

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



Q2-2017

27th September 2017

Provisional Figures

Summary

- 20 invasive meningococcal disease cases (IMD) were notified in Q2-2017, including eight serotype B, nine serotype C and three serogroup W135. Of the nine serogroup C cases, six were unvaccinated (aged <1 year to <95 years), one had an unknown vaccination status (aged 50-54 years), one was an incomplete vaccine failure (aged 1-4 years, two doses received, second dose received less than 10 days prior to onset) and one was a complete vaccine failure (10-14 years, three doses received, too young to receive adolescent booster dose). No IMD cases were reported to have died in this quarter. Three imported cases were identified, one serogroup B and two serogroup C (one unvaccinated and one complete vaccine failure).
- Eight cases of invasive *Streptococcus pneumoniae* infections presenting as meningitis were notified. Other meningitis-related infections reported included one case each of meningitis-related *Streptococcus agalactiae* (aged 2 months) and listeriosis (aged 50-54 years). Eight cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were also notified (aged <1 month to <60 years), six of which had their causative organism identified: five had *Escherichia coli* and one had *Streptococcus constellatus*, the latter being a cause of death.
- 82 cases of viral meningitis NOS, were reported, 70 (85.3%) of which were enterovirus (six enterovirus group A, 51 enterovirus group B and 13 not specified). Other causative organisms identified were six human herpes virus type 6, four varicella/herpes zoster virus, one herpes simplex virus and one with no pathogen identified.
- 12 cases of *Haemophilus influenzae* were reported, none of which was associated with meningitis. Nine of the cases were non-typeable, two were type f and one was a type e. No deaths were reported during this quarter, nor were there any imported cases.

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 report were extracted from CIDR on **27th September 2017**. **These figures are provisional**. Incidence rates for 2017 were calculated using the **2016** Census of Population as denominator data.

Results

Meningococcal Disease (invasive) (IMD)

IMD Cases by Serogroup & Case Classification

In Q2-2017, 20 cases of IMD were notified, all but one were confirmed. Eight were serogroup B, nine serogroup C and three serogroup W135 (Table 1). This quarter represents the first time that the number of MenC cases has exceeded that of MenB cases since Q1-2009. Details of the number of doses of the meningococcal C conjugate vaccine received, age group and outcome of the nine serogroup C cases are presented in Table 2. In Q2-2017 serogroup B disease accounted for 40% (n=8/20; 95%CI 12.2-55.2%) of all IMD notifications (Figure 1, Appendix 1).

Table 1. Classification of IMD cases notified by Serogroup in Q2-2017

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	7	9	3	0	0	0	0	19
Probable	0	0	0	0	0	0	0	0
Possible	1*	0	0	0	0	0	0	1
Not specified	0	0	0	0	0	0	0	0
Total	8	9	3	0	0	0	0	20

*Meningococcal conjunctivitis

Table 2. Details of the MenC cases notified in Q2-2017 including age group, outcome and age at vaccination

Case No.	Age Grp	Outcome	Vaccination Status	No. MenC doses given	Age at (Last) Vaccination
1	<1	Recovering	Unvaccinated	0	.
2	1-4	Still ill	Incomplete*	2	1-2 years
3	10-14	Recovered	Complete**	3	<1 year
4	15-19	Recovering	Unvaccinated	0	.
5	50-54	Not Specified	Not specified	.	.
6	65-69	Still ill	Unvaccinated	0	.
7	80-84	Not Specified	Unvaccinated	0	.
8	85+	Recovering	Unvaccinated	0	.
9	85+	Recovering	Unvaccinated	0	.

*Second dose received less than 10 days prior to onset

**Too young to have received the adolescent booster dose

IMD Trends & Outbreaks

The number of IMD cases reported in Q2-2017 (n=20) was greater than the average number reported in the same quarter over the previous three years (average=18.7 95%CI 16.2-21.1); for serogroup B the average was 12.3 and for serogroup C it was 3.0 (Figure 1; Appendix 1). Second quarterly IMD cases have fallen by 66.7% since 2002 (Appendix 2). Also since 2002, Q2 serogroup B cases have also declined by 83.0%, but serogroup C cases have increased by 125.0%, notably in the current quarter (Appendix 1). In Q2-2017, nine serogroup C cases were reported, compared to eight such cases in all second quarters combined over the previous three years.

All but one meningococcal confirmed case was reported on CIDR in Q2-2017 that were also included in the electronic listing of laboratory tested *N. meningitidis* isolates/specimens provided to the HPSC on August 22nd 2017 by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).

