Version 1.3

INVASIVE MENINGOCOCCAL DISEASE (IMD), OTHER BACTERIAL MENINGITIS, *HAEMOPHILUS INFLUENZAE* & *VIRAL MENINGITIS* 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

Q1-2018 **2nd May 2018**

Provisional Figures

Summary

- **Meningococcal disease.** 42 invasive meningococcal disease cases (IMD) were notified in Q1-2018, including 23 serogroup B, ten serogroup C, four serogroup W135, three serogroup Y, and two not specified. This represents a 55.6% increase in comparison to Q1 2017. Of the ten serogroup C cases, one was a total vaccine failure (3 doses, age 15-19 years), one dose each was given to a 1-4 years old (age appropriately vaccinated), and another to a 15-19 year old (no date of last vaccination reported), six were unvaccinated (aged <1 to 79 years) and one had an unknown vaccination status (aged 15-19 years). Five deaths were reported: two had a serogroup C infection, (aged 0-4 and 60-64 years years), two had a W135 infection (aged 60-69 years) and one had a serogroup B infection (aged 5-9 years). A family-based cluster of two serogroup B cases (aged ≤10 years) was reported in Q1-2018, one of whom died.

- **Other bacterial meningitis.** Nine cases of invasive *Streptococcus pneumoniae* infections presenting as meningitis were notified (range 10-14 to 80-84 years), none of whom died. One other meningitis-related infection was reported, a *Streptococcus agalactiae* (aged < 1 month). Six cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were also notified, including one that had *Escherichia coli* as their causative organism (aged ≤1 month), another with an *Streptococcus agalactiae* infection (aged 50-54 years) and one that had an *Acinetobacter* spp. Infection (aged 40-44 years).

- ***Haemophilus influenzae***. 21 cases of *H. influenzae* were reported, one of which was associated with meningitis. Sixteen of the cases were non-typeable, three were type f and two were not typed. Six deaths were reported during this time, the causes of which have not yet been confirmed.

- **Viral meningitis.** 40 cases of viral meningitis NOS, were reported, 20 (50.0%) of which were enterovirus (15 were enterovirus group B, and five not specified). Other causative organisms identified were 14 human herpes virus type 6, two herpes simplex virus, two varicella /herpes zoster virus. No deaths were reported in 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 and for *Haemophilus influenzae* (invasive) disease, but not for viral meningitis, not otherwise specified. Details of these surveillance systems are described in the HPSC Annual Report 2005. Both the enhanced surveillance forms for IMD (including other forms of bacterial meningitis) and *Haemophilus influenzae* (invasive) disease were updated in early December 2015.

Table 1. Summary of meningococcal C and B vaccine schedules in Ireland from their introduction

Schedule	MenC					MenB
	N. doses	Oct 00 – Jun 08	Jul 08 - Jun 15	Jul 15 - Sep 16	Oct 16 – Present	
Routine	1st dose	2 Months	4 Months	4 Months	6 Months	2 Months
	2nd dose	4 Months	6 Months	13 Months	13 Months	4 Months
	3rd dose	6 Months	13 Months	12 - 13 Years	12 - 13 Years	12 Months
	4th dose		12 -13 Years†			
Catch up*	1 dose	1 -22 years	NA	NA	NA	None

*The MenC catch-up campaign was implemented over the 18-month period, October 2000 to March 2002, targeting <23 year olds
†Adolescent dose introduced in 2014
NA: Not applicable

Data presented in this reported were extracted from CIDR on **2nd May 2018**. **These figures are provisional.** Incidence rates for 2018 were calculated using the **2016** Census of Population as denominator data.

Results

Meningococcal Disease (invasive) (IMD)

IMD Cases by Serogroup & Case Classification

In Q1-2018, 42 cases of IMD were notified, all but three were confirmed. Twenty-three were serogroup B, ten serogroup C, four serogroup W135, three serogroup Y and two not specified (Table 2). Details of the number of doses of the meningococcal C conjugate vaccine received, age group and outcome of the ten serogroup C cases are presented in Table 3. In Q1-2018, no reports of menB vaccine failure were reported. No MenB vaccination failures under one year of age was reported in this quarter.

In Q1-2018 serogroup B disease accounted for 53.5% (n=23/43; 95%CI 38.6-68.4%) of all IMD notifications (Figure 1, Appendix 1). Figure 2 presents the quarterly number of cases between 2008 and 2018.

Table 2. Classification of IMD cases notified by Serogroup in Q1-2018

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	23	10	4	3	0	0	0	40
Probable	0	0	0	0	0	0	0	0
Possible	0	0	0	0	0	0	2	2
Not specified	0	0	0	0	0	0	0	0
Total	**23**	**10**	**4**	**3**	**0**	**0**	**2**	**42**

Table 3. Details of the MenC cases notified in Q1-2018 including age group, outcome and age at vaccination

Case No.	Age Grp	Outcome	Vaccination Status	No. MenC doses given	Age at (Last) Vaccination (Yrs)
1	<1	Recovering	Unvaccinated	0	.
2	<1	Recovering	Unvaccinated	0	.
3	1-4	Recovered	Unvaccinated	0	.
4	1-4	Recovered	Age appropriately vaccinated	1	<1
5	1-4	Died	Unvaccinated	0	.
6	15-19	Recovering	Complete	3	<1
7	15-19	Recovering	Unknown	1	.
9	15-19	Recovered	Unknown	.	.
8	60-64	Died	Unvaccinated	0	.
10	75-79	Not known	Unvaccinated	0	.

