

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 MENINGITIS & SEPSIS REFERENCE LABORATORY AND THE NATIONAL VIRUS REFERENCE LABORATORY



Q4-2016

28th March 2017

Provisional Figures

Summary

- 26 invasive meningococcal disease cases (IMD) were notified in Q4-2016, including 15 serotype B, six serotype C, four serogroup Y and one serogroup W135. An IMD cluster involving two cases aged between 10 and 14 years was reported in HSE-NW. Two IMD cases were also reported to have died (age range 75-84 years), one of which was reported to be attributable to the infection. No imported cases were identified during this quarter.
- Eight cases of invasive *S. pneumoniae* infections presenting as meningitis were notified. Five cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were also notified. These included three that were case classified as confirmed and two others as possible. One of the confirmed cases had *E.coli* identified as the causative organism.
- 42 cases of viral meningitis (NOS) were reported with no related deaths or outbreaks.
- 14 cases of *Haemophilus influenzae* were reported, one of which (a non-typeable/non-capsular infection) was associated with meningitis. Ten were non-typeable, one was a type b (aged 55-59 years, vaccination status unknown), one was a type f and two were not typed. Two deaths occurred (age range 80-82 years), but the actual causes of death was either unknown or pending at the time of writing. There were no imported cases during this quarter.

Introduction

Meningococcal disease became a notifiable disease on the 1st 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 1st 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).

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 primary childhood immunisation (PCI) 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.

In August 2014, NIAC recommended an adolescent MenC booster at 12-13 years to be offered in the first year of secondary level school. This dose was introduced into the HSE schools immunisation programme in September 2014. This was done in response to an increase in MenC cases and the emerging international evidence of waning immunity in populations that had received MCC vaccine in early childhood in the United Kingdom. Further changes occurred in 2015 when NIAC recommended that all babies born on or after July 1st 2015 should receive a single dose of MCC at 4 months, 13 months and at 12-13 years (if not previously vaccinated at >10 years of age). The PCI schedule was again updated in July 2016 to reflect the fact that babies born on or after 1st October 2016 will be offered the new MenB vaccine at 2, 4 and 12 months of age from 1st December 2016. The MenB vaccine cannot be given at same time as MenC vaccine (which is given at 6 months of age).

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 28th March 2017. **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 Q4-2016, 26 cases of IMD were notified, all of which were confirmed. Fifteen were attributable to serogroup B, six were serogroup C, four were serogroup Y and one was serogroup W135 (Table 1). Details of the number of doses of the meningococcal C conjugate vaccine received, age group and outcome of the six serogroup C cases are presented in Table 2. In Q4-2016 serogroup B disease accounted for 57.7% (n=15/26; 95%CI 38.7%-76.7%) of all IMD notifications (Figure 1, Appendix 1).

Table 1. Classification of IMD cases notified by Serogroup in Q4-2016

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	15	6	1	4	0	0	0	26
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
Total	15	6	1	4	0	0	0	26

Table 2. Details of six MenC cases notified in Q4-2016 including age group and outcome

Case. No.	Age Group	Outcome	No. MenC doses given	Age at vaccination
1	<1	Not known	0	.
2	15-19	Recovering	1	3-4 years
3	15-19	Recovered	1	3-4 years
4	30-34	Recovering	.	.
5	45-49	Recovering	.	.
6	80-84	Died	0	.

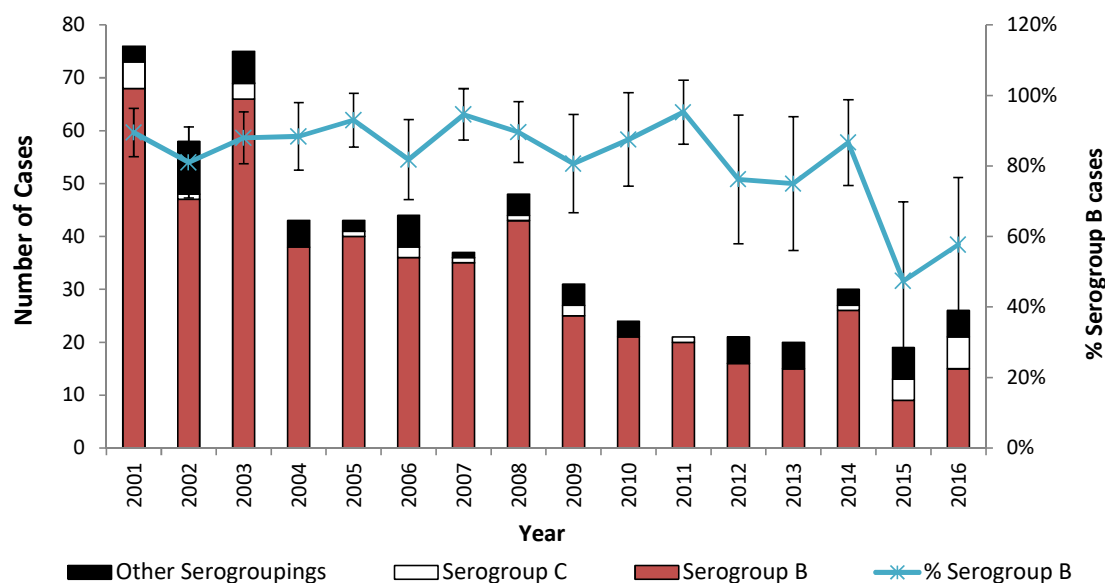


Figure 1. Number of IMD cases notified in Ireland by serogroup in Q4 of each year between 2001 and 2016 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

