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 LABORATORYAND THE NATIONAL VIRUS REFERENCE LABORATORY

Q1-2017 **13th June 2017**

Provisional Figures

Summary

- 27 invasive meningococcal disease cases (IMD) were notified in Q1-2017, including 13 serotype B, 12 serotype C, and two serogroup W135. Of the 12 serogroup C cases, six were unvaccinated (aged <6 months to <95 years), five had an unknown vaccination status (aged 40 to <80 years) and one was a vaccine failure (aged 15-19 years). Four IMD cases were also reported to have died (aged <5 to <95 years), all of which were attributable to a serogroup C infection. Two home-based co-primary serogroup B cases aged <10 years were reported in HSE S. No imported cases were identified during this quarter.

- Nine cases of invasive *Streptococcus pneumoniae* infections presenting as meningitis were notified. Other meningitis-related infections reported included two cases of *Streptococcus agalactiae* (aged <1 month), one case of *Streptococcus pyogenes* (aged 5-9 years) and one case of *Listeria monocytogenes* (aged 80-84 years). Six cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were also notified (aged <1 month to <60 years), including four with *Escherichia coli* identified as the causative organism.

- 53 cases of viral meningitis NOS, were reported, 35 of which were enterovirus (four Coxsackievirus B3, three Echovirus 5 (E-3), one E-6, two E-11, three E-18, three E-25, six E-30 and 13 not specified). Other causative organisms identified were five human herpes virus type 6, three herpes simplex virus, two varicella/herpes zoster virus, one parechovirus, and seven with no pathogen identified.

- 20 cases of *Haemophilus influenzae* were reported, one of which (a non-typeable/non-capsular infection) was associated with meningitis. Ten of the cases were non-typeable, three were type f, one was a type d and six were not typed. One death occurred (aged 60-64 years) with a type f infection, but the actual cause of death was reported as unknown at the time or 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 < 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 and 13 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 **13h June 2017**. **These figures are provisional.** Incidence rates for 2017 were calculated using the 2011 Census of Population as denominator data.

Results

Meningococcal Disease (invasive) (IMD)

IMD Cases by Serogroup & Case Classification

In Q1-2017, 27 cases of IMD were notified, all of which were confirmed. Thirteen were attributable to serogroup B, 12 to serogroup C and two to serogroup W135 (Table 1). Details of the number of doses of the meningococcal C conjugate vaccine received, age group and outcome of the 12 serogroup C cases are presented in Table 2. In Q1-2017 serogroup B disease accounted for 48.1% (n=13/27; 95%CI 29.3%-67.0%) of all IMD notifications (Figure 1, Appendix 1).

Table 1. Classification of IMD cases notified by Serogroup in Q1-2017

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	13	12	2	0	0	0	0	27
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	**13**	**12**	**2**	**0**	**0**	**0**	**0**	**27**

Table 2. Details of 12 MenC cases notified in Q1-2017 including age group, outcome and age at vaccination

Case. No.	Age Group	Outcome	No. MenC doses given	Age at Vaccination
1	<1	Recovering	Unvaccinated	.
2	1-4	Died	Unvaccinated	.
3	15-19	Recovering	Complete	1-2 years
4	20-24	Died	Unvaccinated	.
5	40-44	Recovering	Unvaccinated	.
6	40-44	Died	Unknown	.
7	45-49	Still ill	Unknown	.
8	55-59	Recovering	Unvaccinated	.
9	70-74	Not known	Unknown	.
10	70-74	Not known	Unknown	.
11	75-79	Recovered	Unknown	.
12	85+	Died	Unvaccinated	.

IMD Trends & Outbreaks

The number of IMD cases reported in Q1-2017 (n=27) was greater than 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 16.0 and for serogroup C it was 3.7 (Figure 1; Appendix 1). First quarterly IMD cases have fallen by 67.1% since 2002 (Appendix 2). Also since 2002, Q1 serogroup B cases have also declined by 79.4%, but serogroup C cases have increased by 71.4%, notably in the current quarter (Appendix 1). In Q1-2017, 12 serogroup C cases were reported, compared to 11 such cases in all first quarters combined over the previous three years. Two home-based co-primary serogroup B cases aged <10 years were reported in HSE S.in Q1-2017.

All meningococcal confirmed cases reported on CIDR in Q1-2017 were also included in the electronic listing of laboratory tested *N. meningitidis* isolates/specimens provided to the HPSC on June 14th 2017 by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).