IMD Trends & Outbreaks

The number of IMD cases reported in Q1-2018 (n=42) was nearly double the average number reported in the same quarter over the previous three years (average=24, 95% %CI 20.9-27.1); for serogroup B the average was 13.0

and for serogroup C it was 6.7 (Figure 1; Appendix 1). First quarterly IMD cases have fallen by 42.5% since 2003 (Appendix 2). Also, since 2003, Q1 serogroup B cases have also declined by 64.6%, but the percentage of serogroup C cases increased by 90% (from one to 10 cases) in that time (Appendix 1). One family cluster of meningococcal B infection occurred in Q1-2018 involving two children (aged ≤10 years), one of whom died.

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).in Temple Street Children's Hospital to the HPSC on April 9th 2018, all 23 classified confirmed IMD events on CIDR in Q1-2018 were included on it.

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q1-2018 was 0.9 cases per 100,000 population, ranging from the lowest (0.0/100,000) in HSE SE to the highest (2.0/100,000) in HSE NE (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group and in Q1-2018 the incidence rate in this age group was 6.4 cases per 100,000 population, followed by 4.8 cases/100,000 in the 1-4 year age group (Appendix 4).

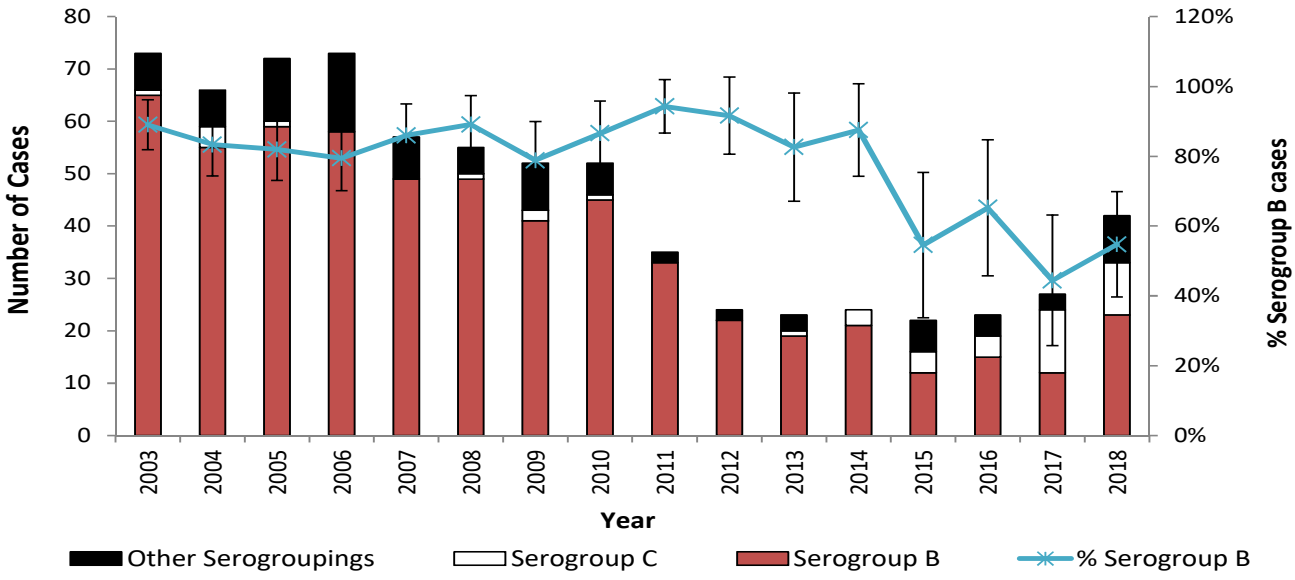

Figure 1. Number of IMD cases notified in Ireland by serogroup in Q1 of each year between 2003 and 2018 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

