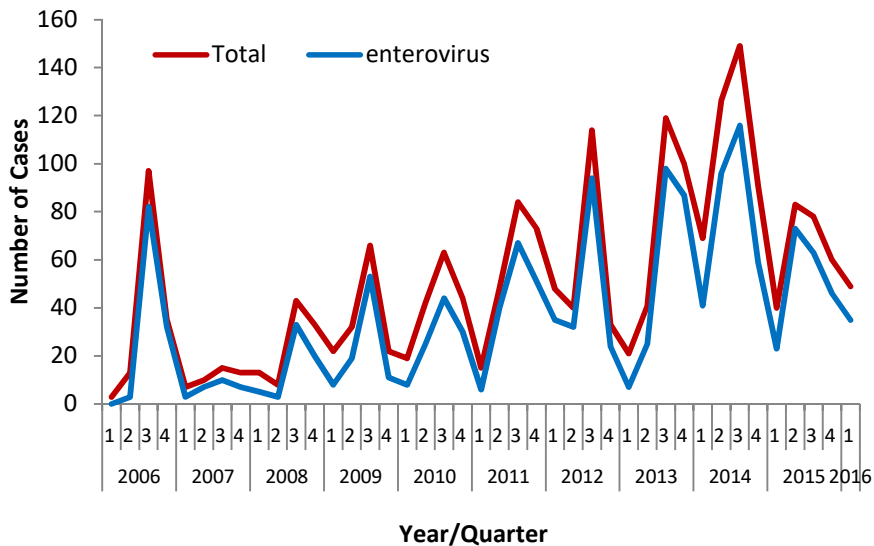
Four cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q1-2016. One confirmed case had an *Escherichia coli* infection (aged 1 month). The remaining three cases (one confirmed and two possible) did not have a causative organism identified (aged between 24 and 50 years) (Appendix 6).

### Viral Meningitis (Specified and Not Otherwise Specified)

Forty-nine viral meningitis notifications (NOS) (age range 1 month to 62 years; median 4.7 months) were reported in Q1-2016 (Figure 2), 44 of which (89.8%) had their causative organism identified: 35 enterovirus (serotypes not reported) (age range four weeks to 62 years, median 2 years), eight human herpes virus type 6 (HHV 6) (age range 1-11 months), one case of varicella zoster virus (aged 49 years) and five with no pathogen identified (1 month to 36 years) (Figure 3, Appendix 7).