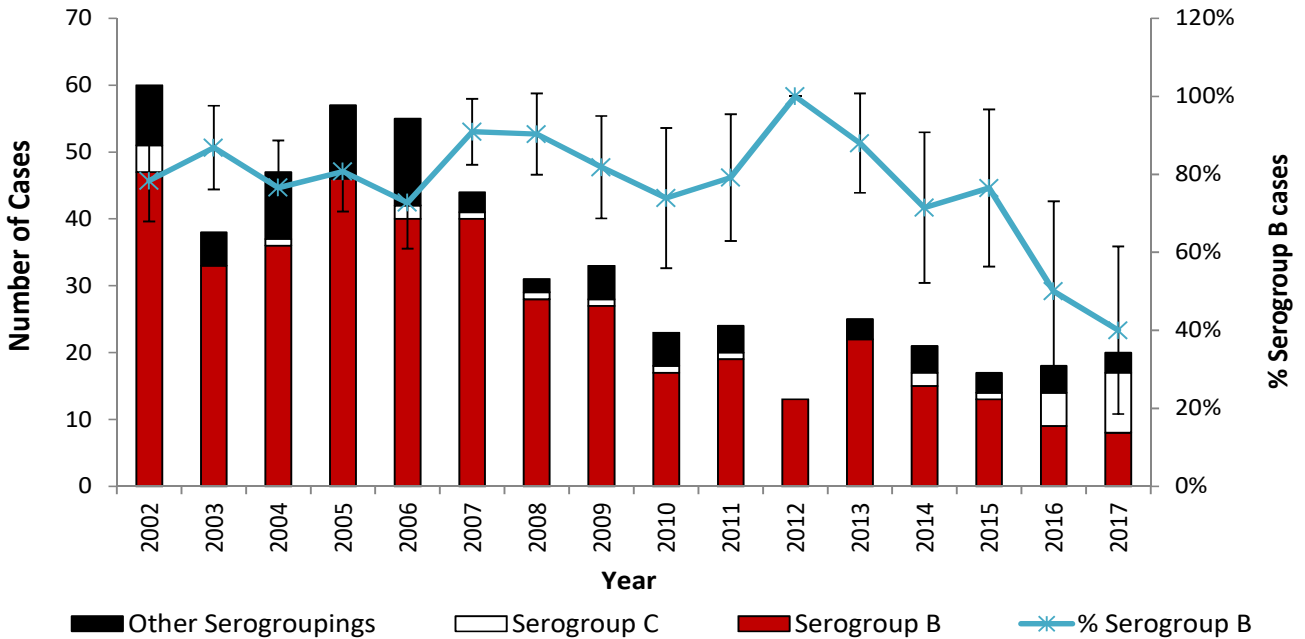


Figure 1. Number of IMD cases notified in Ireland by serogroup in Q2 of each year between 2002 and 2017 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

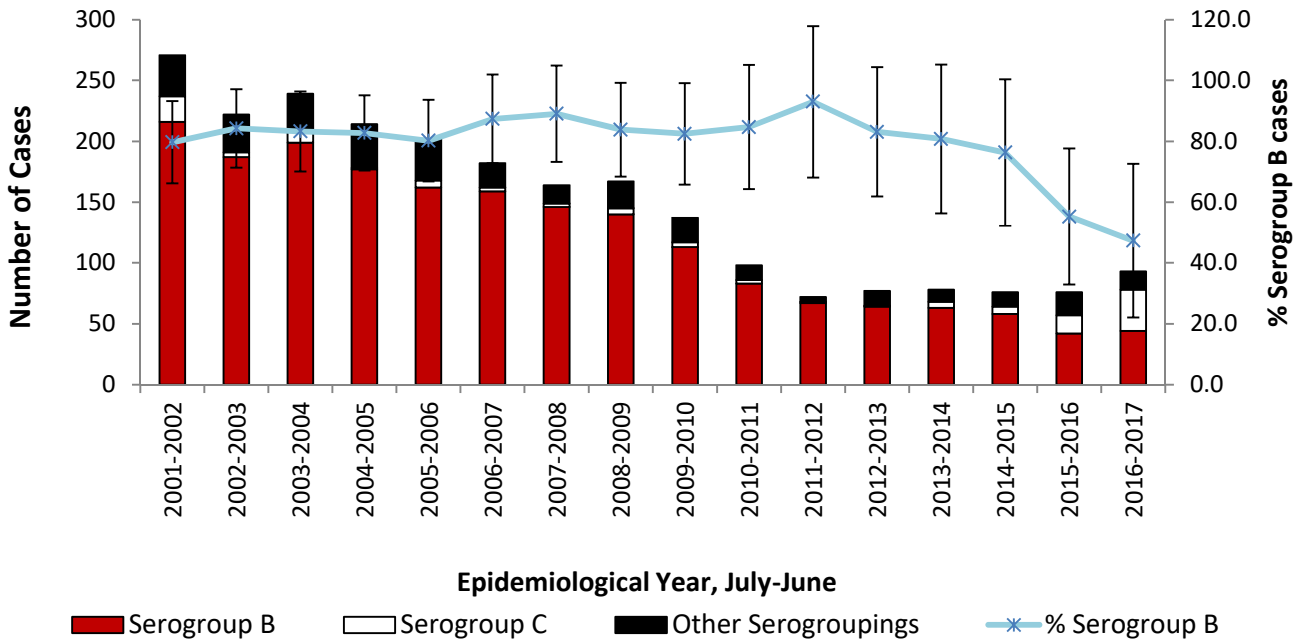


Figure 2. Number of IMD cases notified in Ireland by serogroup and by epidemiological year, 2001-2002 to 2016-2017, with percentage of cases attributable to serogroup B with 95% confidence intervals

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q2-2017 was 0.42 cases per 100,000 population, ranging from the lowest (0.0/100,000) in HSE NW and W to the highest (1.30/100,000) in HSE MW (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group and in Q2-2017 the incidence rate in this age group was 6.4 cases per 100,000 population, followed by 1.5 cases/100,000 in the 1-4 year age group (Appendix 4).