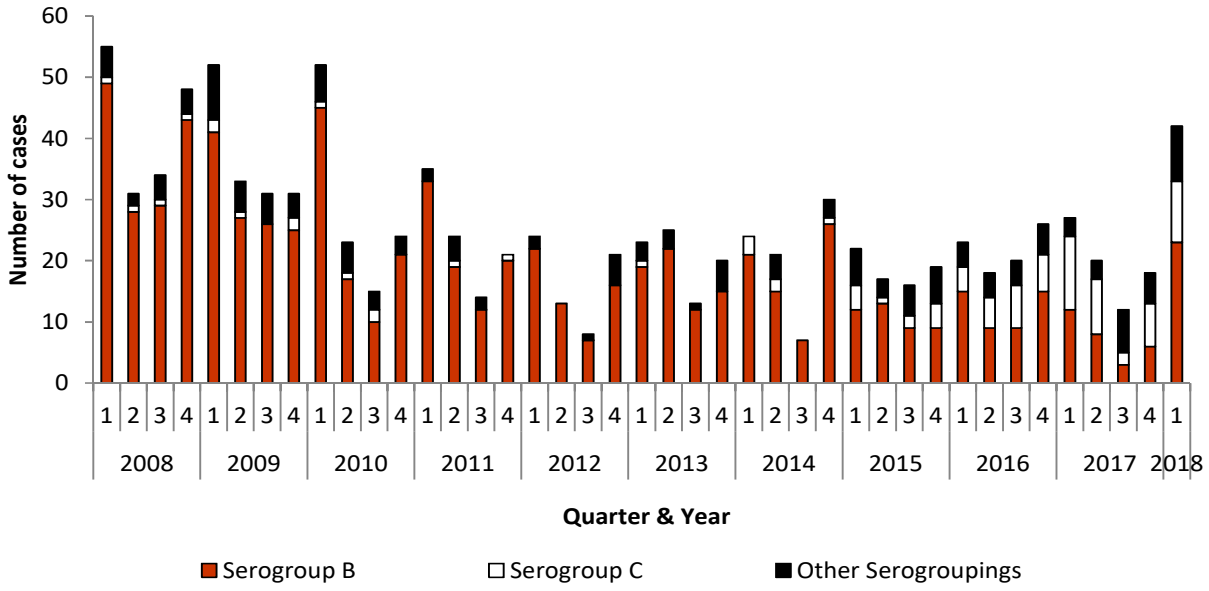

Figure 2. Number of IMD cases by Serogroup, Quarter & Year, 2008-2018

IMD associated deaths

Five deaths were reported in Q1-2018, three of which were due to their infection. Two had a serogroup C infection, (aged 0-4 and 60-64 years), two had a W135 infection (aged 60-69 years) and one had a serogroup B infection

(aged 5-9 years) (Appendix 5). This compares to an average of two deaths in the same quarter between 2015 and 2017.

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q1-2018, nine cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was 10-14 and 80-84 years (Appendix 6). No deaths were reported. Four 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 4 below.

Table 4. Vaccination status, age and risk factors and serotype details of the *Streptococcus pneumoniae* meningitis cases reported in Q1-2018

Case. No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	10-14	No	Unvaccinated	.	.
2	25-29	.	.	.	.
3	55-59	No	Unvaccinated	Unvaccinated	.
4	55-59	Yes	Unvaccinated	Vaccinated (1 dose)	11A*
5	60-64	Yes	Unvaccinated	Unvaccinated	.
6	65-69	Yes	Unvaccinated	Unvaccinated	.
7	65-69	No	Unvaccinated	Unknown	9N*
8	75-79	Not known	Unvaccinated	Unknown	28A
9	80-84	Yes	Unvaccinated	Vaccinated (1 dose)	19A*

*Serotypes 11A, 9N and 19A are covered by the PPV23 vaccine; 19A also covered by PCV13
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 *Strepococcus pneumoniae*)

One case of meningitis-related Group B Strep (*Streptococcus agalactiae*) (aged two weeks) was reported in this quarter. One CSF PCR positive case of *Streptococcus agalactiae* (aged <1 month) was also reported in this quarter; the latter case however, was not labelled as having clinical meningitis or any other clinical description. No deaths were reported in Q1-2018.

Bacterial meningitis (not otherwise specified)

Six cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q1-2018. These included three that were case classified as confirmed, two as probable and one as possible. Of the six cases, three had their causative organism identified: *Escherichia coli* (aged ≤1 month), *S. agalactiae* (aged 50-54 years) and *Acinetobacter* spp. (aged 40-44 years) (Appendix 6). No deaths or imported cases were reported in this quarter.

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q1-2018, 21 cases of invasive *H. influenzae* (all case classified as confirmed) were notified (Figure 3): 16 of the cases were non-typeable, three were type f and two were not typed. This total compares to an average of 19.7 cases for the same quarter in 2015 to 2017 (Table 6, Appendices 7, 8). Of all the Q1 cases reported between 2016 and 2018, 39.0% (n=23/59) had no clinical diagnosis reported (Table 7). In Q1-2018, non-typeable cases accounted for 76.1% (n=16/21) of all cases, compared to an average of 57.6% recorded during the same quarter between 2008 and 2017 (Figure 3).

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL).in Temple Street Children's Hospital to the HPSC on April 9th 2018, all but six classified confirmed *H. influenzae* events on CIDR in Q1-2018 were included on it.

H. influenzae associated deaths

Of the six deaths were reported during this quarter, the actual causes of death were reported as either pending or not specified in these cases; all had non-typeable infections.

H. influenzae meningitis

One meningitis-related *H. influenzae* case was reported in Q1-2018 in a 55-64 year old with a type f infection (Table 8).

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 Q1-2018.The last reported TVF however was in Q4-2010, the only one in nearly 11 years between Q3-2007 and Q1-2018: 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 3, 4). 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 Q1-2018 the number of non-typeable cases reported was 16 (aged <1 to 85+ years), almost twice more than the average of nine cases in the same quarter between 2015 and 2017 (Figure 5).

Table 6. Number of *H. influenzae* cases notified in the first quarter of 2016, 2017 and 2018

Number of cases	Q1-2016	Q1-2017	Q1-2018
All *H. influenzae*	18	20	21
All *H. influenzae* <5yrs	4	4	1
All *H. influenzae* ≥65yrs	5	4	11
H. influenzae type b	1	0	0
H. influenzae type b <5yrs	1	0	0
H. influenzae type b >=65yrs	0	0	0
H. influenzae non-typeable	10	10	16
H. influenzae non-typeable <5yrs	2	1	1
H. influenzae non-typeable ≥65yrs	2	3	8