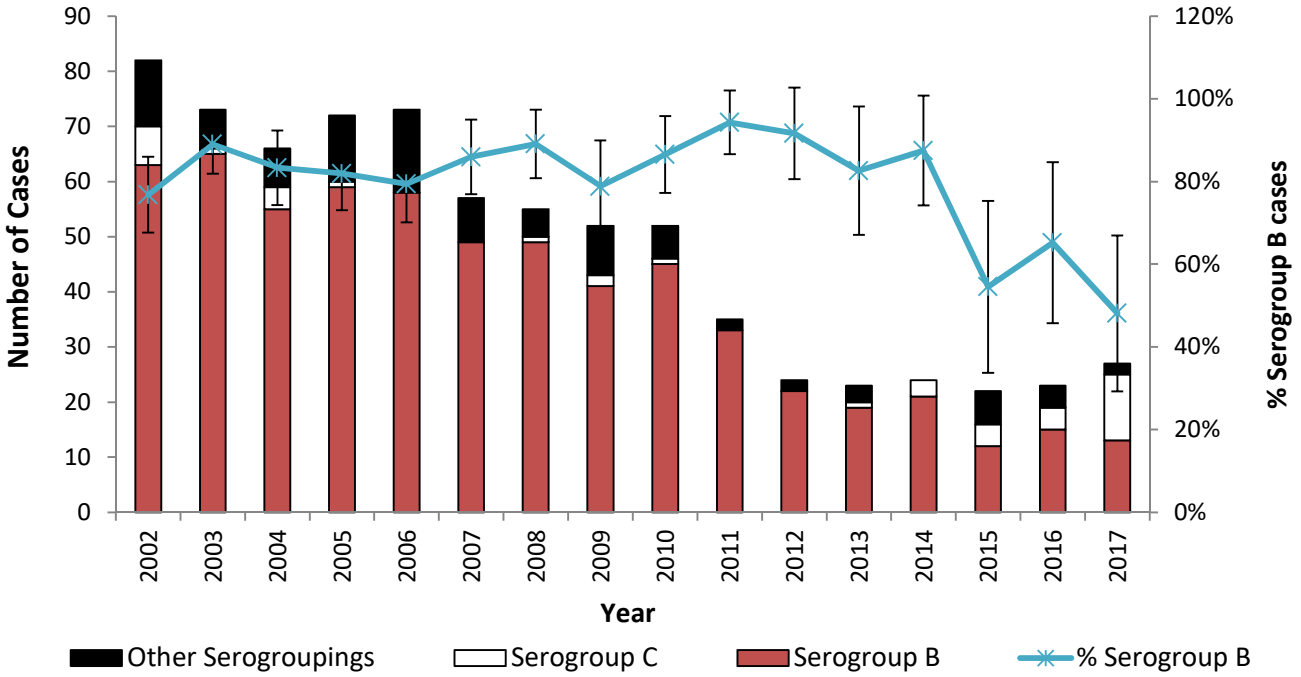

Figure 1. Number of IMD cases notified in Ireland by serogroup in Q1 of each year between 2002 and 2017 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q1-2017 was 0.59 cases per 100,000 population, ranging from the lowest (0.19/100,000) in HSE E to the highest (1.57/100,000) in HSE W (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group and in Q1-2017 the incidence rate in this age group was 6.9 cases per 100,000 population, followed by 1.8 cases/100,000 in the 1-4 year age group (Appendix 4).

IMD associated deaths

Four IMD related deaths were reported in Q1-2017, all attributable to a serogroup C infection (aged <5 to <95 years). This compares to two deaths during Q1-2016, neither of which were associated with serogroup C (Appendix 5).

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q1-2017, nine cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was >10 and <75 years (Appendix 6). No IPD meningitis-related deaths were reported in this quarter. Eight patients had a risk factor recorded. Details of the vaccination status, age group, risk factor and serotype of these nine 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 Q1-2017

Case. No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	10-14	No	Unvaccinated	Not specified	Not specified
2	30-34	Yes	Unvaccinated	Not specified	Not specified
3	40-44	Yes	Vaccinated (1 dose)	Vaccinated (2 doses)	Not specified
4	45-49	Yes	Unvaccinated	Unknown	Not specified
5	45-49	Yes	Unvaccinated	Unvaccinated	12F
6	55-59	Yes	Unvaccinated	Unvaccinated	Not specified
7	55-59	Yes	Unvaccinated	Unvaccinated	12F
8	65-69	Yes	Unvaccinated	Vaccinated (1 dose)	Not specified
9	70-74	Yes	Unvaccinated	Not specified	Not specified

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*)

Two cases of meningitis-related *Streptococcus agalactiae* (aged <1 month) and one CSF PCR positive case with this infection (also aged <1 month) were reported in this quarter; the latter case however, was not labelled as having clinical meningitis or any other clinical description. Other meningitis related infections reported during this time include one case of *Streptococcus pyogenes* (aged 5-9 years) and one case of *Listeria monocytogenes* (aged 80-84 years).