**Figure 2.** Quarter 1 number of viral meningitis (NOS) cases in Ireland by age group (years), 2006-2016

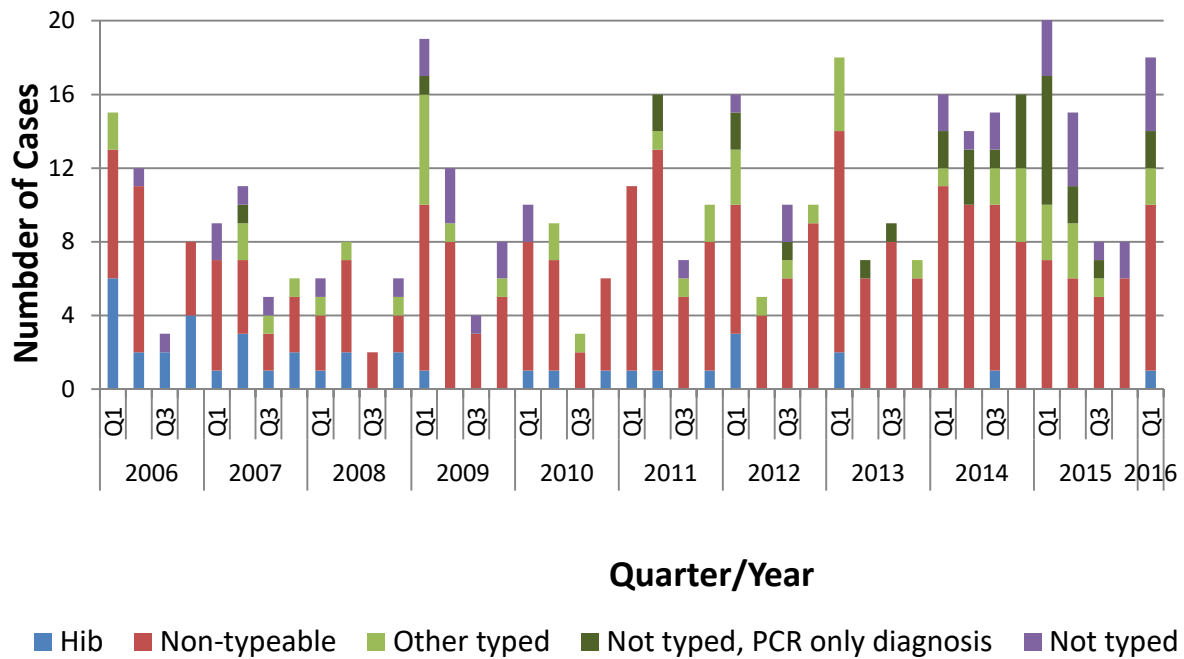


**Figure 3.** Total number of viral meningitis (NOS) cases notified, including those caused by enterovirus by quarter and year, 2006-2016

In Q1-2016, the highest frequency of cases occurred in children <1 year of age (n=29/49; 59.2%) and in adults aged 25-39 years (n=11/49; 22.4%) (Figure 2). Of the 29 cases <1 year of age reported in this quarter, 17 (58.6%) were attributable to enterovirus and eight (27.6%) to HHV6. However, caution is recommended regarding the detection of HHV 6 DNA in cerebral spinal fluid (CSF) specimens, especially in those aged less than 3 months (of which there were four cases in Q1-2016), as HHV 6 DNA can be chromosomally integrated. When this occurs the HHV 6 DNA can be inherited through the germ line and therefore when it is detected, it may not be clinically relevant. Figure 3 presents both the total number of viral meningitis NOS cases and those caused by enterovirus by year and by quarter since 2006. The average Q1 percentage of all viral meningitis NOS cases attributable to enterovirus since 2010 to date has been 53.8%.

***Haemophilus influenzae (invasive) infections***  
***H. influenzae* Cases by Type, Case Classification**

In Q1-2016, 18 cases of invasive *H. influenzae* (all case classified as confirmed) were notified in Ireland (Figure 4): Nine were non-typeable/non-capsulated, one was a type b, two were type f, two were not typed (PCR only diagnoses) and four were not typed. This total compares to an average of 18.3 cases for the same quarter in 2013 to 2015 (Table 3, Appendices 8, 9). In the electronic listing provided by the Epidemiology and Molecular Biology Unit (EMBU) in Temple Street Children’s Hospital on April 18<sup>th</sup>, 2016, five classified confirmed *H. influenzae* events on CIDR in Q1-2016 were not included on it: two each from HSE E and HSE W and one from HSE S. Appendices 10 and 11 give a breakdown of all Q1 cases notified since 2006 by HSE area and age group, respectively. Of all the Q1 cases reported between 2014 and 2016, 18.2% (n=10/55) had no clinical diagnosis reported (Table 4).



**Figure 4.** Quarterly number of *H. influenzae* cases by type since 2006

#### *H. influenzae* associated deaths

No deaths occurred among the eighteen *H. influenzae* cases reported during this quarter.

#### *H. influenzae* meningitis

No meningitis-related *H. influenzae* cases were reported in Q1-2016 (Table 5, Appendix 9).

#### *H. influenzae* type b (Hib)

A true vaccine failure (TVF) is the occurrence of invasive Hib infection in an individual, despite having been fully vaccinated against Hib disease in the past. One Hib case was reported in Q1-2016 in a 6 month old who had received two of the three doses of the 6 in 1 vaccine (which includes the HIB component) and was therefore considered to be incompletely vaccinated and not a TVF. The last reported TVF however was in Q4-2010, the only one in nearly nine years between Q3-2007 and Q1-2016: an indication of the continuing positive impact of the Hib immunisation catch-up booster campaign launched in November 2005 (Figure 5). A routine Hib booster is now recommended for all children at 13 months of age. Ensuring high uptake of the Hib vaccine during infancy and a booster in the second year of life is recommended to provide continued protection of the population from invasive Hib disease. Individuals with risk conditions for Hib, regardless of age are also recommended the Hib vaccine.