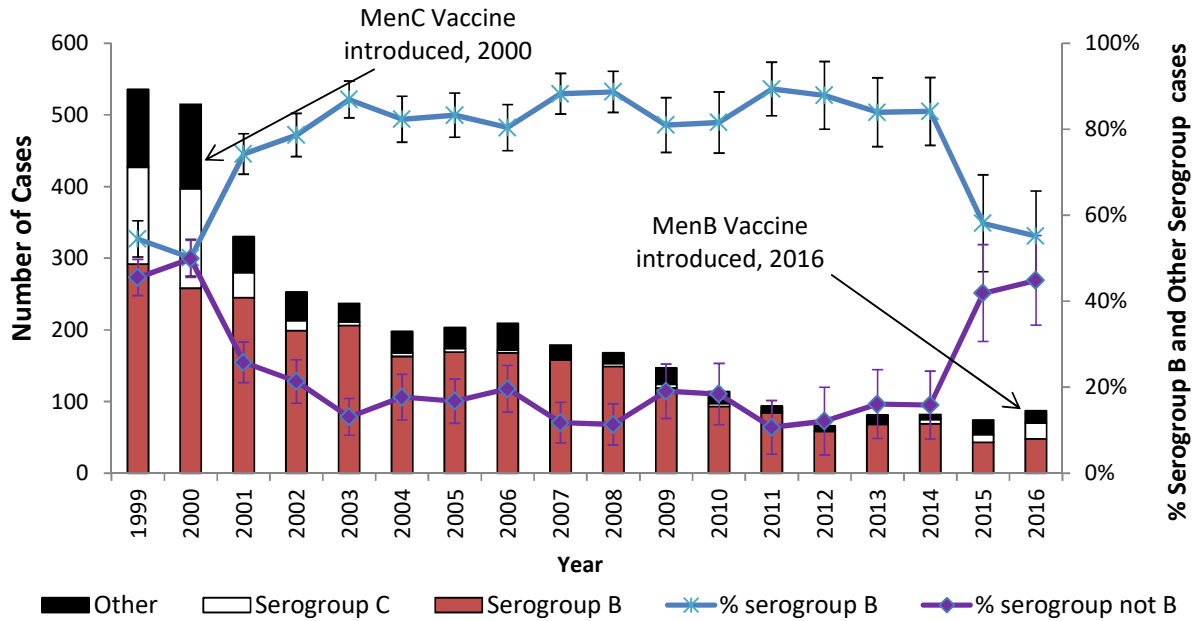


Figure 2. Number of IMD cases notified in Ireland by serogroup and by year between 1999 and 2016 with percentage of annual cases attributable to serogroup B and non-serogroup B with 95% confidence intervals

IMD Trends & Outbreaks

The number of IMD cases reported in Q4-2016 (n=26) was greater than the average number reported in the same quarter over the previous three years (average=23; 95%CI 15.9-30.1); for serogroup B the average was 16.7 and for serogroup C it was 1.7 (Figure 1; Appendix 1). Fourth quarterly IMD cases have fallen by 65.8% since 2001 (Appendix 2). Since 2001, Q4 serogroup B cases have also declined by 77.9%, but serogroup C cases have increased by 20%, notably in recent years (Appendix 1). In Q4-2016, six serogroup C cases were reported, compared to six such cases in all four quarters combined over the previous six years. An IMD cluster involving two cases aged between 10 and 14 years was reported in HSE-NW in Q4-2016.

All confirmed cases reported on CIDR in Q4-2016 were also included in the electronic listings of laboratory tested *N. meningitidis* isolates/specimens provided to the HPSC on January 25th 2017 and on 16th March 2017 by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q4-2016 was 0.57 cases per 100,000 population ranging from the lowest (0.22/100,000) in HSE W to the highest (0.90/100,000) in HSE S (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group and in Q4-2016 the incidence rate in this age group was 5.5 cases per 100,000 population, followed by 2.1 cases/100,000 in the 15-19 year age group (Appendix 4).

IMD associated deaths

Two IMD related deaths were reported in Q4-2016, a 75-79 year old with a serogroup B infection and an 80-84 year old with a serogroup C infection. One death was reported to be attributable to the meningococcal infection. This compares to none reported during Q4-2015 (Appendix 5).

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q4-2016, eight cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was between 1-4 years and 80-84 years (Appendix 6). No IPD meningitis-related deaths were reported in this quarter. Five patients had a risk factor recorded. Details of the vaccination status, age group, risk factor, and serotype associated with these eight cases are presented in Table 3 below.