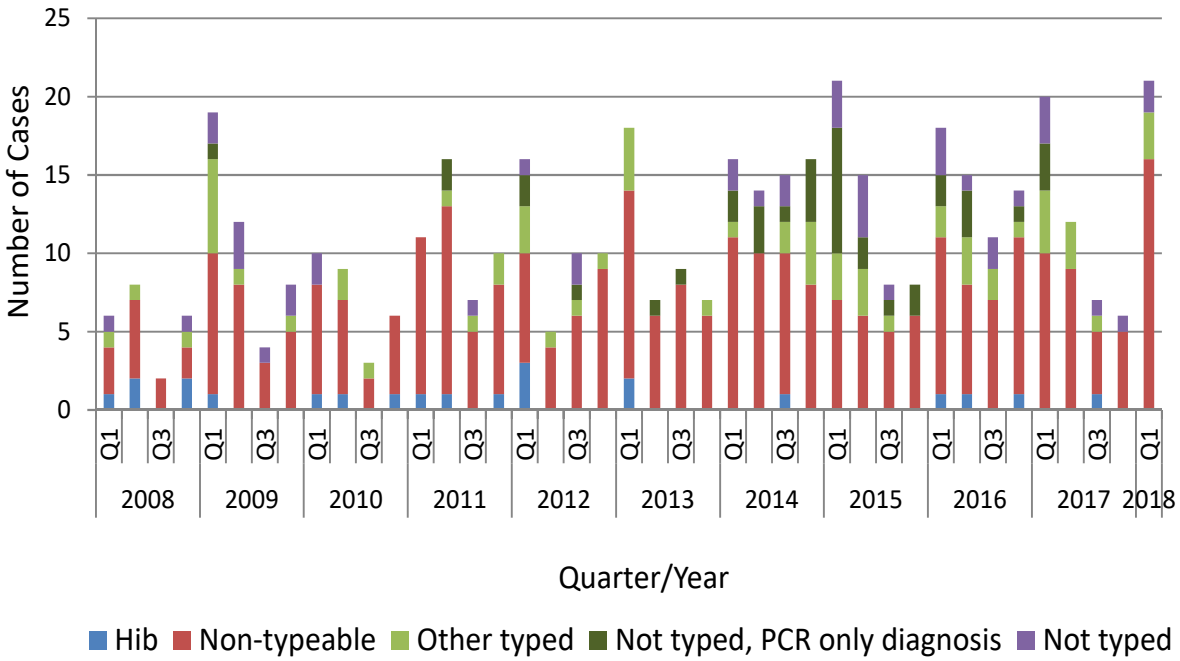

Figure 3. Quarterly number of *H. influenzae* cases by type since 2008

Table 7. Number of *H. influenzae* cases by clinical diagnosis notified in the first quarter of 2016, 2017 and 2018

Number of cases	Q1-2016	Q1-2017	Q1-2018	Total	Total (%)
Septicaemia	6	5	2	13	22.0
Bacteraemia (without focus)	0	3	2	5	8.5
Pneumonia	1	2	5	8	13.6
Meningitis	0	1	0	1	1.7
Meningitis & septicaemia and/or other	0	0	1	1	1.7
Other	4	1	1	6	10.2
Cellulitis	1	0	0	1	1.7
Epiglottitis	0	0	0	0	0.0
Osteomyelitis	0	0	0	0	0.0
Septic arthritis	0	1	0	1	1.7
Clinical diagnosis not reported	6	7	10	23	39.0
Total	**18**	**20**	**21**	**59**	**100**

Table 8. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q1-2018

Number of cases	Typed (b, d, e, f, d or not-b)	Non-typeable	Not typed*	Total
Septicaemia	0	2	0	2
Bacteraemia (without focus)	1	1	0	2
Pneumonia	0	5	0	5
Meningitis	0	0	0	0
Meningitis & septicaemia and/or other	1	0	0	1
Other	0	0	1	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	8	1	10
Total	**3**	**16**	**2**	**21**