#### Non-typeable/non-capsulated *H. influenzae*

In Q1-2016 the number of non-typeable cases was nine (aged 13 months to 85 years), less than the average of 10 cases in the same quarter between 2013 and 2015 (Figure 6, Table 3).

**Table 3.** Number of *H. influenzae* cases notified in the first quarter of 2014, 2015 and 2016

Number of cases	Q1-2014	Q1-2015	Q1-2016
All <i>H. influenzae</i>	16	21	<b>18</b>
All <i>H. influenzae</i> <5yrs	6	12	<b>4</b>
All <i>H. influenzae</i> ≥65yrs	6	5	<b>5</b>
<i>H. influenzae</i> type b	0	0	<b>1</b>
<i>H. influenzae</i> type b <5yrs	0	0	<b>1</b>
<i>H. influenzae</i> type b ≥65yrs	0	0	<b>0</b>
<i>H. influenzae</i> non-typeable	11	7	<b>9</b>
<i>H. influenzae</i> non-typeable <5yrs	4	2	<b>2</b>
<i>H. influenzae</i> non-typeable ≥65yrs	4	3	<b>2</b>

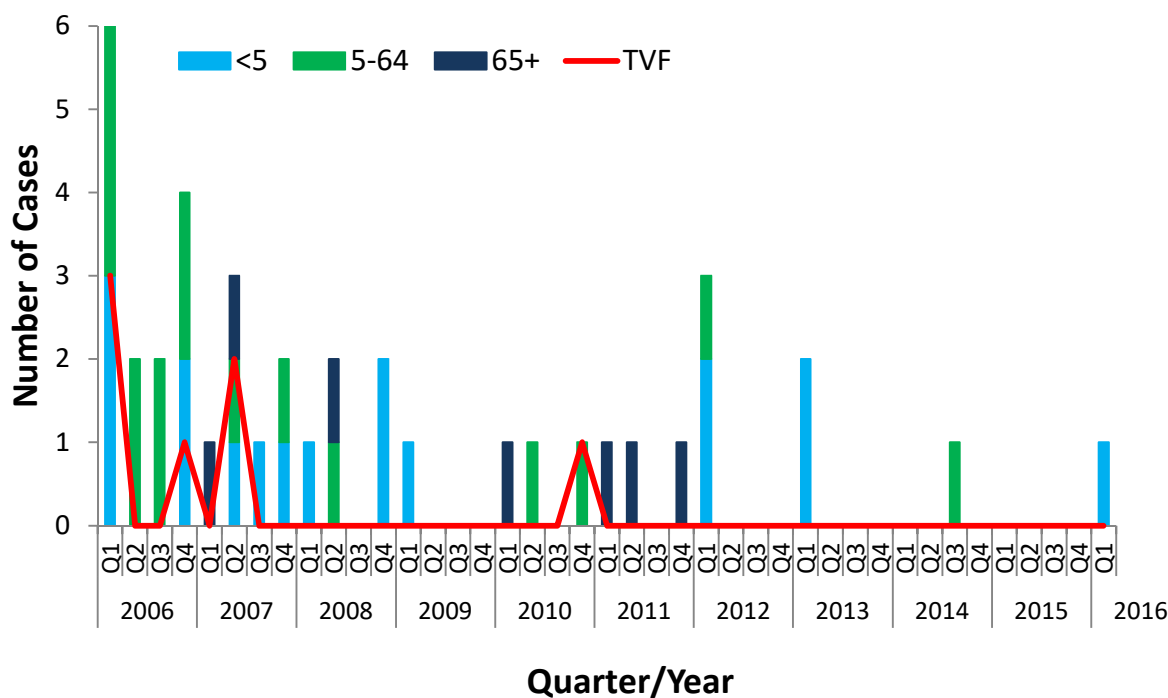
**Table 4.** Number of *H. influenzae* cases by clinical diagnosis notified in the first quarter of 2014, 2015 and 2016