Bacterial meningitis (not otherwise specified)

Six cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q1-2017. These included four that were case classified as confirmed and two others as probable. All of the confirmed cases had *Escherichia coli* identified as the causative organism. The age range for all six cases was <1 month to <60 years (Appendix 6).

Viral Meningitis (Specified and Not Otherwise Specified)

Fifty-three viral meningitis notifications (NOS) (aged <1 month to <80 years; median 7.5 years) were reported in Q1-2017 (Figure 2), 46 of which (86.8%) had their causative organism identified: 35 enterovirus (aged<1 month to <70 years, median 12.2 years); five human herpes virus type 6 (HHV 6) (all aged <=18 months); three herpes simplex virus (two type 1 aged 70-79 years and one type 2 aged 25-29 years); two varicella/herpes zoster virus (aged >15 to <75 years); one parechovirus (aged 1 month); and seven with no pathogen identified (aged <1 month to <55 years).

All enterovirus typing records in Q1-2017 provided by the NVRL provided to the HPSC on the 16th June were matched to CIDR event ID numbers at the time of writing.

In Q1-2017, the highest frequency of cases occurred in children <1 year of age (n=22/53; 41.5%) and in adults aged 15-39 years (n=18/53; 33.9%) (Figure 2). Of the 22 cases <1 year of age reported in this quarter, 15 (68.2%) were attributable to enterovirus, three to HHV 6 (13.6%), one (4.5%) to parechovirus and three (13.6%) with no pathogen identified. Caution is recommended regarding the detection of HHV 6 DNA in cerebral spinal fluid (CSF) specimens, especially in those aged less than three months (of which there was one case in Q1-2017), 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 not caused by enterovirus by year and by quarter since 2007. The average Q1 percentage of all viral meningitis NOS cases attributable to enterovirus since 2010 to date has been 56.1%. Details of enterovirus serotypes by age group in Q1-2017 are presented in Table 4 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

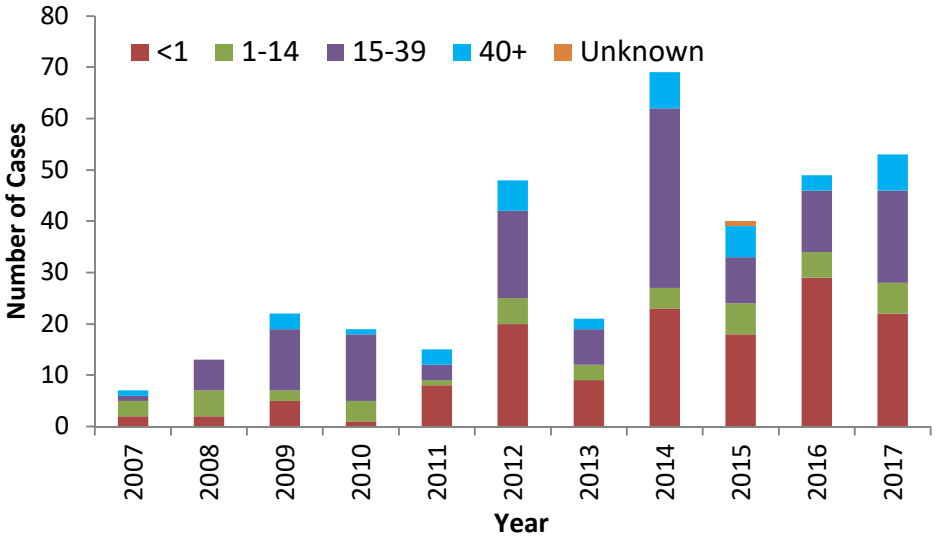

Figure 2. Quarter 1 number of viral meningitis (NOS) cases in Ireland by age group (years), 2007-2017

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q1-2017, 20 cases of invasive *H. influenzae* (all case classified as confirmed) were notified (Figure 5): ten of the cases were non-typeable, three were type f, one was a type d and six were not typed (of which two were diagnosed by PCR only). This total compares to an average of 18.3 cases for the same quarter in 2014 to 2016 (Table 5, Appendices 8, 9). Of all the Q1 cases reported between 2015 and 2017, 28.8% (n=17/59) had no clinical diagnosis reported (Table 6). There were no imported cases during this quarter.