IMD associated deaths

No IMD related deaths were reported in Q2-2017 (Appendix 5). This compares to one each in during Q2-2016 and Q2-2005.

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q2-2017, eight cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was <1 and 85+ years (Appendix 6). One IPD meningitis-related death was reported in this quarter: an unvaccinated 85+ year old, in whom the infection was the cause of death. Six patients had a risk factor recorded. Details of the vaccination status, age group, risk factor and serotype of 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 Q2-2017

Case. No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	<1	No	Vaccinated (1 dose)	Unvaccinated	.
2	10-14	No	Unvaccinated	Unvaccinated	.
3	35-39	Yes	Unvaccinated	Not specified	.
4	40-44	Yes	Unvaccinated	Unvaccinated	12A
5	45-49	Yes	Unvaccinated	Unvaccinated	12F
6	60-64	Yes	Unvaccinated	Not specified	.
7	60-64	Yes	Unvaccinated	Unvaccinated	12F
8*	85+	Yes	Unvaccinated	Vaccinated (1 dose)	.

*Died from 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*)

One case each of meningitis-related *Streptococcus agalactiae* (aged 2 months) and listeriosis (*L. monocytogenes* serotype 1/2a) (aged 50-54 years) were reported in this quarter.

Bacterial meningitis (not otherwise specified)

Eight cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q2-2017. These included six that were case classified as confirmed, one as probable and one as possible. Of the eight cases, six had their causative organism identified: five with *Escherichia coli* (age range (1 week to 3 months) and one with *Streptococcus constellatus* (aged 55-59 years and who died from this infection) (Appendix 6).

Viral Meningitis (Specified and Not Otherwise Specified)

Eighty-two viral meningitis notifications (NOS) (aged 1 week to <60 years; median 1.3 years) were reported in Q2-2017 (Figure 3), all but one had their causative organism identified: 70 enterovirus (aged 1 week to <45 years; median 0.5 years); six human herpes virus type 6 (HHV 6) (aged 2 weeks to 22 months); four varicella/herpes zoster virus (aged 10 to <60 years); one herpes simplex virus (type 2 aged 40-44 years); and one with no pathogen identified (aged 10 to 14 years).

All but 12 enterovirus typing records in Q2-2017 provided by the NVRL (Figure 6) provided to the HPSC on the October 5th 2017 were matched to CIDR event ID numbers at the time of writing.

In Q2-2017, the highest frequency of cases occurred in children <1 year of age (n=41/82; 50.0%) and in adults aged 15-39 years (n=31/82; 37.8%) (Figures 3, 4). Of the 41 cases <1 year of age reported in this quarter, 36 (87.8%) were attributable to enterovirus and five to HHV 6 (12.2%). 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 were three in Q2-2017), 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 5 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 Q2 percentage of all viral meningitis NOS cases attributable to enterovirus since 2010 to date has been 77.4%. Details of enterovirus serotypes by age group in Q2-2017 are presented in Table 4 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q2-2017, 12 cases of invasive *H. influenzae* (all case classified as confirmed) were notified (Figure 6): nine of the cases were non-typeable, two were type f and one was type e. This total compares to an average of 14.7 cases for the same quarter in 2014 to 2016 (Table 5, Appendices 8, 9). Of all the Q2 cases reported between 2015 and 2017, 23.8% (n=10/42) 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 August 22nd 2017, all classified confirmed *H. influenzae* events on CIDR in Q2-2017 were included on it.

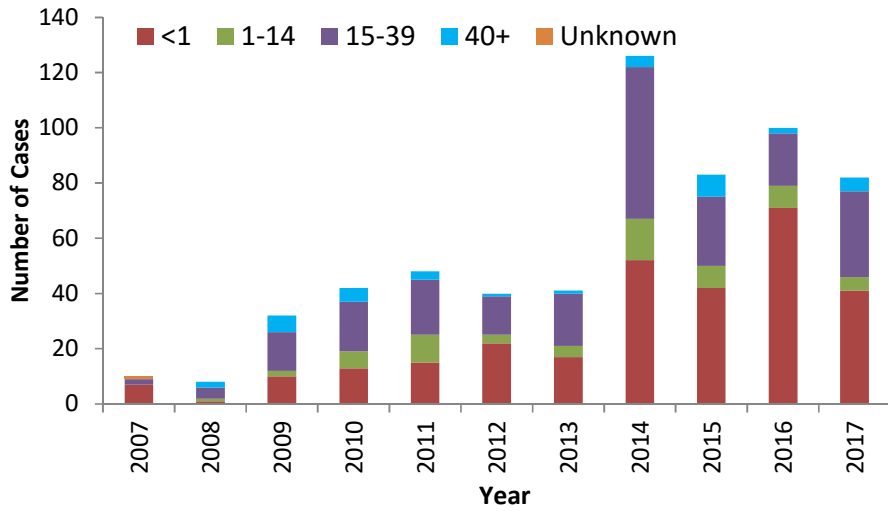


Figure 3. Quarter 2 number of viral meningitis (NOS) cases in Ireland by age group (years), 2007-2017