Table 3. Vaccination status, age and risk factors, and serotype details of the *Streptococcus pneumoniae* meningitis cases reported in Q4-2016

Case. No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	1-4	No	Vaccinated (3doses)	Not specified	Not specified
2	5-9	No	Vaccinated (3doses)	Not specified	Not specified
3	35-39	Yes	Unvaccinated	Vaccinated (1 dose)	Not specified
4	40-44	Yes	Unvaccinated	Not specified	19F
5	55-59	Yes	Unvaccinated	Unvaccinated	Not specified
6	55-59	No	Unvaccinated	Not specified	12F
7	60-64	Yes	Not specified	Not specified	15A
8*	80-84	Yes	Unvaccinated	Vaccinated (1 dose)	11A

*Vaccine failure

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 Q4-2016, there were two cases of *Streptococcus agalactiae* meningitis that were CSF PCR positive, but not labelled as having clinical meningitis or any other clinical description.

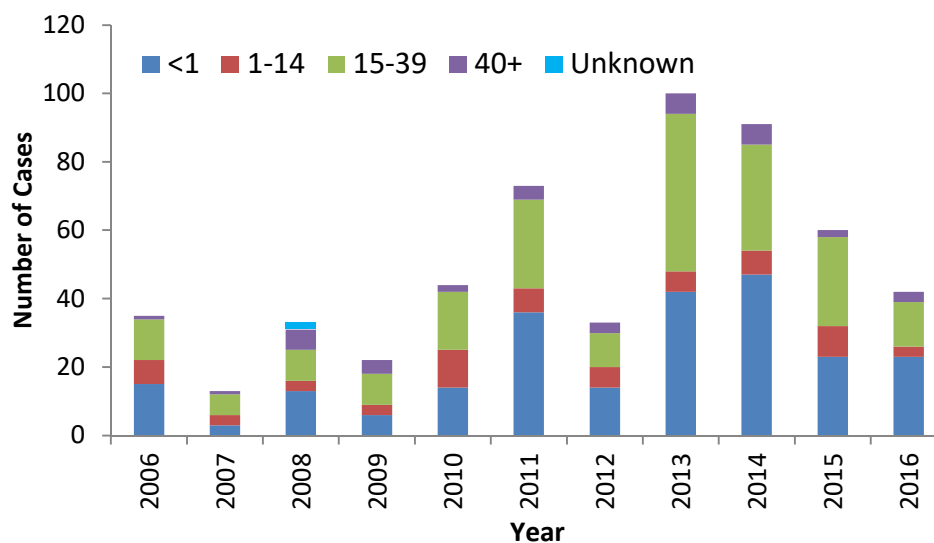
Bacterial meningitis (not otherwise specified)

Five cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q4-2016. These included three that were case classified as confirmed and two others as possible. One of the confirmed cases had *Escherichia coli* identified as the causative organism. The age range for all five cases was 12 to 87 years (Appendix 6).

Viral Meningitis (Specified and Not Otherwise Specified)

Forty-two viral meningitis notifications (NOS) (age range 2 weeks to 76 years; median 4.5 months) were reported in Q4-2016 (Figure 3), 38 of which (90.5%) had their causative organism identified: 30 enterovirus (serotypes not reported) (age range two weeks to 39 years, median 4.5 months); four parechovirus virus (all aged ≤ 1 month); two varicella/herpes zoster virus (age range 16-54 years); two herpes simplex virus (one type 1 aged 75-79 years and one type 2 aged 15-19 years) and four with no pathogen identified (aged 1 month to 57 years) (Appendix 7).

In Q4-2016, the highest frequency of cases occurred in children <1 year of age ($n=23/42$; 54.8%) and in adults aged 15-39 years ($n=8/42$; 19.0%) (Figure 3). Of the 23 cases <1 year of age reported in this quarter, 17 (73.1%) were attributable to enterovirus, four (17.4%) to parechovirus and two (8.7%) with no pathogen identified. Figure 4 presents both the total number of viral meningitis NOS cases and those not caused by enterovirus by year and by quarter since 2006. The average Q4 percentage of all viral meningitis NOS cases attributable to enterovirus since 2010 to date has been 73.0%.

**Figure 3.** Quarter 4 number of viral meningitis (NOS) cases in Ireland by age group (years), 2006-2016

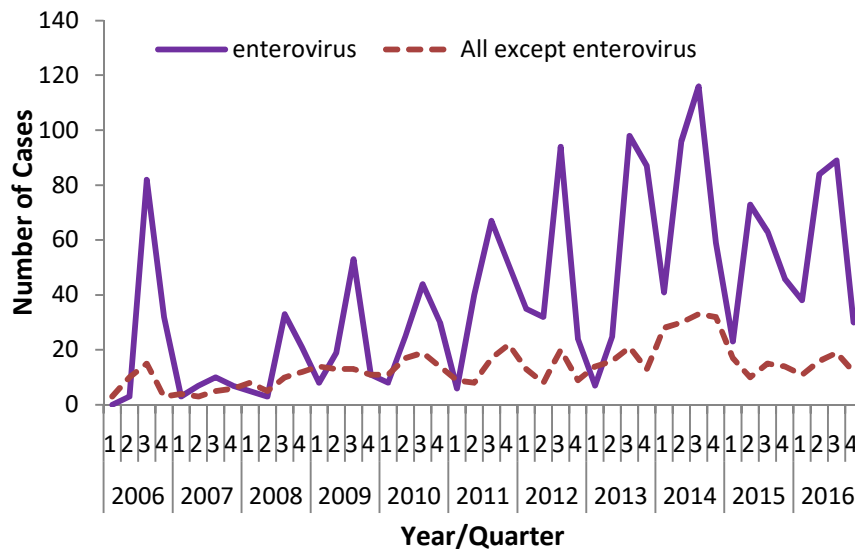


Figure 4. Number of viral meningitis (NOS) cases caused by enterovirus and not by enterovirus by quarter and year, 2006-2016