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).in Temple Street Children's Hospital to the HPSC on June 14th 2017, all classified confirmed *H. influenzae* events on CIDR in Q1-2017 were included on it.

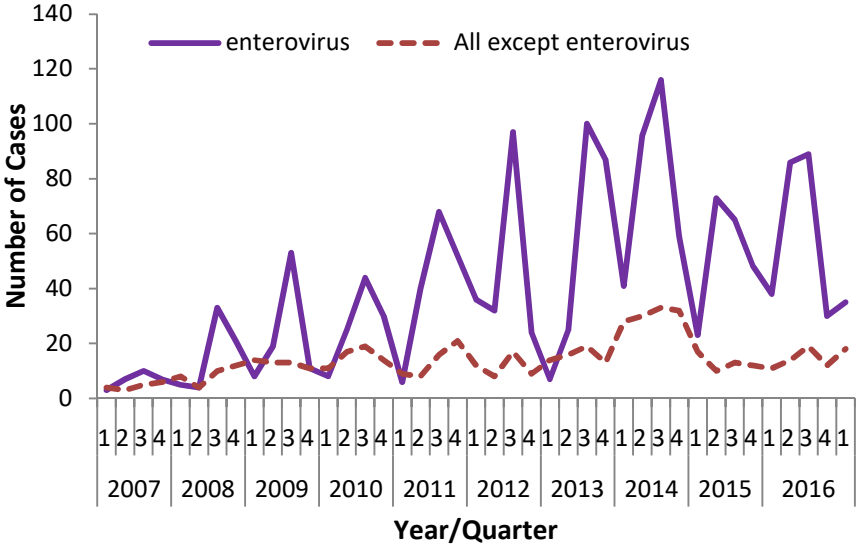

Figure 3. Number of viral meningitis (NOS) cases caused by enterovirus and not by enterovirus by quarter and year, 2007-2017

Table 4. Enterovirus genotypes by age group (years) reported by NVRL in Q1-2017
(Enterovirus genotyping targets the VP1 gene of the virus)

		Age Group (Years)					
Enterovirus Group	**Genotype**	**<1**	**1-14**	**15-39**	**40+**	**Unknown**	**Total**
Enterovirus A	-	0	0	0	0	0	0
Enterovirus B	Coxsackievirus B3	2	0	2	0	0	4
	Echovirus 5	3	0	0	0	0	3
	Echovirus 6	1	0	0	0	0	1
	Echovirus 11	1	0	1	0	0	2
	Echovirus 18	2	0	1	0	0	3
	Echovirus 25	2	0	1	0	0	3
	Echovirus 30	1	0	5	0	0	6
Enterovirus C	-	0	0	0	0	0	0
Enterovirus D	-	0	0	0	0	0	0
Not specified	Not specified	3	3	5	2	0	13
Total		**15**	**3**	**15**	**2**	**0**	**35**

H. influenzae associated deaths

One death occurred among the 20 *H. influenzae* cases reported during this quarter. The patient was aged between 60 and 64 years with septicaemia, had a type f infection, but the actual cause of death was unknown at the time or writing.

H. influenzae meningitis

One meningitis-related *H. influenzae* cases were reported in Q1-2017 (Table 7, Appendix 9). The case was aged 50-54 years old with an infection that was not typed (a PCR only diagnosis).

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. No Hib cases were reported in Q1-2017.The last reported TVF however was in Q4-2010, the only one in more than nine years between Q3-2007 and Q1-2017: 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 4, 5). 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 Q1-2017 the number of non-typeable cases reported was ten (aged <2 years to <75 years), slightly more than the 9.3 average in the same quarter between 2014 and 2016 (Figure 6).