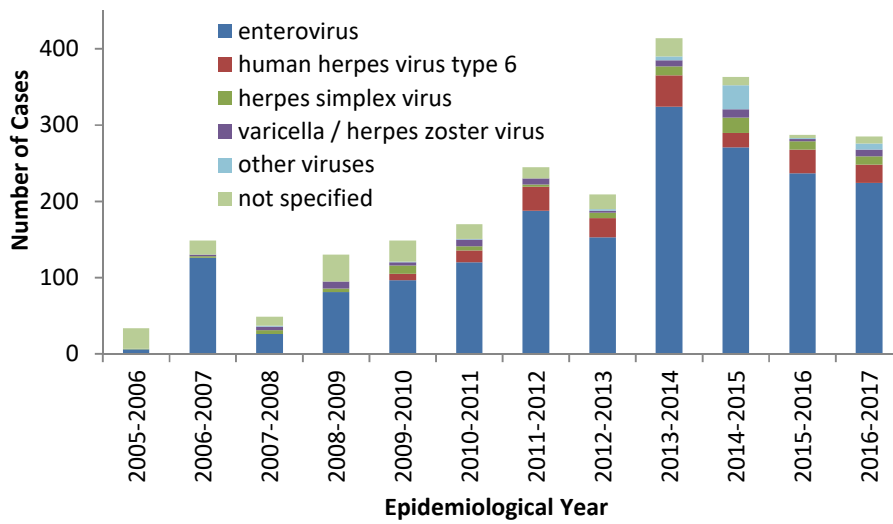


Figure 4. Number of viral meningitis (NOS) cases in Ireland by causative pathogen and by epidemiological year (2005-2006 to 2016-2017)

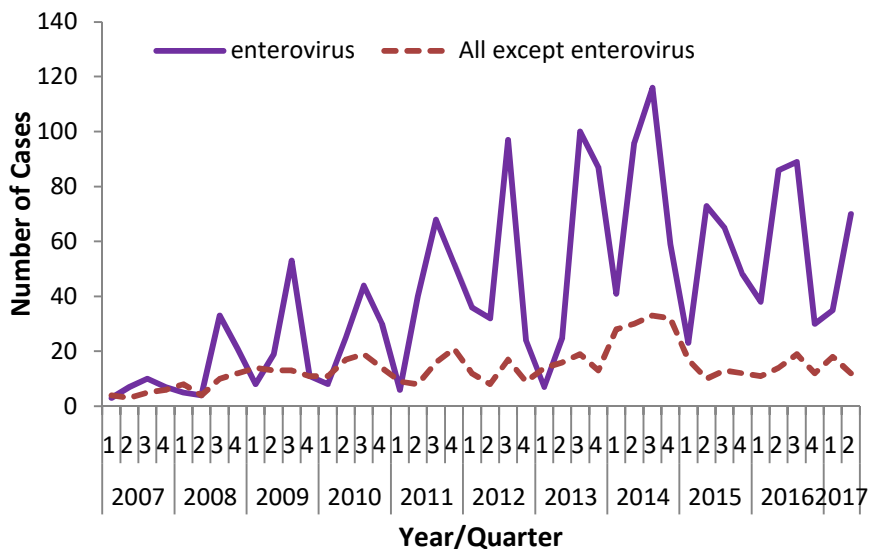


Figure 5. Number of viral meningitis (NOS) cases caused by enterovirus and not by enterovirus by quarter and year, 2007-2017

Table 4. Enterovirus genotypes by age group (years) on CIDR in Q2-2017
(Enterovirus genotyping targets the VP1 gene of the virus)

Genus	Group	Type	Age Group (years)					Total	
			<1	1-14	15-39	40+	Unknown		
	Enterovirus A	Enterovirus 71 C1	3	0	0	0	0	3	
		Enterovirus 71 C2	2	0	0	0	0	2	
		Coxsackievirus A4	1	0	0	0	0	1	
	Enterovirus B	Echovirus 5	4	0	4	1	0	9	
		Echovirus 6	0	0	1	0	0	1	
		Echovirus 7	0	0	1	0	0	1	
		Echovirus 11	5	0	0	0	0	5	
		Echovirus 15	0	0	1	0	0	1	
		Echovirus 18	6	0	1	0	0	7	
		Echovirus 25	3	1	1	0	0	5	
		Echovirus 30	2	0	13	1	0	16	
		Coxsackievirus A9	0	0	1	0	0	1	
		Coxsackievirus B3	2	0	0	0	0	2	
	Coxsackievirus B5	2	0	1	0	0	3		
	Enterovirus C		0	0	0	0	0	0	
	Enterovirus D		0	0	0	0	0	0	
	Not specified	Unable to generate sequence for this sample	0	0	1	0	0	1	
		Not specified	6	1	4	1	0	12	
	Total			36	2	29	3	0	70