Haemophilus influenzae (invasive) infections

***H. influenzae* Cases by Type, Case Classification**

In Q4-2016, 14 cases of invasive *H. influenzae* (all case classified as confirmed) were notified in Ireland (Figure 5): Ten were non-typeable/non-capsulated, one was a type b (vaccination status unknown and aged 55-59 years), one was a type f and two were not typed. This total compares to an average of 10.3 cases for the same quarter in 2013 to 2015 (Table 4, Appendices 8, 9). Of all the Q4 cases reported between 2014 and 2016, 21.1% (n=8/38) had no clinical diagnosis reported (Table 5). There were no imported cases during this quarter.

In the electronic listings provided by the Epidemiology and Molecular Biology Unit (EMBU) in Temple Street Children's Hospital w to the HPSC on January 25th 2017 and on 16th March 2017, two classified confirmed *H. influenzae* events on CIDR in Q4-2016 were not included on it; both were from HSE MW.

***H. influenzae* associated deaths**

Two deaths occurred among the 14 *H. influenzae* cases reported during this quarter. Both were aged between 80 and 82 years and had non-typeable infections, but the actual causes of death were either unknown or pending at the time of writing.

***H. influenzae* meningitis**

One meningitis-related *H. influenzae* cases were reported in Q4-2016 (Table 6, Appendix 9). The case was aged 6-11 months old and had a non-typeable infection.

***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 Q4-2016. The last reported TVF however was in Q4-2010, the only one in more than nine years between Q3-2007 and Q4-2016: an indication of the continuing positive impact of the Hib immunisation catch-up booster campaign launched in November 2005 and introduction of a routine Hib booster for all children in the second year of life since 2006 (Figures 6, 7). 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.