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

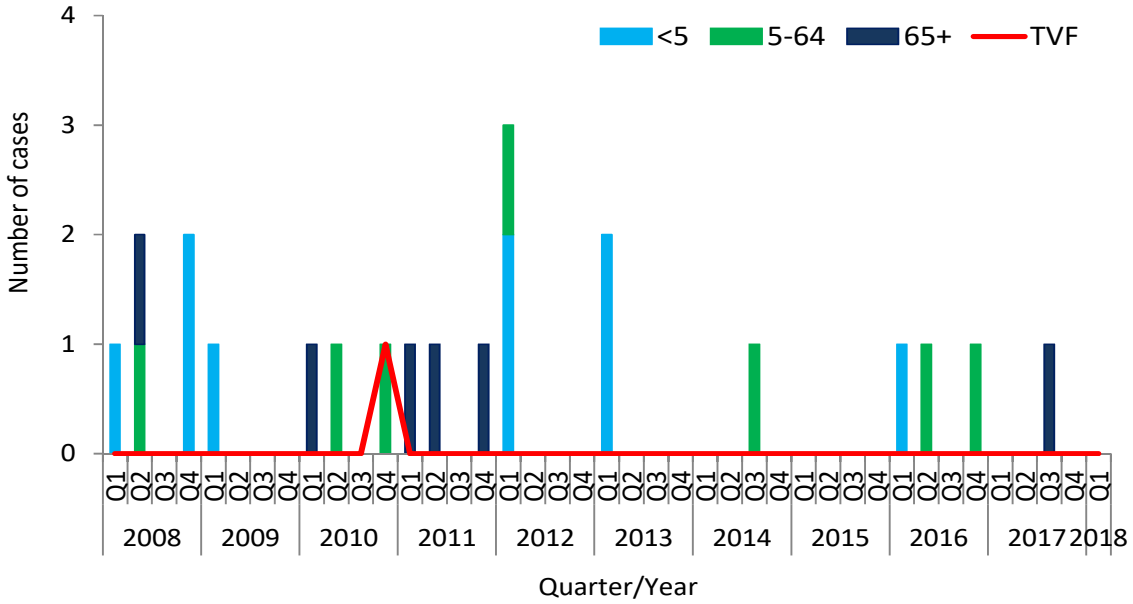

Figure 4. Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2008

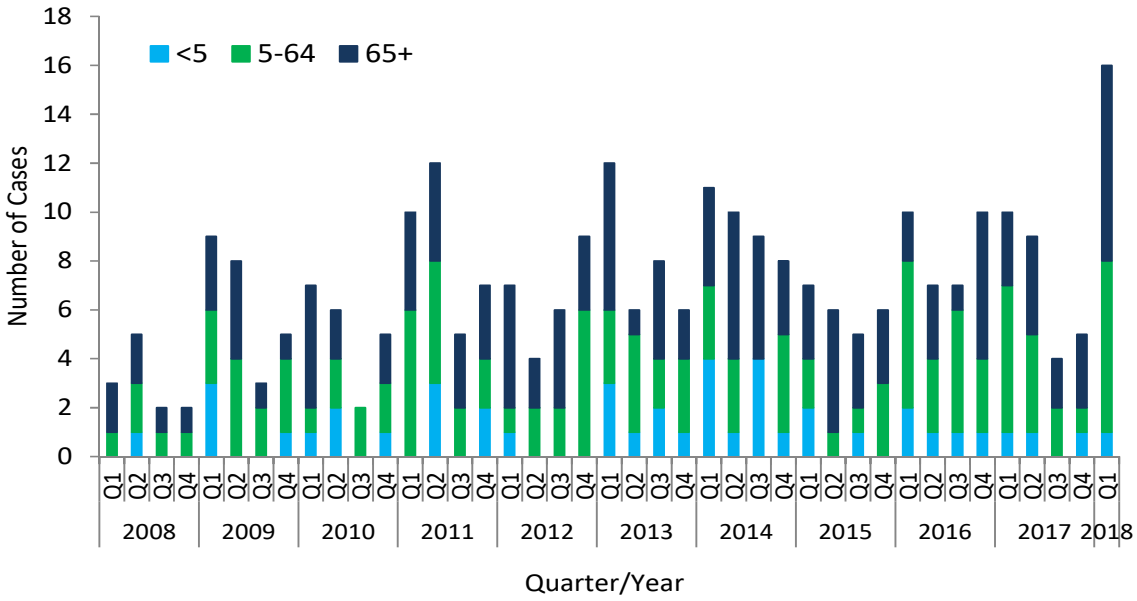

Figure 5 Quarterly number of non-typeable/non-capsulated cases by age group, since 2008

Viral Meningitis (Specified and Not Otherwise Specified)

Forty viral meningitis notifications (NOS) (aged 1 week to 47 years; median 3.6 months) were reported in Q1-2018 (Figures 6, 7), all but two had their causative organism identified: 20 enterovirus (aged 1 week to 37 years; median 81 days); 14 human herpes virus type 6 (HHV 6) (aged 2 weeks to 2 years); two herpes simplex virus (aged 13-32 years, both type 1) and two varicella/herpes zoster virus (aged 44-46 years). No deaths were reported in this quarter.

In Q1-2018, the highest frequency of cases occurred in children <1 year of age (n=25/40; 62.5%) and in adults aged 15-39 years (n=7/40; 17.5%) (Figure 6). Of the 25 cases <1 year of age reported in this quarter, 13 (52.0%) were attributable to enterovirus and 12 (48.0%) to HHV 6. 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 five in Q1-2018), 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 7 presents both the total number of viral meningitis NOS cases and those not caused by enterovirus by year and by quarter since 2008. The average Q1 percentage of all viral meningitis NOS cases attributable to enterovirus since 2014 to date has been 62.1%. Details of enterovirus serotypes by age group in Q1-2018 are presented in Table 5 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

All but four CIDR events in Q1 of 2018 were matched to NVRL viral meningitis enterovirus typing records (Figure 8) provided to the HPSC on the April 30th 2018; specimens for these four cases were not sent to the NVRL, three of the unmatched cases were attributable to laboratory reports from University Hospital Waterford and the remaining case to Galway University Hospital.

Table 5. Enterovirus genotypes by age group (years) on CIDR in Q1-2018
(Enterovirus genotyping targets the VP1 gene of the virus)

			Age Group (years)					
Genus	**Species**	**Type**	**<1**	**1-4**	**5-14**	**15-39**	**40+**	**Total**
Enterovirus	**Enterovirus A**		0	0	0	0	0	0
	Enterovirus B	Coxsackievirus B4	2	0	0	0	0	2
		Coxsackievirus B5	1	0	0	1	0	2
		Echovirus 3	1	0	0	0	0	1
		Echovirus 5	1	0	0	0	0	1
		Echovirus 9	6	0	0	0	0	6
		Echovirus 30	0	0	0	3	0	3
	Enterovirus C		0	0	0	0	0	0
	Enterovirus D		0	0	0	0	0	0
	Not specified	Unable to generate genotype*	0	0	0	0	0	0
		Not specified	2	1	0	2	0	5
Total			**13**	**1**	**0**	**6**	**0**	**20**