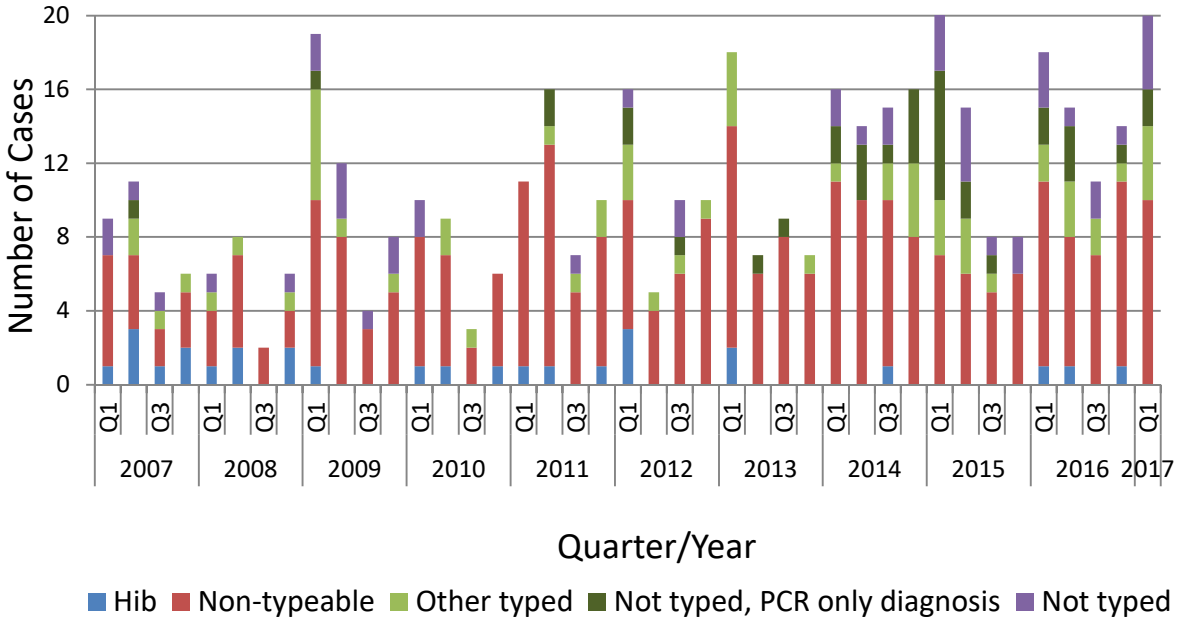

Figure 4. Quarterly number of *H. influenzae* cases by type since 2007

Table 5. Number of *H. influenzae* cases notified in the first quarter of 2015, 2016 and 2017

Number of cases	Q1-2015	Q1-2016	Q1-2017
All *H. influenzae*	21	18	20
All *H. influenzae* <5yrs	12	4	4
All *H. influenzae* ≥65yrs	5	5	4
H. influenzae type b	0	1	0
H. influenzae type b <5yrs	0	1	0
H. influenzae type b >=65yrs	0	0	0
H. influenzae non-typeable	7	10	10
H. influenzae non-typeable <5yrs	2	2	1
H. influenzae non-typeable ≥65yrs	3	2	3

Table 6. Number of *H. influenzae* cases by clinical diagnosis notified in the first quarter of 2015, 2016 and 2017

Number of cases	Q1-2015	Q1-2016	Q1-2017	Total	Total (%)
Septicaemia	6	6	4	16	27.1%
Bacteraemia (without focus)	4	0	2	6	10.2%
Pneumonia	3	1	2	6	10.2%
Meningitis	2	0	1	3	5.1%
Meningitis & septicaemia and/or other	2	0	0	2	3.4%
Other	1	4	1	6	10.2%
Cellulitis	1	1	0	2	3.4%
Epiglottitis	0	0	0	0	0.0%
Osteomyelitis	0	0	0	0	0.0%
Septic arthritis	0	0	1	1	1.7%
Clinical diagnosis not reported	2	6	9	17	28.8%
Total	**21**	**18**	**20**	**59**	**100%**

Table 7. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q1-2017

Number of cases	Typed (b, e, f, d or not-b)	Non-typeable	Not typed*	Total
Septicaemia	2	2	0	**4**
Bacteraemia (without focus)	1	1	0	**2**
Pneumonia	0	1	1	**2**
Meningitis	0	0	1	**1**
Meningitis & septicaemia and/or other	0	0	0	**0**
Other	0	1	0	**1**
Cellulitis	0	0	0	**0**
Epiglottitis	0	0	0	**0**
Osteomyelitis	0	0	0	**0**
Septic arthritis	0	0	1	**1**
Clinical diagnosis not reported	1	5	3	**9**
Total	**4**	**10**	**6**	**20**