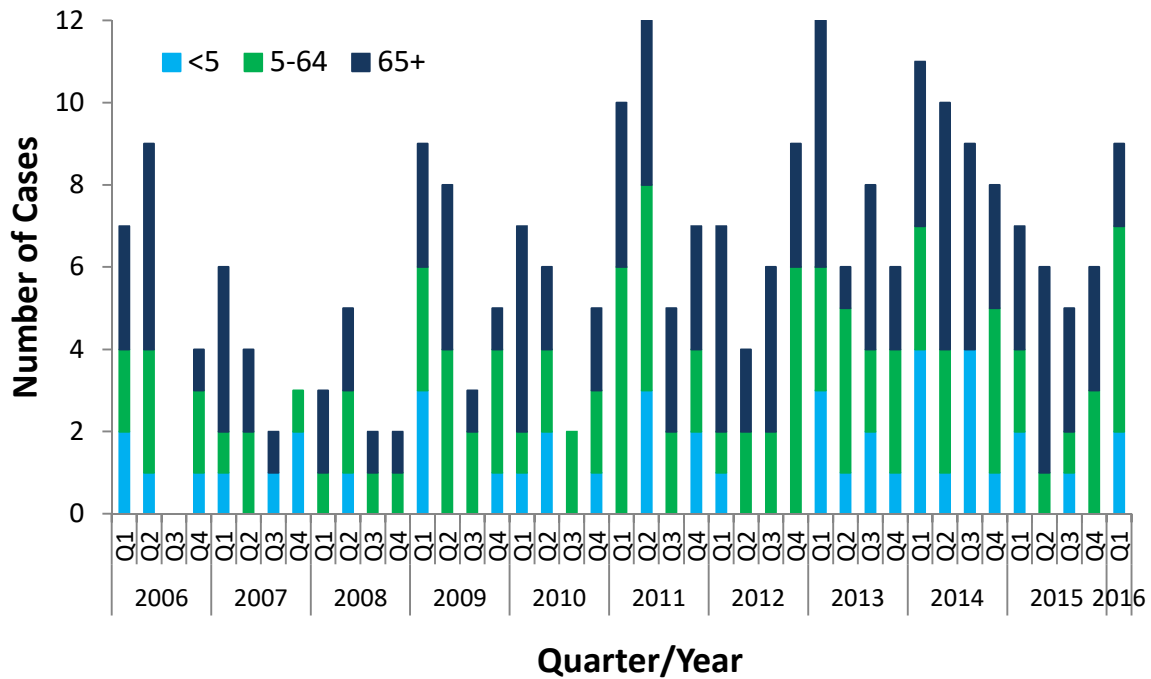
Number of cases	Q1-2014	Q1-2015	Q1-2016	Total	Total (%)
Septicaemia	4	6	6	16	29.1%
Bacteraemia (without focus)	2	4	0	6	10.9%
Pneumonia	4	3	1	8	14.5%
Meningitis	2	2	0	4	7.3%
Meningitis & septicaemia	0	1	0	1	1.8%
Other	2	2	4	8	14.5%
Cellulitis	0	1	1	2	3.6%
Epiglottitis	0	0	0	0	0.0%
Osteomyelitis	0	0	0	0	0.0%
Septic arthritis	0	0	0	0	0.0%
Clinical diagnosis not reported	2	2	6	10	18.2%
<b>Total</b>	<b>16</b>	<b>21</b>	<b>18</b>	<b>55</b>	<b>100%</b>

**Table 5.** Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q1-2016

Number of cases	Typed (b, e, f or not-b)	Non-typeable	Not typed*	Total
Septicaemia	0	4	2	6
Bacteraemia (without focus)	0	0	0	0
Pneumonia	0	1	0	1
Meningitis	0	0	0	0
Meningitis & septicaemia	0	0	0	0
Other	1	1	2	4
Cellulitis	1	0	0	1
Epiglottitis	0	0	0	0
Osteomyelitis	0	0	0	0
Septic arthritis	0	0	0	0
Clinical diagnosis not reported	1	3	2	6
<b>Total</b>	<b>3</b>	<b>9</b>	<b>6</b>	<b>18</b>