*excludes one case, reported instead as human herpes virus type 6 on CIDR

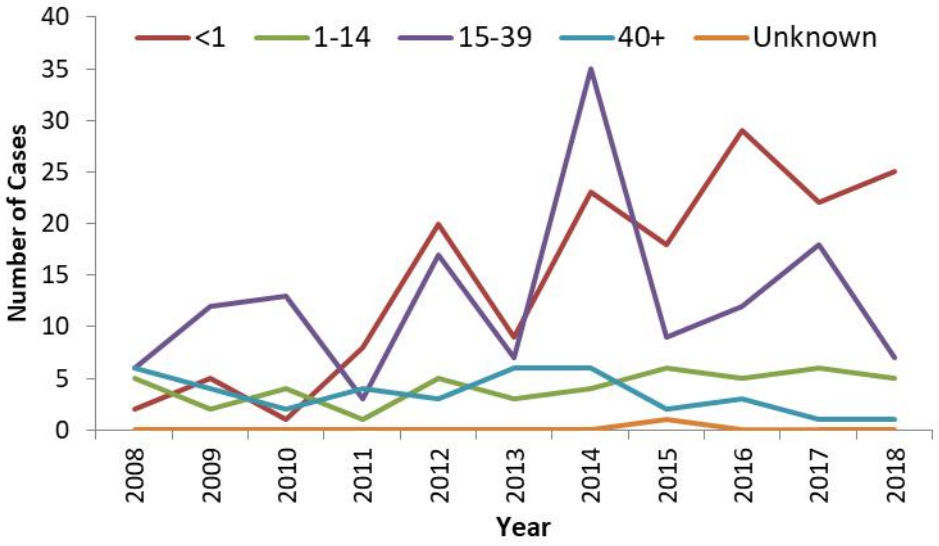

Figure 6. Quarter 1 number of viral meningitis (NOS) cases in Ireland by age group (years), 2008-2018

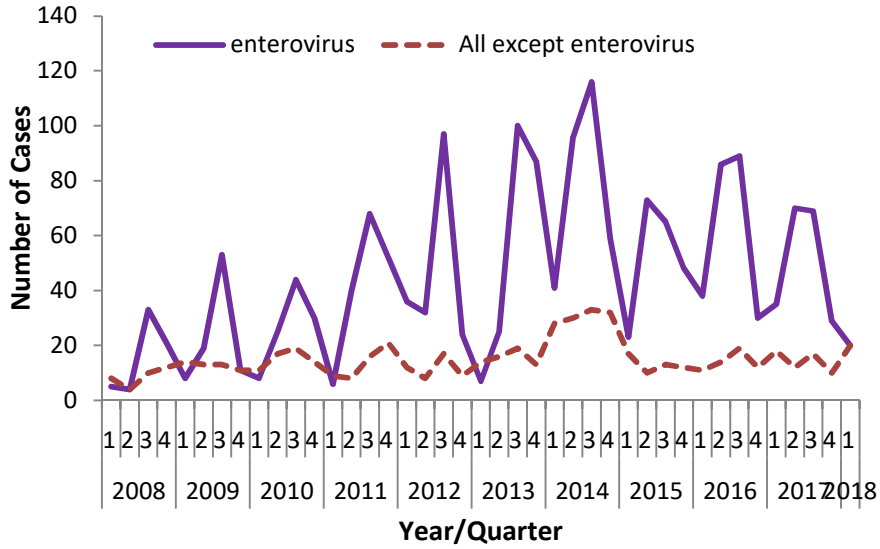

Figure 7. Number of viral meningitis (NOS) cases caused by enterovirus and all except enterovirus by quarter and year, 2008-2018

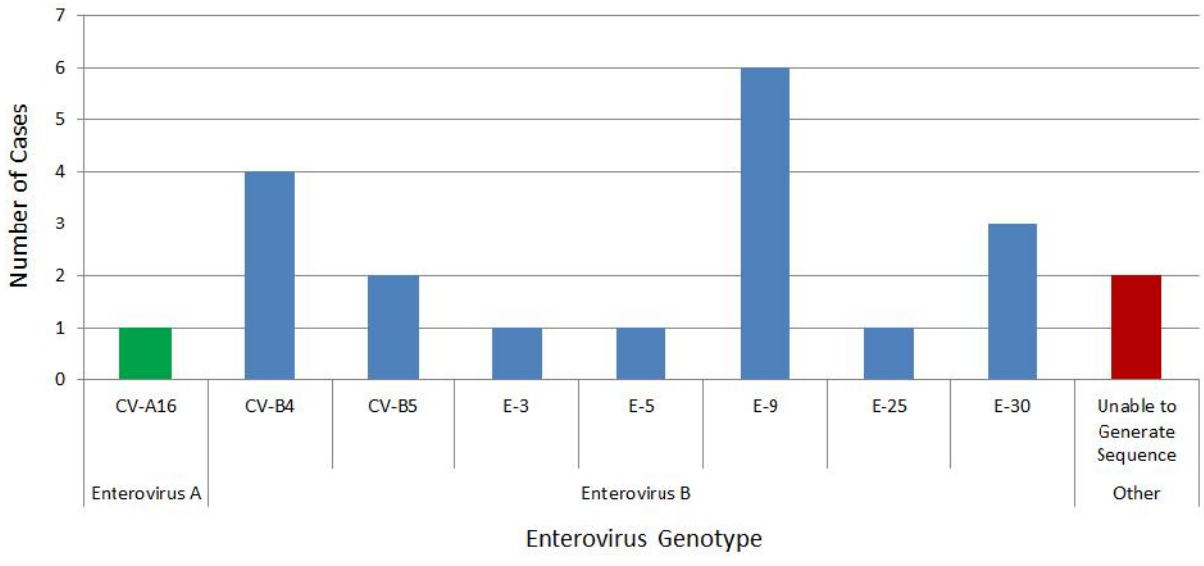

Figure 8. Breakdown of enterovirus genotype lab records reported by NVRL in Q1-2018