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

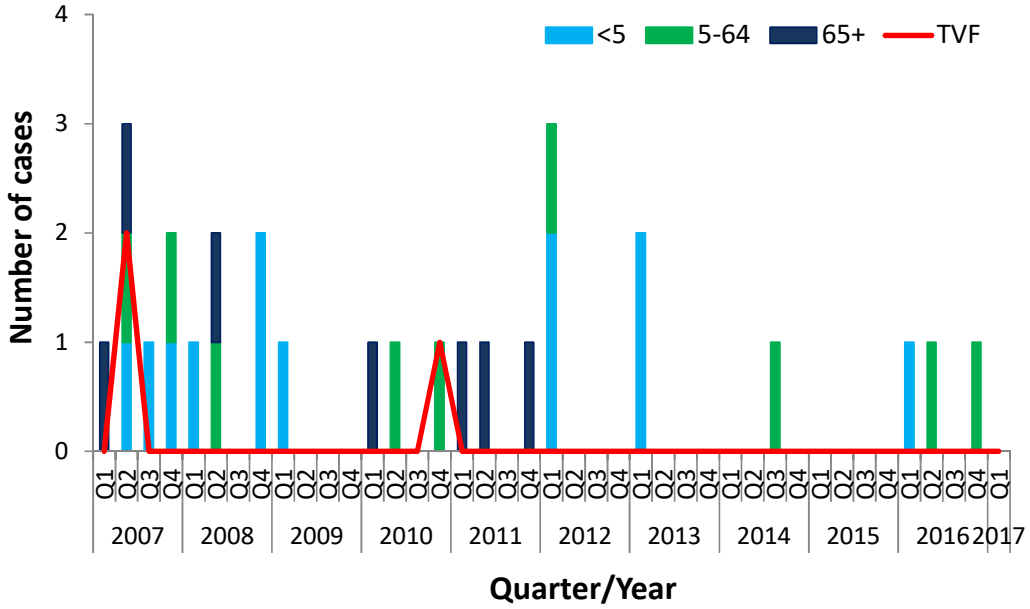

Figure 5 Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2007

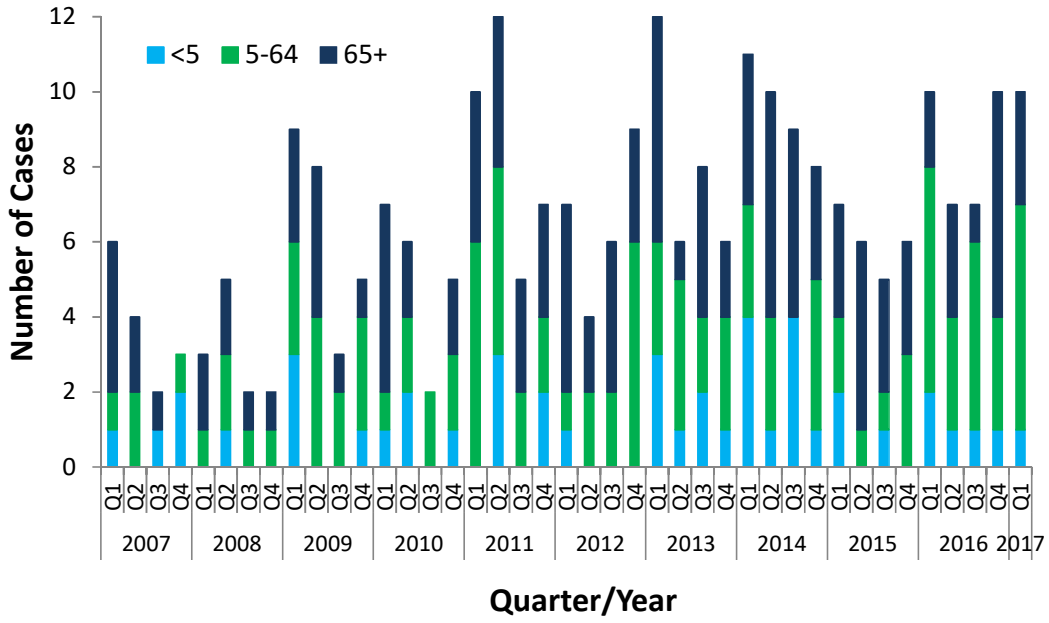

Figure 6. Quarterly number of non-typeable/non-capsulated cases by age group, since 2007

Acknowledgements

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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 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 1, 2002-2017

Serogroup	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	Q1-2017
B	63	65	55	59	58	49	49	41	45	33	22	19	21	12	15	13
C	7	1	4	1	0	0	1	2	1	0	0	1	3	4	4	12
W135	2	2	0	1	0	1	1	2	0	0	0	2	0	2	1	2
Y	0	1	0	1	2	0	0	2	0	1	1	1	0	2	0	0
Non-groupable (NG)	0	1	0	2	1	0	0	0	0	0	0	0	0	0	1	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	10	3	7	8	12	7	4	5	6	1	1	0	0	2	2	0
Total	**82**	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**