\*including not typed, PCR diagnosis only (if any)

**Figure 5.** Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2006



**Figure 6.** Quarterly number of non-typeable/non-capsulated cases by age group, since 2006

## Acknowledgements

- HPSC wishes to thank all who provided data for this report: Departments of Public Health, the Irish Meningococcal and Meningitis Reference Laboratory (IMMRL) and Epidemiology and Molecular Biology Unit (EMBU) in Temple Street Children's Hospital, National Virus Reference Laboratory (NVRL) and other Microbiology Laboratories

## NOTES

### Invasive IMD and other bacterial meningitis notifications:

- The collection of specimens for all bacterial meningitis diagnostic testing should be performed as per recommendations outlined in the HPSC's 'Guidelines for the Early Clinical and Public Health Management of Bacterial Meningitis (including Meningococcal Disease). Report of the Scientific Advisory Committee of HPSC' published in January 2012, a copy of which is available at: <http://www.hpsc.ie/A-Z/VaccinePreventable/BacterialMeningitis/Guidance/File.12977.en.pdf>
- An enhanced surveillance form should be completed for each notification. A copy is available at: <http://www.hpsc.ie/A-Z/VaccinePreventable/BacterialMeningitis/SurveillanceForms/File.1832.en.pdf>.
- All suspected/confirmed *Neisseria meningitidis* isolates recovered from any site (blood/CSF/other sterile-site or nose/throat) from an individual with suspected or confirmed IMD should be forwarded by laboratories to the IMMRL for confirmation of identity and epidemiological typing

### Invasive viral meningitis notifications:

- The collection of specimens for viral meningitis diagnostic testing should be performed as per recommendations in the NVRL's user manual, which is available at: [http://nvrl.ucd.ie/sites/default/files/uploads/pdfs/NVRL\\_USER\\_MANUAL\\_13.0.pdf](http://nvrl.ucd.ie/sites/default/files/uploads/pdfs/NVRL_USER_MANUAL_13.0.pdf).

### Invasive *H. influenzae* notifications:

- Serotype should be determined for all isolates, regardless of patient age, and the results reported to HPSC.
- For all type b cases born since 1987, Hib vaccination status should be ascertained and the vaccine details reported to HPSC.
- On time Hib vaccinations (at 2, 4, 6 and 13 months of age) are strongly recommended to prevent unnecessary Hib disease occurring in children. Older children/adults with risk conditions (asplenia/hyposplenism/complement deficiency) are recommended the Hib vaccine (two doses, at least two months apart).
- An enhanced surveillance form should be completed for each Hib notification. A copy is available at: <http://www.hpsc.ie/A-Z/VaccinePreventable/Haemophilusinfluenzae/SurveillanceForms/File.1847.en.pdf>. Details of the clinical diagnosis of each case should also be provided when completing this form.
- All suspected/confirmed *H. influenzae* isolates recovered from any site from an individual with suspected or confirmed invasive *Haemophilus* infection should be forwarded by laboratories to the IMMRL for confirmation of identity and epidemiological typing



## Appendices

### Appendix 1. IMD Cases by Serogroup in Quarter 1, 2001-2016

Serogroup	Q1-2001	Q1-2002	Q1-2003	Q1-2004	Q1-2005	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016
B	75	63	65	55	59	58	49	49	41	45	33	22	19	21	12	15
C	22	7	1	4	1	0	0	1	2	1	0	0	1	3	4	4
W135	0	2	2	0	1	0	1	1	2	0	0	0	2	0	2	1
Y	1	0	1	0	1	2	0	0	2	0	1	1	1	0	2	0
Non-groupable (NG)	3	0	1	0	2	1	0	0	0	0	0	0	0	0	0	1
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	14	10	3	7	8	12	7	4	5	6	1	1	0	0	2	2
<b>Total</b>	<b>115</b>	<b>82</b>	<b>73</b>	<b>66</b>	<b>72</b>	<b>73</b>	<b>57</b>	<b>55</b>	<b>52</b>	<b>52</b>	<b>35</b>	<b>24</b>	<b>23</b>	<b>24</b>	<b>22</b>	<b>23</b>