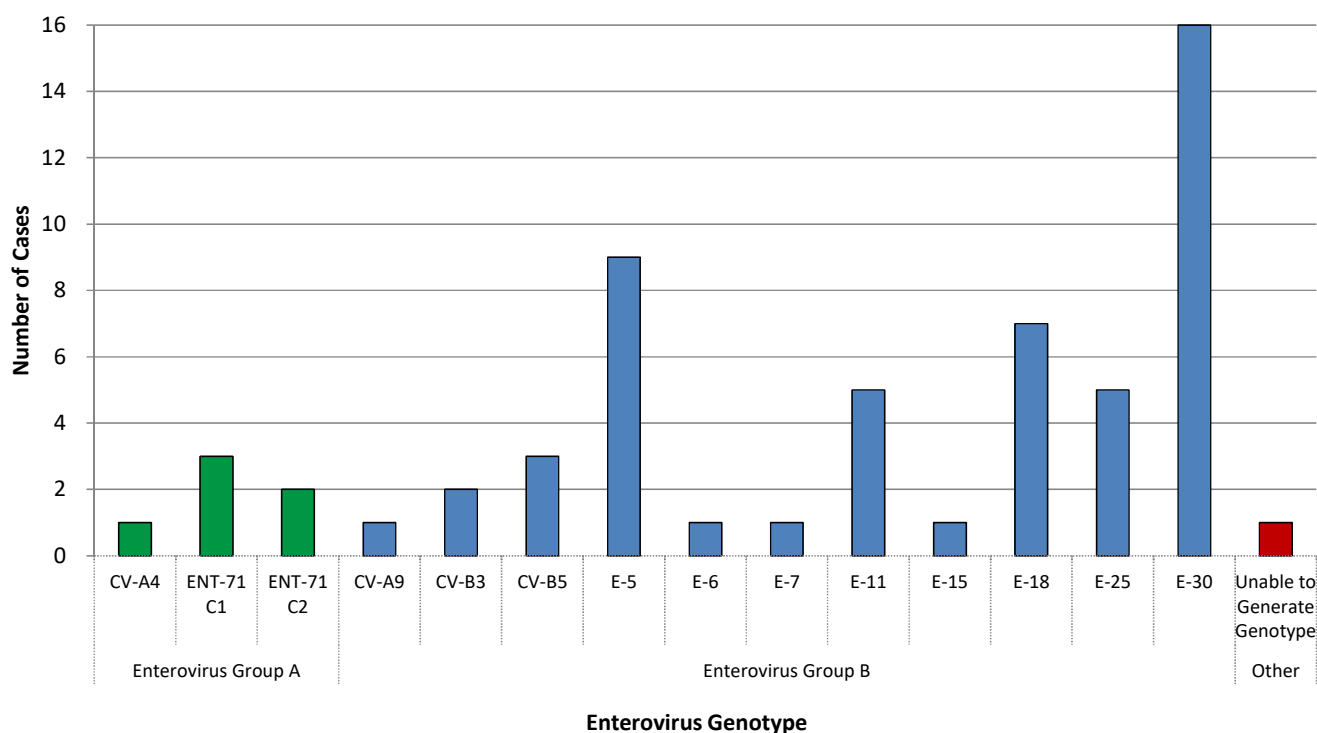


Figure 6. Breakdown of enterovirus genotypes reported by NVRL in Q2-2017

H. influenzae associated deaths

No deaths occurred among the 12 *H. influenzae* cases reported during this quarter.

H. influenzae meningitis

No meningitis-related *H. influenzae* cases were reported in Q2-2017 (Table 7).

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 Q2-2017. The last reported TVF however was in Q4-2010, the only one in ten years between Q3-2007 and Q2-2017: 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 7, 8, 9). 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 Q2-2017 the number of non-typeable cases reported was nine (aged <2 years to >90 years), more than the 7.7 average in the same quarter between 2014 and 2016 (Figure 10).