Appendix 2. IMD Cases by Quarter, 2002-2017

Qr	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2002-2017 change
Q1	82	73	66	72	73	57	55	52	52	35	24	23	24	22	23	27	-67.1%
Q2	60	38	47	57	55	44	31	33	23	24	13	25	21	17	18	-	-
Q3	53	51	42	31	37	41	34	31	15	14	8	13	7	16	20	-	-
Q4	58	75	43	43	44	37	48	31	24	21	21	20	30	19	26	-	-
Total	**253**	**237**	**198**	**203**	**209**	**179**	**168**	**147**	**114**	**94**	**66**	**81**	**82**	**74**	**87**	**-**	**-**

Appendix 3. IMD Cases by HSE Area in Quarter 1, 2002-2017

HSE Area	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	Q1-2017	Q1-2017 CIR*
E	26	23	21	25	33	14	12	13	20	7	8	10	5	4	3	3	0.19
M	6	10	5	5	4	4	3	3	1	5	2	1	2	2	1	1	0.35
MW	6	6	3	7	5	6	6	5	8	3	3	2	1	0	2	3	0.79
NE	10	6	9	6	4	4	11	9	4	5	5	3	5	1	1	3	0.68
NW	3	1	5	4	4	6	2	1	6	4	1	2	3	3	6	1	0.39
SE	8	10	5	10	9	10	11	8	9	5	1	1	3	3	2	3	0.60
S	17	14	11	9	11	6	9	11	3	4	2	2	1	5	5	6	0.90
W	6	3	7	6	3	7	1	2	1	2	2	2	4	4	3	7	1.57
Total	**82**	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**	**0.59**

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 1, 2002-2017

Age Group (Yrs)	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	Q1-2017	Q1-2017 CIR*
<1	23	18	14	19	18	16	12	12	12	11	9	4	5	4	6	5	6.91
1-4	27	23	21	32	26	20	18	15	22	9	4	7	8	8	3	5	1.76
5-9	7	6	8	4	8	1	8	4	4	6	4	3	2	2	2	1	0.31
10-14	6	8	5	2	3	5	4	3	2	1	1	1	0	0	3	2	0.66
15-19	8	7	6	6	10	6	4	7	6	2	1	3	3	5	5	2	0.71
20-24	4	0	5	3	2	2	4	4	1	1	0	1	2	1	2	1	0.34
25-34	2	6	1	0	0	3	0	2	2	2	0	0	0	0	0	0	0.00
35-44	1	0	1	1	3	1	0	0	0	1	1	1	1	1	0	3	0.43
45-54	0	0	1	2	2	0	1	2	0	2	3	0	1	0	0	1	0.17
55-64	2	3	2	3	0	1	2	0	1	0	0	2	0	0	0	2	0.43
65+	2	2	2	0	1	2	2	3	2	0	1	1	2	1	2	5	0.93
Total	**82**	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**	**0.59**

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 1, 2002-2017

Serogroup	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	Q1-2017
B	1	3	4	4	2	2	3	3	2	1	1	1	1	0	1	0
C	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	4
W135	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Y	0	0	0	0	0	0	0	0	0	0	1	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	1	0
Total	**1**	**3**	**5**	**4**	**2**	**2**	**5**	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**2**	**4**
%CFR* (Total)	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	14.8

* %CFR, case fatality ratio

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 1, 2007-2017 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1:2007-2017
Specified	*Leptospira* spp.	1	0	0	0	0	0	0	0	0	0	0	**1**
	Listeria spp.	2	1	0	0	1	0	1	0	2	2	1	**10**
	Mycobacterium tuberculosis#	1	2	1	3	0	2	1	0	0	0	0	**10**
	Streptococcus pneumoniae	n/a	10	7	4	8	10	7	13	11	13	9	**92**
	*Streptococcus agalactiae**	na	na	na	na	na	3	2	3	2	0	2	**12**
	Streptococcus pyogenes	0	1	0	1	0	0	2	0	2	0	1	**7**
	Salmonella spp	0	0	0	0	0	0	0	0	0	0	0	**0**
Not specified	*Escherichia coli*	0	0	1	0	0	0	0	1	2	1	4	**9**
	Staphylococcus aureus	0	0	0	2	0	0	0	0	0	0	0	**2**
	Streptococcus agalactiae†	2	3	2	2	4	0	0	0	0	0	0	**13**
	Streptococcus bovis biotype II/2	0	0	1	0	0	0	0	0	0	0	0	**1**
	Unknown/Not specified	6	1	6	8	2	4	2	1	2	2	2	**36**
	Total	**12**	**18**	**18**	**20**	**15**	**19**	**15**	**18**	**21**	**18**	**19**	**193**