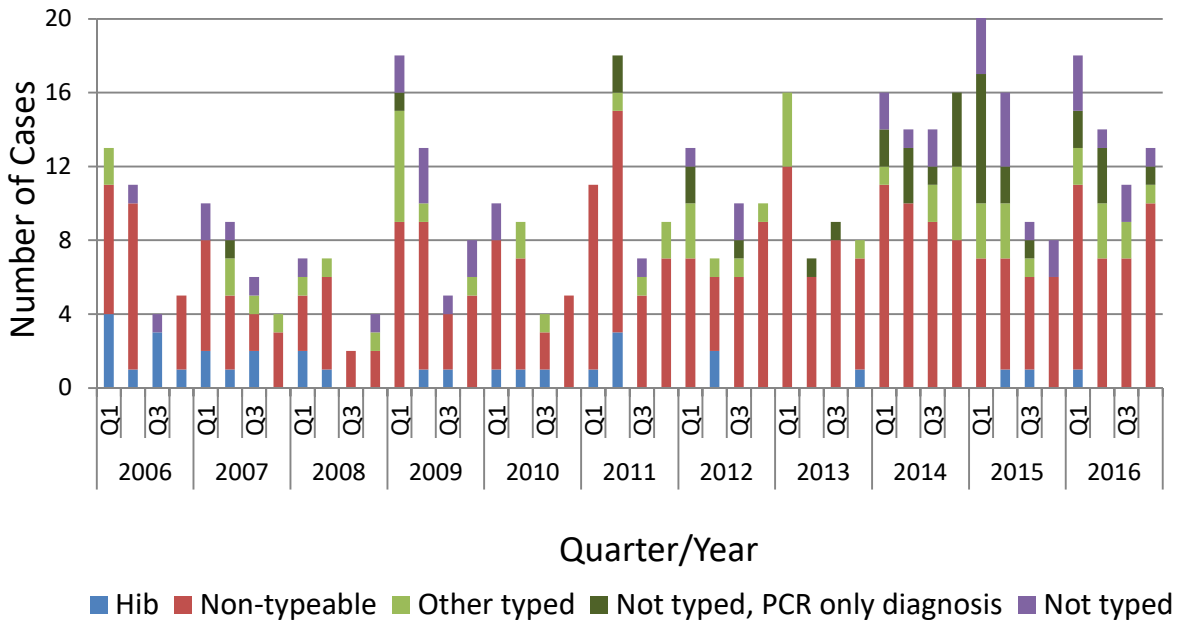


Figure 5. Quarterly number of *H. influenzae* cases by type since 2006

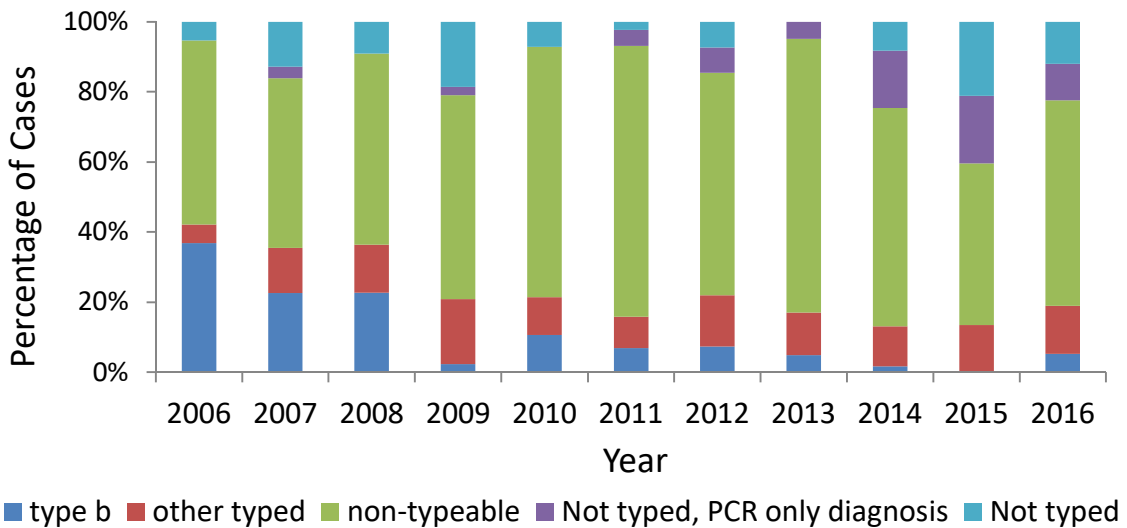


Figure 6. Percentage of annual of *H. influenzae* cases by type since 2006

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

In Q4-2016 the number of non-typeable cases was ten (aged 7 months to 91 years), compared to the average of 6.7 cases in the same quarter between 2013 and 2015 (Figure 8, Table 4).

Table 4. Number of *H. influenzae* cases notified in the fourth quarter of 2014, 2015 and 2016

Number of cases	Q4-2014	Q4-2015	Q4-2016
All <i>H. influenzae</i>	16	8	14
All <i>H. influenzae</i> <5yrs	5	1	1
All <i>H. influenzae</i> ≥65yrs	3	3	8
<i>H. influenzae</i> type b	0	0	1
<i>H. influenzae</i> type b <5yrs	0	0	0
<i>H. influenzae</i> type b ≥65yrs	0	0	0
<i>H. influenzae</i> non-typeable	8	6	10
<i>H. influenzae</i> non-typeable <5yrs	1	0	1
<i>H. influenzae</i> non-typeable ≥65yrs	3	3	6

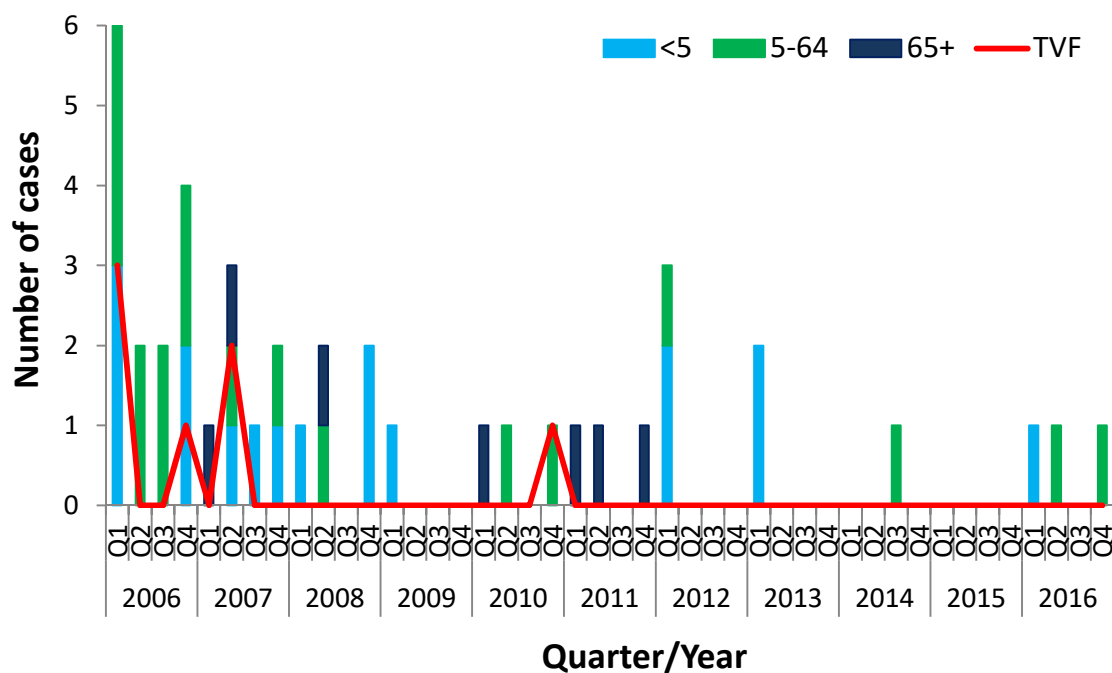
Table 5. Number of *H. influenzae* cases by clinical diagnosis notified in the fourth quarter of 2014, 2015 and 2016