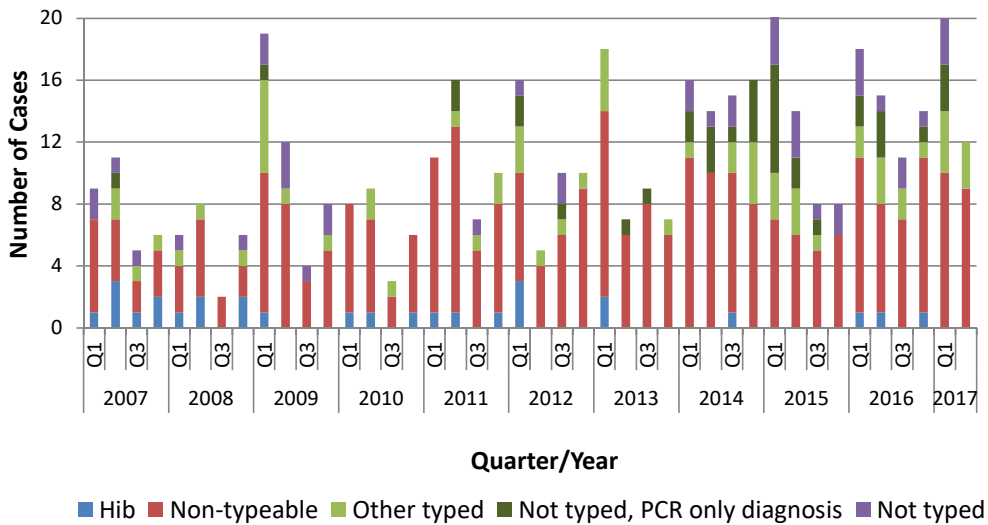


Figure 7. Quarterly number of *H. influenzae* cases by type since 2007

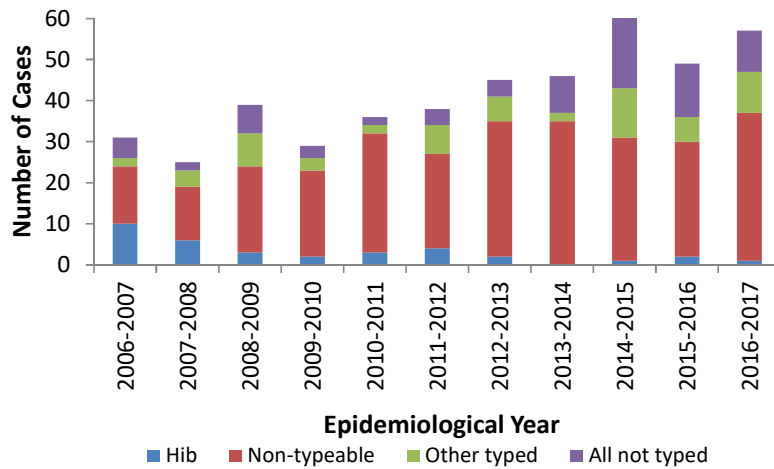


Figure 8. Number of *H. influenzae* cases by type and by epidemiological year (2006-2007 to 2016-2017)

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

Number of cases	Q2-2015	Q2-2016	Q2-2017
All <i>H. influenzae</i>	15	15	12
All <i>H. influenzae</i> <5yrs	5	5	2
All <i>H. influenzae</i> ≥65yrs	6	4	5
<i>H. influenzae</i> type b	0	1	0
<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	6	7	9
<i>H. influenzae</i> non-typeable <5yrs	0	1	1
<i>H. influenzae</i> non-typeable ≥65yrs	5	3	4

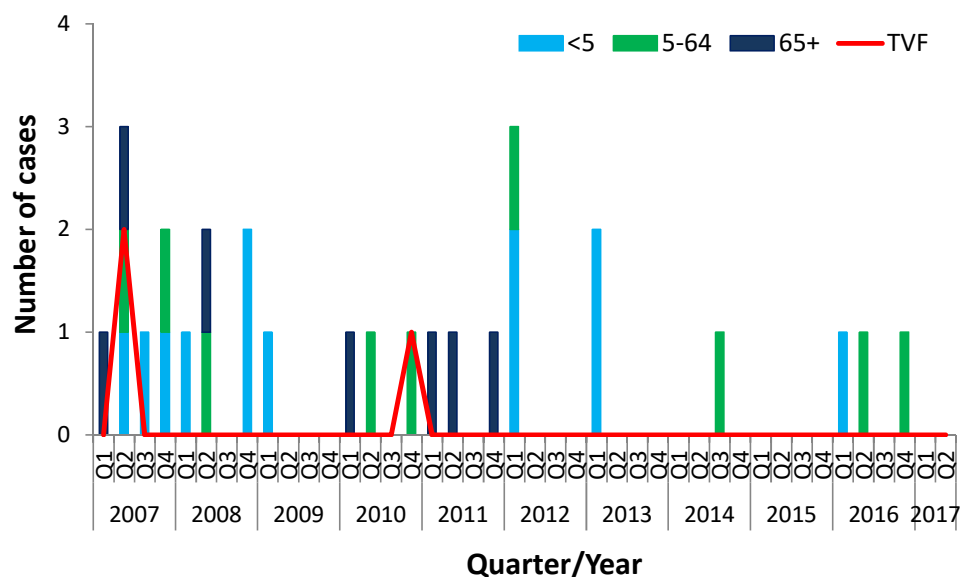
Table 6. Number of *H. influenzae* cases by clinical diagnosis notified in the second quarter of 2015, 2016 and 2017

Number of cases	Q2-2015	Q2-2016	Q2-2017	Total	Total (%)
Septicaemia	3	2	3	8	19.0%
Bacteraemia (without focus)	2	4	0	6	14.3%
Pneumonia	3	3	5	11	26.2%
Meningitis	1	0	0	1	2.4%
Meningitis & septicaemia and/or other	0	0	0	0	0.0%
Other	1	3	1	5	11.9%
Cellulitis	0	0	0	0	0.0%
Epiglottitis	1	0	0	1	2.4%
Osteomyelitis	0	0	0	0	0.0%
Septic arthritis	0	0	0	0	0.0%
Clinical diagnosis not reported	4	3	3	10	23.8%
Total	15	15	12	42	100%

Table 7. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q2-2017

Number of cases	Typed (b, d, 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	0	5
Meningitis	0	0	0	0
Meningitis & septicaemia and/or other	0	0	0	0
Other	1	0	0	1
Cellulitis	0	0	0	0
Epiglottitis	0	0	0	0
Osteomyelitis	0	0	0	0
Septic arthritis	0	0	0	0
Clinical diagnosis not reported	1	2	0	3
Total	3	9	0	12