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- **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/HPSC%20BacMen%202017%20Web.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: https://nvrl.ucd.ie/sites/default/files/uploads/pdfs/UCD_NVRL_User_Manual_17.0.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: https://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, 2003-2018

Serogroup	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	Q1-2018
B	65	55	59	58	49	49	41	45	33	22	19	21	12	15	12	23
C	1	4	1	0	0	1	2	1	0	0	1	3	4	4	12	10
W135	2	0	1	0	1	1	2	0	0	0	2	0	2	1	2	4
Y	1	0	1	2	0	0	2	0	1	1	1	0	2	0	0	3
Non-groupable (NG)	1	0	2	1	0	0	0	0	0	0	0	0	0	1	1	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	3	7	8	12	7	4	5	6	1	1	0	0	2	2	0	2
Total	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**	**42**

Appendix 2. IMD Cases by Quarter, 2003-2018

Qr	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2003-2018 change
Q1	73	66	72	73	57	55	52	52	35	24	23	24	22	23	27	42	-42.5%
Q2	38	47	57	55	44	31	33	23	24	13	25	21	17	18	20	-	-
Q3	51	42	31	37	41	34	31	15	14	8	13	7	16	20	12	-	-
Q4	75	43	43	44	37	48	31	24	21	21	20	30	19	26	18	-	-
Total	**237**	**198**	**203**	**209**	**179**	**168**	**147**	**114**	**94**	**66**	**81**	**82**	**74**	**87**	**77**	**-**	**-**

Appendix 3. IMD Cases by HSE Area in Quarter 1, 2003-2018

HSE Area	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	Q1-2018	Q1-2018 CIR*
E	23	21	25	33	14	12	13	20	7	8	10	5	4	3	3	21	1.23
M	10	5	5	4	4	3	3	1	5	2	1	2	2	1	1	2	0.68
MW	6	3	7	5	6	6	5	8	3	3	2	1	0	2	3	3	0.78
NE	6	9	6	4	4	11	9	4	5	5	3	5	1	1	3	9	1.95
NW	1	5	4	4	6	2	1	6	4	1	2	3	3	6	1	1	0.39
SE	10	5	10	9	10	11	8	9	5	1	1	3	3	2	3	0	0.00
S	14	11	9	11	6	9	11	3	4	2	2	1	5	5	6	3	0.59
W	3	7	6	3	7	1	2	1	2	2	2	4	4	3	7	3	0.66
Total	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**	**42**	**0.88**

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 1, 2003-2018

Age Group (Yrs)	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	Q1-2018	Q1-2018 CIR*
<1	18	14	19	18	16	12	12	12	11	9	4	5	4	6	5	4	6.42
1-4	23	21	32	26	20	18	15	22	9	4	7	8	8	3	5	13	4.83
5-9	6	8	4	8	1	8	4	4	6	4	3	2	2	2	1	5	1.41
10-14	8	5	2	3	5	4	3	2	1	1	1	0	0	3	2	2	0.63
15-19	7	6	6	10	6	4	7	6	2	1	3	3	5	5	2	6	1.98
20-24	0	5	3	2	2	4	4	1	1	0	1	2	1	2	1	1	0.37
25-34	6	1	0	0	3	0	2	2	2	0	0	0	0	0	0	1	0.15
35-44	0	1	1	3	1	0	0	0	1	1	1	1	1	0	3	1	0.13
45-54	0	1	2	2	0	1	2	0	2	3	0	1	0	0	1	2	0.32
55-64	3	2	3	0	1	2	0	1	0	0	2	0	0	0	2	2	0.39
65+	2	2	0	1	2	2	3	2	0	1	1	2	1	2	5	5	0.78
Total	**73**	**66**	**72**	**73**	**57**	**55**	**52**	**52**	**35**	**24**	**23**	**24**	**22**	**23**	**27**	**42**	**0.88**

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 1, 2003-2018

Serogroup	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	Q1-2018
B	3	4	4	2	2	3	3	2	1	1	1	1	0	1	0	1
C	0	1	0	0	0	1	0	0	0	0	0	0	0	0	4	2
W135	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
Y	0	0	0	0	0	0	0	0	0	1	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	1	0	0
Total	**3**	**5**	**4**	**2**	**2**	**5**	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**2**	**4**	**5**
%CFR* (Total)	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	11.6