Number of cases	Q4-2014	Q4-2015	Q4-2016	Total	Total (%)
Septicaemia	1	1	3	5	13.2%
Bacteraemia (without focus)	6	0	0	6	15.8%
Pneumonia	3	2	6	11	28.9%
Meningitis	2	0	1	3	7.9%
Meningitis & septicaemia	0	0	0	0	0.0%
Other	2	0	2	4	10.5%
Cellulitis	0	0	0	0	0.0%
Epiglottitis	0	0	1	1	2.6%
Osteomyelitis	0	0	0	0	0.0%
Septic arthritis	0	0	0	0	0.0%
Clinical diagnosis not reported	2	5	1	8	21.1%
Total	16	8	14	38	100%

Table 6. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q4-2016

Number of cases	Typed (b, e, f, d or not-b)	Non-typeable	Not typed*	Total
Septicaemia	0	3	0	3
Bacteraemia (without focus)	0	0	0	0
Pneumonia	1	4	1	6
Meningitis	0	1	0	1
Meningitis & septicaemia	0	0	0	0
Other	0	1	1	2
Cellulitis	0	0	0	0
Epiglottitis	1	0	0	1
Osteomyelitis	0	0	0	0
Septic arthritis	0	0	0	0
Clinical diagnosis not reported	0	1	0	1
Total	2	10	2	14

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

**Figure 7.** Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2006

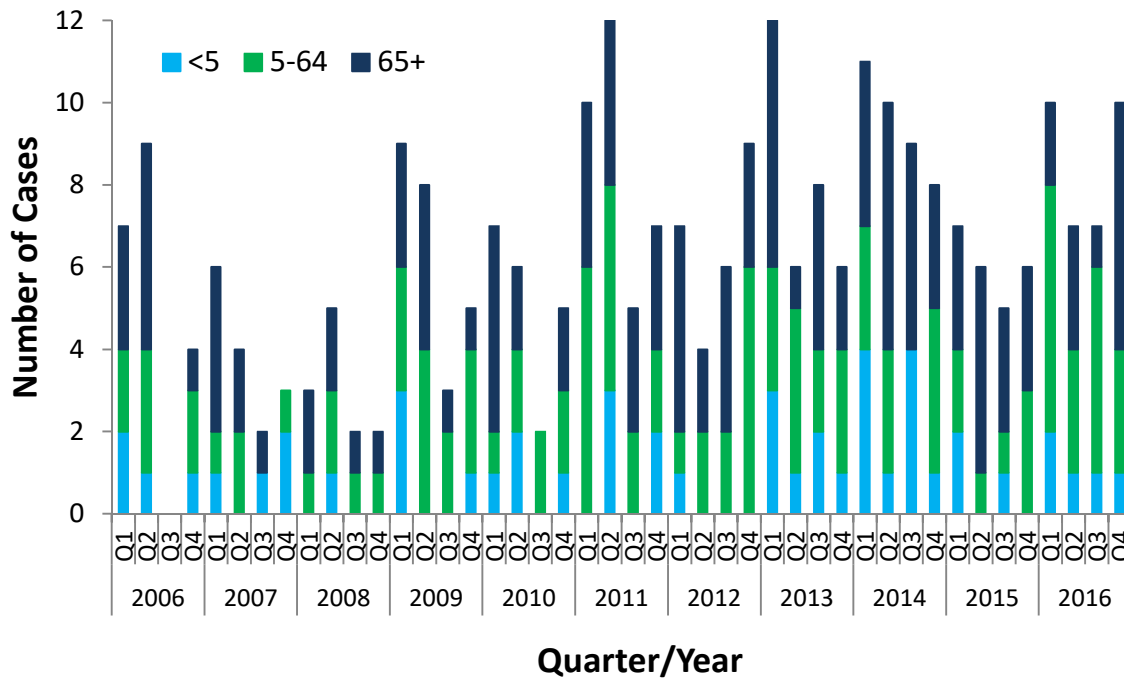


Figure 8. Quarterly number of non-typeable/non-capsulated cases by age group, since 2006

Acknowledgements

- HPSC wishes to thank all who provided data for this report: Departments of Public Health, the Irish Meningitis & Sepsis Reference Laboratory (IMSRL) 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 IMSRL for confirmation of identity and epidemiological typing. If an isolate is not available, please forward residual sample or PCR extract for confirmation/typing. Details are available at <http://www.cuh.ie/healthcare-professionals/departments/laboratory/> and at <http://www.cuh.ie/healthcare-professionals/departments/irish-meningitis-sepsis-reference-laboratory-imsrl/>**

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.