#TB meningitis figures for 2015, 2016 and 2017 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, 2007-2017

Causative Organism	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017
enterovirus group A	0	0	0	0	0	0	0	0	0	0	0
enterovirus group B	0	0	0	0	0	1	0	0	0	0	22
enterovirus group C	0	0	0	0	0	0	0	0	0	0	0
enterovirus group D	0	0	0	0	0	0	0	0	0	0	0
enterovirus group not specified	3	5	8	8	6	35	7	41	23	38	13
human herpes virus type 6	0	0	0	1	3	4	6	11	4	9	5
varicella & varicella zoster virus	1	1	1	3	0	0	0	9	6	1	2
herpes simplex virus*	1	3	2	1	2	3	3	4	2	1	3
parechovirus	0	0	0	0	0	0	0	0	4	0	1
adenovirus	0	0	0	0	0	0	0	0	0	0	0
not specified	2	4	11	6	4	5	5	4	1	0	7
Total	**7**	**13**	**22**	**19**	**15**	**48**	**21**	**69**	**40**	**49**	**53**
% known organism	71.4	69.2	50.0	68.4	73.3	89.6	76.2	94.2	97.5	100.0	86.8

*includes types 1 and 2

Appendix 8. *H. influenzae* Cases by Type in Quarter 1, 2007-2017

Type	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017
b	1	1	1	1	1	3	2	0	0	1	0
d	0	0	0	0	0	0	0	0	0	0	1
e	0	0	3	0	0	0	1	0	0	0	0
f	0	1	3	0	0	3	2	1	1	2	3
not type-b	0	0	0	0	0	0	1	0	2	0	0
non-typeable/non-capsulated	6	3	9	7	10	7	12	11	7	10	10
not typed*	**2**	**1**	**3**	**2**	**0**	**3**	**0**	**4**	**11**	**5**	**6**
Total	**9**	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**

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

Appendix 9. *H. influenzae* Cases by Quarter, 2007-2017

Qr	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2007-2017 change
Q1	9	6	19	10	11	16	18	16	21	18	20	+122.2%
Q2	11	8	12	9	16	5	7	14	15	15	-	-
Q3	5	2	4	3	7	10	9	15	8	11	-	-
Q4	6	6	8	6	10	10	7	16	8	14	-	-
Total	**31**	**22**	**43**	**28**	**44**	**41**	**41**	**61**	**52**	**58**	**-**	**-**
Meningitis	2	3	3	2	4	3	2	7	6	1	-	-
Type b meningitis	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	-

Appendix 10. *H. influenzae* Cases by HSE Area in Quarter 1, 2007-2017

HSE Area	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2017 CIR*
E	6	1	9	4	3	7	5	5	8	7	7	0.43
M	0	2	1	0	2	0	2	1	0	0	4	1.42
MW	0	0	4	0	0	1	1	2	2	1	3	0.79
NE	0	0	0	0	2	3	2	3	3	2	1	0.23
NW	1	0	0	0	1	1	2	0	1	1	1	0.39
SE	1	2	1	3	1	1	2	2	4	0	0	0.00
S	0	1	2	3	1	3	2	2	2	3	1	0.15
W	1	0	2	0	1	0	2	1	1	4	3	0.67
Total	**9**	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**	**0.44**

* CIR, crude incidence rate per 100,000

Appendix 11. *H. influenzae* Cases by Age Group in Quarter 1, 2007-2017

Age Grp (Yrs)	Q1-2007	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2017 CIR*
<1	1	0	2	0	0	3	2	3	8	2	3	4.14
1-4	1	2	4	1	0	1	3	3	4	2	1	0.35
5-9	0	0	3	0	1	2	1	1	1	1	1	0.31
10-14	0	0	1	0	0	0	0	0	0	1	1	0.33
15-19	0	0	0	0	0	0	0	0	1	0	1	0.35
20-24	1	0	0	0	0	1	0	0	0	1	0	0.00
25-34	0	0	1	2	0	0	2	1	1	4	0	0.00
35-44	1	0	1	0	3	0	0	0	1	1	1	0.14
45-54	0	0	0	0	1	1	0	1	0	1	6	1.04
55-64	0	1	1	0	1	2	2	1	0	0	2	0.43
65+	5	3	6	7	5	6	8	6	5	5	4	0.75
Total	**9**	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**	**0.44**

* CIR, crude incidence rate per 100,000