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

**Figure 9.** Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2007

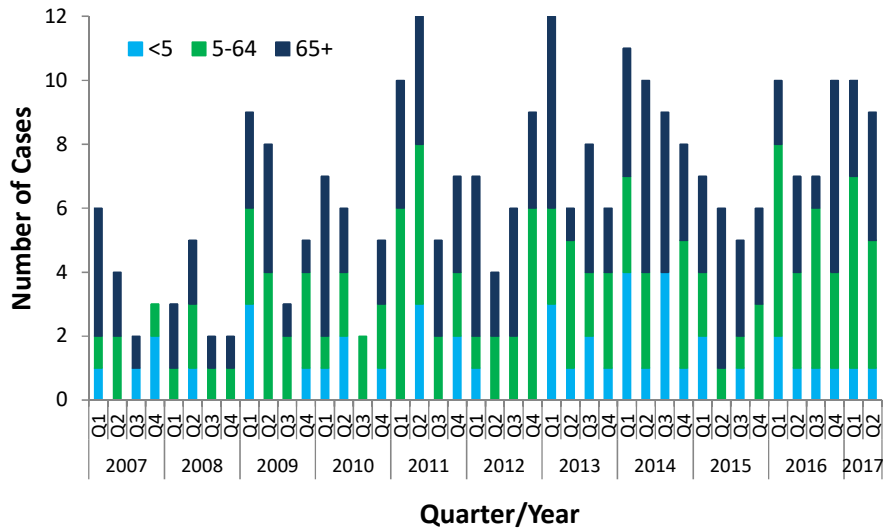


Figure 10. Quarterly number of non-typeable/non-capsulated cases by age group, since 2007

Acknowledgements

- HPSC wishes to thank all who provided data for this report: Departments of Public Health, the Irish Meningitis & Sepsis Reference Laboratory (IMSRL) 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 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 2, 2002-2017

Serogroup	Q2-2002	Q2-2003	Q2-2004	Q2-2005	Q2-2006	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017
B	47	33	36	46	40	40	28	27	17	19	13	22	15	13	9	8
C	4	0	1	0	2	1	1	1	1	1	0	0	2	1	5	9
W135	2	0	0	2	1	0	0	0	0	1	0	0	1	2	3	3
Y	1	0	1	2	1	0	0	2	0	0	0	1	1	0	0	0
Non-groupable (NG)	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	6	4	9	7	11	3	2	3	5	3	0	2	1	1	1	0
Total	60	38	47	57	55	44	31	33	23	24	13	25	21	17	18	20

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	20	-66.7%
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 2, 2002-2017

HSE Area	Q2-2002	Q2-2003	Q2-2004	Q2-2005	Q2-2006	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2017 CIR*
E	25	10	13	11	19	17	6	10	6	9	4	10	6	6	4	4	0.23
M	5	2	4	11	7	0	4	2	2	0	0	2	3	1	3	3	1.03
MW	4	7	4	5	7	3	3	6	0	3	1	1	0	6	1	5	1.30
NE	4	5	2	3	5	7	5	3	5	3	4	2	2	0	2	2	0.43
NW	3	4	3	1	3	4	2	0	2	1	0	1	1	0	3	0	0.00
SE	8	7	9	7	2	2	3	4	3	4	2	4	3	1	1	3	0.43
S	8	3	10	14	7	6	6	6	5	3	1	3	4	2	3	3	0.59
W	3	0	2	5	5	5	2	2	0	1	1	2	2	1	1	0	0.00
Total	60	38	47	57	55	44	31	33	23	24	13	25	21	17	18	20	0.42

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 2, 2002-2017

Age Group (Yrs)	Q2-2002	Q2-2003	Q2-2004	Q2-2005	Q2-2006	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2017 CIR*
<1	11	10	13	13	9	13	10	10	8	8	2	10	4	1	2	4	6.42
1-4	22	15	20	20	25	16	10	9	8	7	7	7	7	4	6	4	1.49
5-9	11	4	3	5	6	2	2	1	2	1	0	2	2	2	1	0	0.00
10-14	7	2	2	6	4	2	0	1	1	0	0	1	1	2	1	1	0.31
15-19	4	2	6	5	4	6	2	5	1	3	2	2	2	1	1	3	0.99
20-24	2	1	1	2	1	0	2	2	0	0	0	1	0	1	1	1	0.37
25-34	2	1	1	2	3	2	2	0	0	2	0	0	2	1	1	0	0.00
35-44	0	2	0	0	1	1	2	1	0	0	0	0	1	3	0	0	0.00
45-54	1	1	1	0	1	2	0	0	0	0	0	1	1	0	1	3	0.48
55-64	0	0	0	1	0	0	1	0	2	1	0	0	0	0	2	0	0.00
65+	0	0	0	3	1	0	0	4	1	2	2	1	1	2	2	4	0.63
Total	60	38	47	57	55	44	31	33	23	24	13	25	21	17	18	20	0.42

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 2, 2002-2017

Serogroup	Q2-2002	Q2-2003	Q2-2004	Q2-2005	Q2-2006	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017
B	3	1	1	0	1	2	1	0	1	0	0	2	0	1	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Y	0	0	0	1	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	1	0	0	1	0	0	0	0	0	0	0
Total	3	1	1	1	1	3	1	0	2	0	0	2	0	1	1	0
%CFR* (Total)	5.0	2.6	2.1	1.8	1.8	6.8	3.2	0.0	8.7	0.0	0.0	8.0	0.0	5.9	5.6	0.0