* %CFR, case fatality ratio

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 1, 2008-2018 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1:2008-2018
Specified	*Leptospira* spp.	0	0	0	0	0	0	0	0	0	0	0	0
	Listeria spp.	1	0	0	1	0	1	0	2	2	1	0	8
	Mycobacterium tuberculosis#	2	1	3	0	2	1	0	0	0	0	0	9
	Streptococcus pneumoniae	10	7	4	8	10	7	13	11	13	10	9	102
	*Streptococcus agalactiae**	na	na	na	na	3	2	3	2	0	2	1	13
	Streptococcus pyogenes	1	0	1	0	0	2	0	2	0	1	0	7
	Salmonella spp.	0	0	0	0	0	0	0	0	0	0	0	0
Not specified	*Escherichia coli*	0	1	0	0	0	0	1	2	1	4	1	10
	Staphylococcus aureus	0	0	2	0	0	0	0	0	0	0	0	2
	Streptococcus agalactiae†	3	2	2	4	0	0	0	0	0	0	1	12
	Streptococcus bovis biotype II/2	0	1	0	0	0	0	0	0	0	0	0	1
	Acinetobacter spp.	0	0	0	0	0	0	0	0	0	0	1	1
	Unknown/Not specified	1	6	8	2	4	2	1	2	2	2	3	33
	Total	**18**	**18**	**20**	**15**	**19**	**15**	**18**	**21**	**18**	**20**	**16**	**198**

#TB meningitis figures for 2016, 2017 and 2018 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

na not applicable for the years prior to 2012

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

Appendix 7. *H. influenzae* Cases by Type in Quarter 1, 2008-2018

Type	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018
b	1	1	1	1	3	2	0	0	1	0	0
d	0	0	0	0	0	0	0	0	0	1	0
e	0	3	0	0	0	1	0	0	0	0	0
f	1	3	0	0	3	2	1	1	2	3	3
not type-b	0	0	0	0	0	1	0	2	0	0	0
non-typeable/non-capsulated	3	9	7	10	7	12	11	7	10	10	16
not typed*	1	3	2	0	3	0	4	11	5	6	2
Total	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**	**21**

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

Appendix 8. *H. influenzae* Cases by Quarter, 2008-2018

Qr	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2008-2018 change
Q1	6	19	10	11	16	18	16	21	18	20	21	+250%
Q2	8	12	9	16	5	7	14	15	15	12	-	-
Q3	2	4	3	7	10	9	15	8	11	7	-	-
Q4	6	8	6	10	10	7	16	8	14	6	-	-
Total	**22**	**43**	**28**	**44**	**41**	**41**	**61**	**52**	**58**	**45**	**-**	**-**
Meningitis	*3*	*3*	*2*	*4*	*3*	*2*	*7*	*5*	*1*	*1*	-	-
Type b meningitis	*1*	*0*	*1*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	-	-

Appendix 9. *H. influenzae* Cases by HSE Area in Quarter 1, 2008-2018

HSE Area	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-203	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2018 CIR*
E	1	9	4	3	7	5	5	8	7	7	10	0.58
M	2	1	0	2	0	2	1	0	0	4	0	0.00
MW	0	4	0	0	1	1	2	2	1	3	1	0.26
NE	0	0	0	2	3	2	3	3	2	1	3	0.65
NW	0	0	0	1	1	2	0	1	1	1	1	0.39
SE	2	1	3	1	1	2	2	4	0	0	4	0.58
S	1	2	3	1	3	2	2	2	3	1	1	0.20
W	0	2	0	1	0	2	1	1	4	3	1	0.22
Total	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**	**21**	**0.44**

* CIR, crude incidence rate per 100,000

Appendix 10. *H. influenzae* Cases by Age Group in Quarter 1, 2008-2018

Age Grp (Yrs)	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-203	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2018 CIR*
<1	0	2	0	0	3	2	3	8	2	3	1	1.61
1-4	2	4	1	0	1	3	3	4	2	1	0	0.00
5-9	0	3	0	1	2	1	1	1	1	1	0	0.00
10-14	0	1	0	0	0	0	0	0	1	1	1	0.31
15-19	0	0	0	0	0	0	0	1	0	1	1	0.33
20-24	0	0	0	0	1	0	0	0	1	0	0	0.00
25-34	0	1	2	0	0	2	1	1	4	0	0	0.00
35-44	0	1	0	3	0	0	0	1	1	1	2	0.27
45-54	0	0	0	1	1	0	1	0	1	6	2	0.32
55-64	1	1	0	1	2	2	1	0	0	2	3	0.59
65+	3	6	7	5	6	8	6	5	5	4	11	1.73
Total	**6**	**19**	**10**	**11**	**16**	**18**	**16**	**21**	**18**	**20**	**21**	**0.44**

* CIR, crude incidence rate per 100,000

Appendix 11. Viral Meningitis Cases, Not Otherwise Specified, by Causative Organism in Quarter 1, 2008-2018

Causative Organism	Q1-2008	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018
enterovirus group A	0	0	0	0	0	0	0	0	0	0	0
enterovirus group B	0	0	0	0	1	0	0	0	0	21	15
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
rhinovirus A	0	0	0	0	0	0	0	0	0	0	0
enterovirus group not specified	5	8	8	6	35	7	41	23	38	14	5
human herpes virus type 6	0	0	1	3	4	6	11	4	9	9	14**
varicella/herpes zoster virus	1	1	3	0	0	0	9	6	1	2	2
herpes simplex virus*	3	2	1	2	3	3	4	2	1	3	2
parechovirus	0	0	0	0	0	0	0	4	0	1	0
adenovirus	0	0	0	0	0	0	0	0	0	0	0
not specified	4	11	6	4	5	5	4	1	0	3	2
Total	**13**	**22**	**19**	**15**	**48**	**21**	**69**	**40**	**49**	**53**	**40**
% known causative organism	69.2	50.0	68.4	73.3	89.6	76.2	94.2	97.5	100.0	94.3	95.0

*Includes types 1 and 2

**excludes one case (where the enterovirus genotype could not be generated) and reported instead as human herpes virus type 6 on CIDR