### Appendix 2. IMD Cases by Quarter, 2001-2016

Qr	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2001-2016 change
Q1	115	82	73	66	72	73	57	55	52	52	35	24	23	24	22	23	-80.0%
Q2	86	60	38	47	57	55	44	31	33	23	24	13	25	21	17	-	-
Q3	53	53	51	42	31	37	41	34	31	15	14	8	13	7	17	-	-
Q4	76	58	75	43	43	44	37	48	31	24	21	21	20	30	19	-	-
<b>Total</b>	<b>330</b>	<b>253</b>	<b>237</b>	<b>198</b>	<b>203</b>	<b>209</b>	<b>179</b>	<b>168</b>	<b>147</b>	<b>114</b>	<b>94</b>	<b>66</b>	<b>81</b>	<b>82</b>	<b>75</b>	<b>-</b>	<b>-</b>

### Appendix 3. IMD Cases by HSE Area in Quarter 1, 2001-2016

HSE Area	Q1-2001	Q1-2002	Q1-2003	Q1-2004	Q1-2005	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2016 CIR*
E	40	26	23	21	25	33	14	12	13	20	7	8	10	5	4	3	0.19
M	9	6	10	5	5	4	4	3	3	1	5	2	1	2	2	1	0.35
MW	8	6	6	3	7	5	6	6	5	8	3	3	2	1	0	2	0.53
NE	9	10	6	9	6	4	4	11	9	4	5	5	3	5	1	1	0.23
NW	4	3	1	5	4	4	6	2	1	6	4	1	2	3	3	6	2.32
SE	19	8	10	5	10	9	10	11	8	9	5	1	1	3	3	2	0.40
S	17	17	14	11	9	11	6	9	11	3	4	2	2	1	5	5	0.75
W	9	6	3	7	6	3	7	1	2	1	2	2	2	4	4	3	0.67
<b>Total</b>	<b>115</b>	<b>82</b>	<b>73</b>	<b>66</b>	<b>72</b>	<b>73</b>	<b>57</b>	<b>55</b>	<b>52</b>	<b>52</b>	<b>35</b>	<b>24</b>	<b>23</b>	<b>24</b>	<b>22</b>	<b>23</b>	<b>0.50</b>

\* CIR, crude incidence rate per 100,000

### Appendix 4. IMD Cases by Age Group in Quarter 1, 2001-2016

Age Group (Yrs)	Q1-2001	Q1-2002	Q1-2003	Q1-2004	Q1-2005	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2016 CIR*
<1	20	23	18	14	19	18	16	12	12	12	11	9	4	5	4	6	8.29
1-4	46	27	23	21	32	26	20	18	15	22	9	4	7	8	8	3	1.06
5-9	13	7	6	8	4	8	1	8	4	4	6	4	3	2	2	2	0.62
10-14	10	6	8	5	2	3	5	4	3	2	1	1	1	0	0	3	0.99
15-19	14	8	7	6	6	10	6	4	7	6	2	1	3	3	5	5	1.77
20-24	3	4	0	5	3	2	2	4	4	1	1	0	1	2	1	2	0.67
25-34	1	2	6	1	0	0	3	0	2	2	2	0	0	0	0	0	0.00
35-44	1	1	0	1	1	3	1	0	0	0	1	1	1	1	1	0	0.00
45-54	4	0	0	1	2	2	0	1	2	0	2	3	0	1	0	0	0.00
55-64	1	2	3	2	3	0	1	2	0	1	0	0	2	0	0	0	0.00
65+	2	2	2	2	0	1	2	2	3	2	0	1	1	2	1	2	0.37
<b>Total</b>	<b>115</b>	<b>82</b>	<b>73</b>	<b>66</b>	<b>72</b>	<b>73</b>	<b>57</b>	<b>55</b>	<b>52</b>	<b>52</b>	<b>35</b>	<b>24</b>	<b>23</b>	<b>24</b>	<b>22</b>	<b>23</b>	<b>0.50</b>