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 EMBU/IMSRL for confirmation of identity and epidemiological typing. Details are available at <http://www.cuh.ie/healthcare-professionals/departments/laboratory/> and at <http://www.cuh.ie/healthcare-professionals/departments/irish-meningitis-sepsis-reference-laboratory-imsrl/>**

APPENDICES

Appendix 1. IMD Cases by Serogroup in Quarter 4, 2001-2016

Serogroup	Q4-2001	Q4-2002	Q4-2003	Q4-2004	Q4-2005	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016
B	68	47	66	38	40	36	35	43	25	21	20	16	15	26	9	15
C	5	1	3	0	1	2	1	1	2	0	1	0	0	1	4	6
W135	0	0	1	1	0	0	1	0	0	1	0	0	0	0	1	1
Y	0	1	1	1	0	1	0	1	0	0	0	1	0	2	2	4
Non-groupable (NG)	0	1	2	1	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	1	0
No organism detected	3	8	2	2	2	5	0	3	4	2	0	4	5	1	2	0
Total	76	58	75	43	43	44	37	48	31	24	21	21	20	30	19	26

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	18	-79.1%
Q3	53	53	51	42	31	37	41	34	31	15	14	8	13	7	16	20	-62.3%
Q4	76	58	75	43	43	44	37	48	31	24	21	21	20	30	19	26	-65.8%
Total	330	253	237	198	203	209	179	168	147	114	94	66	81	82	74	87	-73.6%

Appendix 3. IMD Cases by HSE Area in Quarter 4, 2001-2016

HSE Area	Q4-2001	Q4-2002	Q4-2003	Q4-2004	Q4-2005	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016	Q4-2016 CIR*
E	27	15	29	16	12	11	16	12	11	13	10	4	5	12	3	7	0.43
M	6	3	5	1	3	1	5	2	1	1	3	0	3	4	3	2	0.71
MW	7	12	6	4	3	7	4	2	2	2	3	2	2	0	2	1	0.26
NE	5	6	4	3	7	5	4	5	3	0	0	0	1	6	3	3	0.68
NW	6	3	2	6	3	3	0	2	4	2	3	0	0	0	1	2	0.77
SE	4	5	6	4	2	8	3	9	3	3	0	9	5	1	2	4	0.80
S	14	11	16	7	8	8	3	11	3	3	1	2	3	2	3	6	0.90
W	7	3	7	2	5	1	2	5	4	0	1	4	1	5	2	1	0.22
Total	76	58	75	43	43	44	37	48	31	24	21	21	20	30	19	26	0.57

* CIR, crude incidence rate per 100,000

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

Age Group (Yrs)	Q4-2001	Q4-2002	Q4-2003	Q4-2004	Q4-2005	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016	Q4-2016 CIR*
<1	23	13	19	9	10	11	6	9	8	6	7	5	5	10	3	4	5.52
1-4	17	18	25	21	12	8	11	21	9	8	7	9	6	9	3	5	1.76
5-9	11	7	7	3	4	0	7	1	3	1	2	1	3	2	3	0	0.00
10-14	7	4	1	1	3	4	2	3	1	1	2	1	0	2	1	2	0.66
15-19	9	7	12	6	7	10	3	6	4	5	1	3	2	1	3	6	2.12
20-24	2	1	6	2	2	3	3	5	2	0	0	0	0	1	0	1	0.34
25-34	3	1	2	0	1	1	4	2	1	1	0	2	0	2	0	1	0.13
35-44	0	1	0	1	1	0	0	0	2	0	0	0	2	1	3	2	0.29
45-54	0	1	2	0	0	3	0	1	0	0	2	0	0	0	0	2	0.35
55-64	0	3	1	0	2	2	0	0	0	0	0	0	1	0	2	0	0.00
65+	4	2	0	0	0	2	1	0	1	2	0	0	1	2	1	3	0.56
Total	76	58	75	43	42	44	37	48	31	24	21	21	20	30	19	26	0.57

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 4, 2001-2016

Serogroup	Q4-2001	Q4-2002	Q4-2003	Q4-2004	Q4-2005	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016
B	2	2	3	1	0	0	1	1	2	0	0	0	0	2	0	1
C	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
W135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Total	3	2	3	1	0	0	1	1	2	0	0	0	0	3	0	2
%CFR* (Total)	3.9	3.4	4.0	2.3	0.0	0.0	2.7	2.1	6.5	0.0	0.0	0.0	0.0	10.0	0.0	7.7

* %CFR, case fatality ratio

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 4, 2006-2016 (excluding IMD and Haemophilus influenzae)

	Causative organism	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016	Q4:2006-2016
Specified	<i>Leptospira</i> spp.	1	0	0	0	1	1	0	0	0	0	0	3
	<i>Listeria</i> spp.	0	0	1	0	0	0	1	1	0	1	0	4
	<i>Mycobacterium tuberculosis</i> #	2	1	1	4	1	1	1	0	0	0	0	11
	<i>Streptococcus pneumoniae</i>	n/a	n/a	5	9	4	5	9	11	14	6	8	71
	<i>Streptococcus agalactiae</i> *	na	na	na	na	na	na	4	1	0	1	0	6
	<i>Streptococcus pyogenes</i>	0	0	0	0	1	0	0	0	0	1	0	2
	<i>Salmonella</i> spp	0	0	0	1	0	0	0	0	0	0	0	1
Not specified	<i>Enterococcus species</i>	0	0	0	0	0	0	0	0	1	0	0	1
	<i>Escherichia coli</i>	1	0	6	2	2	0	2	3	3	6	1	26
	Group C Streptococcus	0	0	0	0	0	0	1	0	0	0	0	1
	<i>Klebsiella oxytoca</i>	0	0	0	0	0	1	0	0	0	0	0	1
	<i>Mycoplasma pneumoniae</i>	0	0	0	0	1	0	0	0	0	0	0	1
	<i>Proteus mirabilis</i>	0	1	0	0	0	0	0	0	0	0	0	1
	<i>Serratia liquefaciens</i>	0	0	1	0	0	0	0	0	0	0	0	1
	<i>Staphylococcus aureus</i>	0	0	1	0	1	1	0	0	0	0	0	3
	<i>Streptococcus agalactiae</i> †	0	4	2	1	4	2	0	1	1	0	0	15
	Unknown/Not specified	6	5	9	5	5	4	5	6	2	4	4	55
Total	10	11	26	22	20	15	23	23	21	19	13	203	