* %CFR, case fatality ratio

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 2, 2007-2017 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2:2007-2017
Specified	<i>Leptospira</i> spp.	0	0	0	0	0	0	0	0	0	0	0	0
	<i>Listeria</i> spp.	0	1	0	1	1	0	0	0	3	0	1	7
	<i>Mycobacterium tuberculosis</i> #	3	1	0	2	2	3	3	1	2	0	0	17
	<i>Streptococcus pneumoniae</i>	n/a	9	3	4	6	11	10	8	9	12	8	80
	<i>Streptococcus agalactiae</i> *	na	na	na	na	na	0	0	2	1	1	0	4
	<i>Streptococcus pyogenes</i>	0	1	0	0	0	1	1	0	0	0	1	4
	<i>Salmonella</i> spp	0	0	0	0	0	0	0	0	0	0	0	0
Not specified	<i>Escherichia coli</i>	0	2	0	0	1	1	1	0	3	1	5	14
	<i>Micrococcus luteus</i>	0	0	0	0	0	0	0	1	0	0	0	1
	<i>Pasteurella multocida</i>	0	0	0	0	0	0	0	0	1	0	0	1
	<i>Staphylococcus aureus</i>	0	2	1	3	0	0	0	0	0	0	0	6
	<i>Streptococcus agalactiae</i> †	2	0	3	2	3	0	0	0	0	0	0	10
	<i>Streptococcus bovis</i> biotype II/2	0	0	1	0	0	0	0	0	0	0	0	1
	<i>Streptococcus constellatus</i>	0	0	0	0	0	0	0	0	0	0	1	1
	Unknown/Not specified	7	0	5	6	5	5	1	5	5	2	2	43
Total	12	16	13	18	18	21	16	17	24	16	18	189	

#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 2, 2007-2017

Causative Organism	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017
enterovirus group A	0	0	0	0	0	0	0	0	0	0	6
enterovirus group B	0	1	0	0	0	0	0	0	0	1	51
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	7	3	19	25	40	32	25	96	73	85	13
human herpes virus type 6	0	0	0	2	4	6	8	11	2	10	6
varicella & varicella zoster virus	0	3	0	5	1	0	1	2	6	3	4
herpes simplex virus*	1	0	2	1	2	0	0	1	1	0	1
parechovirus	0	0	0	0	0	0	0	5	0	0	0
adenovirus	0	0	0	0	0	0	0	0	0	0	0
not specified	2	1	11	9	1	2	7	11	1	1	1
Total	10	8	32	42	48	40	41	126	83	100	82
% known organism	80.0	87.5	65.6	78.6	97.9	95.0	82.9	91.3	98.8	99.0	98.8

*includes types 1 and 2

Appendix 8. *H. influenzae* Cases by Type in Quarter 2, 2007-2017

Type	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017
b	3	2	0	1	1	0	0	0	0	1	0
d	0	0	0	0	0	0	0	0	0	0	0
e	0	0	1	0	1	0	0	0	0	0	1
f	2	1	0	2	0	1	0	0	1	2	2
not type-b	0	0	0	0	0	0	0	0	2	1	0
non-typeable/non-capsulated	4	5	8	6	12	4	6	10	6	7	9
not typed*	2	0	3	0	2	0	1	4	6	4	0
Total	11	8	12	9	16	5	7	14	15	15	12

*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	12	+9.1%
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	-	-
<i>Meningitis</i>	2	3	3	2	4	3	2	7	5	1	-	-
<i>Type b meningitis</i>	1	1	0	1	0	1	0	0	0	0	-	-

Appendix 10. *H. influenzae* Cases by HSE Area in Quarter 2, 2007-2017

HSE Area	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2017 CIR*
E	4	3	1	2	8	0	0	4	8	8	5	0.29
M	0	0	1	1	1	0	1	3	1	2	0	0.00
MW	0	2	2	0	0	0	2	1	1	1	3	0.78
NE	0	0	0	1	3	1	2	1	1	1	0	0.00
NW	0	0	1	1	0	0	0	0	0	1	0	0.00
SE	3	1	2	1	2	3	0	3	0	2	2	0.29
S	1	1	5	3	0	0	2	1	2	0	2	0.39
W	3	1	0	0	2	1	0	1	2	0	0	0.00
Total	11	8	12	9	16	5	7	14	15	15	12	0.25

* CIR, crude incidence rate per 100,000

Appendix 11. *H. influenzae* Cases by Age Group in Quarter 2, 2007-2017

Age Grp (Yrs)	Q2-2007	Q2-2008	Q2-2009	Q2-2010	Q2-2011	Q2-2012	Q2-2013	Q2-2014	Q2-2015	Q2-2016	Q2-2017	Q2-2017 CIR*
<1	1	2	0	2	3	0	0	3	2	4	0	0.00
1-4	0	0	0	0	2	0	1	1	3	1	2	0.74
5-9	0	1	1	1	0	0	0	0	0	0	1	0.28
10-14	1	0	0	0	0	0	0	0	0	0	0	0.00
15-19	0	0	0	0	1	1	0	0	0	0	0	0.00
20-24	0	1	0	1	0	0	1	0	2	1	0	0.00
25-34	0	0	0	1	2	0	1	0	1	1	2	0.30
35-44	1	0	1	2	0	2	2	2	0	0	0	0.00
45-54	0	1	0	0	0	0	0	0	1	2	2	0.32
55-64	3	0	3	0	2	0	1	2	0	2	0	0.00
65+	5	3	7	2	6	2	1	6	6	4	5	0.78
Total	11	8	12	9	16	5	7	14	15	15	12	0.25

* CIR, crude incidence rate per 100,000