\* CIR, crude incidence rate per 100,000



### Appendix 5. Deaths associated with IMD by Serogroup in Quarter 1, 2001-2016

Serogroup	Q1-2001	Q1-2002	Q1-2003	Q1-2004	Q1-2005	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016
B	3	1	3	4	4	2	2	3	3	2	1	1	1	1	0	1
C	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
W135	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Y	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Non-groupable (NG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
<b>Total</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>
%CFR* (Total)	3.5%	1.2%	4.1%	7.6%	5.6%	2.7%	3.5%	9.1%	5.8%	3.8%	2.9%	8.3%	4.3%	4.2%	0.0%	8.7%

\* %CFR, case fatality ratio

### Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 1, 2006-2016 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1:2006-2016
Specified	<i>Leptospira</i> spp.	1	1	0	0	0	0	0	0	0	0	0	2
	<i>Listeria</i> spp.	1	2	1	0	0	1	0	1	0	2	2	10
	<i>Mycobacterium tuberculosis</i> #	1	1	2	1	3	0	2	1	0	0	0	11
	<i>Streptococcus pneumoniae</i>	n/a	n/a	10	7	4	8	10	7	13	11	10	80
	<i>Streptococcus agalactiae</i> *	na	na	na	na	na	na	3	2	3	2	0	10
	<i>Streptococcus pyogenes</i>	0	0	1	0	1	0	0	2	0	2	0	6
Not specified	<i>Escherichia coli</i>	1	0	0	1	0	0	0	0	1	2	1	6
	<i>Klebsiella pneumoniae</i>	1	0	0	0	0	0	0	0	0	0	0	1
	<i>Staphylococcus aureus</i>	0	0	0	0	2	0	0	0	0	0	0	2
	<i>Streptococcus agalactiae</i> †	2	2	3	2	2	4	0	0	0	0	0	15
	<i>Streptococcus bovis</i> biotype II/2	0	0	0	1	0	0	0	0	0	0	0	1
	Bacmen Unknown/Not specified	8	6	1	6	8	2	4	2	1	2	3	43
<b>Total</b>		<b>15</b>	<b>12</b>	<b>18</b>	<b>18</b>	<b>20</b>	<b>15</b>	<b>19</b>	<b>15</b>	<b>18</b>	<b>21</b>	<b>16</b>	<b>187</b>

#TB meningitis figures for 2014, 2015 and 2016 are provisional

\**Streptococcus agalactiae* causing meningitis aged < 90 days old notifiable under the disease category Streptococcus Group B infection (invasive) after 01/01/2012

†All *Streptococcus agalactiae* causing meningitis cases notifiable under the disease category Bacterial Meningitis (NOS) except after 01/01/2012 when cases aged >=90 days old only notifiable

n/a not available-details of meningitis-related *Streptococcus pneumoniae* currently not complete on CIDR for the years 2006-2007

na not applicable for the years prior to 2012

§Meningitis-related lyme neuroborreliosis cases are not included in this report

### Appendix 7. Viral Meningitis Cases, Not Otherwise Specified, by Causative Organism in Quarter 1 2006-2016

Causative Organism	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016
enterovirus	0	3	5	8	8	6	35	7	41	23	35
human herpes virus type 6	0	0	0	0	1	3	4	6	11	4	8
varicella & varicella zoster virus	1	1	1	1	3	0	0	0	9	6	1
herpes simplex virus types 1 or 2	0	1	3	2	1	2	3	3	4	2	0
parechovirus	0	0	0	0	0	0	0	0	0	4	0
echovirus types, 6, 9, 13, 30 or 33	0	0	0	0	0	0	1	0	0	0	0
coxsackievirus A, B or B4	0	0	0	0	0	0	0	0	0	0	0
adenovirus	0	0	0	0	0	0	0	0	0	0	0
not specified	2	2	4	11	6	4	5	5	4	1	5
<b>Total</b>	<b>3</b>	<b>7</b>	<b>13</b>	<b>22</b>	<b>19</b>	<b>15</b>	<b>48</b>	<b>21</b>	<b>69</b>	<b>40</b>	<b>49</b>
% enterovirus	0.0%	42.9%	38.5%	36.4%	42.1%	40.0%	72.9%	33.3%	59.4%	57.5%	71.4%
% known organism	33.3%	71.4%	69.2%	50.0%	68.4%	73.3%	89.6%	76.2%	94.2%	97.5%	89.8%