#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 notifiablen/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 4 2006-2016

Causative Organism	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016
enterovirus	32	7	21	11	30	51	24	87	59	46	30
human herpes virus type 6	0	0	0	3	3	13	3	6	5	9	0
varicella & varicella zoster virus	1	0	2	2	1	1	3	0	4	1	2
herpes simplex virus types 1 or 2	0	2	3	1	3	3	0	3	4	0	2
parechovirus	0	0	0	0	0	0	0	0	12	0	4
echovirus types, 6, 9, 13, 30 or 33	0	0	0	0	0	1	0	0	0	2	0
coxsackievirus A, B or B4	0	0	0	0	0	0	0	0	0	0	0
adenovirus	0	0	0	0	0	0	1	0	0	0	0
not specified	2	4	7	5	7	4	2	4	7	2	4
Total	35	13	33	22	44	73	33	100	91	60	42
% enterovirus	91.4%	53.8%	63.6%	50.0%	68.2%	69.9%	72.7%	87.0%	64.8%	76.7%	71.4%
% known organism	94.3%	69.2%	78.8%	77.3%	84.1%	94.5%	93.9%	96.0%	92.3%	96.7%	90.5%

Appendix 8. *H. influenzae* Cases by Type in Quarter 4, 2006-2016

Type	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016
b	4	2	2	0	1	1	0	0	0	0	1
e	0	1	0	0	0	0	0	0	0	0	0
f	0	0	1	0	0	1	1	1	2	0	1
not type-b	0	0	0	1	0	1	0	0	2	0	0
non-typeable/non-capsulated	4	3	2	5	5	7	9	6	8	6	10
not typed*	0	0	1	2	0	0	0	0	4	2	2
Total	8	6	6	8	6	10	10	7	16	8	14

*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	15	+25.0%
Q3	3	5	2	4	3	7	10	9	15	8	11	+266.7%
Q4	8	6	6	8	6	10	10	7	16	8	14	+75.0%
Total	38	31	22	43	28	44	41	41	61	52	58	+52.6%
<i>Meningitis</i>	4	2	3	3	2	4	3	2	7	5	1	-
<i>Type b meningitis</i>	3	1	1	0	1	0	1	0	0	0	0	-

Appendix 10. *H. influenzae* Cases by HSE Area in Quarter 4, 2006-2016

HSE Area	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016	Q4-2016 CIR*
E	3	1	4	1	2	3	6	4	5	6	2	0.12
M	0	1	0	0	0	0	0	1	1	0	1	0.35
MW	0	2	0	2	1	1	1	0	3	1	3	0.79
NE	0	0	0	1	1	1	0	1	0	0	2	0.45
NW	2	0	0	0	0	1	0	0	1	0	1	0.39
SE	1	1	0	1	1	1	2	0	3	0	2	0.40
S	1	0	1	0	1	1	1	1	2	1	1	0.15
W	1	1	1	3	0	2	0	0	1	0	2	0.45
Total	8	6	6	8	6	10	10	7	16	8	14	0.31

* CIR, crude incidence rate per 100,000

Appendix 11. *H. influenzae* Cases by Age Group in Quarter 4, 2006-2016

Age Grp (Yrs)	Q4-2006	Q4-2007	Q4-2008	Q4-2009	Q4-2010	Q4-2011	Q4-2012	Q4-2013	Q4-2014	Q4-2015	Q4-2016	Q4-2016 CIR*
<1	2	1	3	2	0	1	0	1	2	0	1	1.38
1-4	1	3	0	0	1	1	1	0	3	1	0	0.00
5-9	1	0	1	1	0	1	1	0	0	1	0	0.00
10-14	0	0	0	1	1	0	0	0	1	0	0	0.00
15-19	0	0	0	0	0	0	2	0	1	0	1	0.35
20-24	1	0	0	0	0	0	0	0	0	0	0	0.00
25-34	0	2	0	1	0	0	0	1	1	1	0	0.00
35-44	1	0	0	0	0	1	1	0	2	1	2	0.29
45-54	0	0	0	0	2	0	0	0	1	1	1	0.17
55-64	1	0	1	1	0	1	2	3	2	0	1	0.22
65+	1	0	1	2	2	5	3	2	3	3	8	1.49
Total	8	6	6	8	6	10	10	7	16	8	14	0.31

* CIR, crude incidence rate per 100,000