**Appendix 8. *H. influenzae* Cases by Type in Quarter 1, 2006-2016**

Type	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016
b	6	1	1	1	1	1	3	2	0	0	1
e	2	0	0	3	0	0	0	1	0	0	0
f	0	0	1	3	0	0	3	2	1	1	2
not type-b	0	0	0	0	0	0	0	1	0	2	0
non-typeable/non-capsulated	7	6	3	9	7	10	7	12	11	7	9
not typed*	0	2	1	3	2	0	3	0	4	11	6
<b>Total</b>	<b>15</b>	<b>9</b>	<b>6</b>	<b>19</b>	<b>10</b>	<b>11</b>	<b>16</b>	<b>18</b>	<b>16</b>	<b>21</b>	<b>18</b>

\*including not typed, PCR diagnosis only (if any)

**Appendix 9. *H. influenzae* Cases by Quarter, 2006-2016**

Qr	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2006-2016 change
Q1	15	9	6	19	10	11	16	18	16	21	18	+20.0%
Q2	12	11	8	12	9	16	5	7	14	15	-	-
Q3	3	5	2	4	3	7	10	9	15	8	-	-
Q4	8	6	6	8	6	10	10	7	16	8	-	-
<b>Total</b>	<b>38</b>	<b>31</b>	<b>22</b>	<b>43</b>	<b>28</b>	<b>44</b>	<b>41</b>	<b>41</b>	<b>61</b>	<b>52</b>	<b>-</b>	<b>-</b>
<i>Meningitis</i>	4	2	3	3	2	4	3	2	7	5	-	-
<i>Type b meningitis</i>	3	1	1	0	1	0	1	0	0	0	-	-

**Appendix 10. *H. influenzae* Cases by HSE Area in Quarter 1, 2006-2016**

HSE Area	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2016 CIR*
E	4	6	1	9	4	3	7	5	5	8	7	0.43
M	0	0	2	1	0	2	0	2	1	0	0	0.00
MW	1	0	0	4	0	0	1	1	2	2	1	0.26
NE	0	0	0	0	0	2	3	2	3	3	2	0.45
NW	2	1	0	0	0	1	1	2	0	1	1	0.39
SE	2	1	2	1	3	1	1	2	2	4	0	0.00
S	4	0	1	2	3	1	3	2	2	2	3	0.45
W	2	1	0	2	0	1	0	2	1	1	4	0.90
<b>Total</b>	<b>15</b>	<b>9</b>	<b>6</b>	<b>19</b>	<b>10</b>	<b>11</b>	<b>16</b>	<b>18</b>	<b>16</b>	<b>21</b>	<b>18</b>	<b>0.39</b>

\* CIR, crude incidence rate per 100,000

**Appendix 11. *H. influenzae* Cases by Age Group in Quarter 1, 2006-2016**

Age Grp (Yrs)	Q1-2006	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2016 CIR*
<1	3	1	0	2	0	0	3	2	3	8	2	2.76
1-4	2	1	2	4	1	0	1	3	3	4	2	0.70
5-9	3	0	0	3	0	1	2	1	1	1	1	0.31
10-14	0	0	0	1	0	0	0	0	0	0	1	0.33
15-19	0	0	0	0	0	0	0	0	0	1	0	0.00
20-24	0	1	0	0	0	0	1	0	0	0	1	0.34
25-34	0	0	0	1	2	0	0	2	1	1	4	0.53
35-44	0	1	0	1	0	3	0	0	0	1	1	0.14
45-54	1	0	0	0	0	1	1	0	1	0	1	0.17
55-64	2	0	1	1	0	1	2	2	1	0	0	0.00
65+	4	5	3	6	7	5	6	8	6	5	5	0.93
<b>Total</b>	<b>15</b>	<b>9</b>	<b>6</b>	<b>19</b>	<b>10</b>	<b>11</b>	<b>16</b>	<b>18</b>	<b>16</b>	<b>21</b>	<b>18</b>	<b>0.39</b>

\* CIR, crude incidence rate per 100,000