

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

A REPORT BY THE HEALTH PROTECTION SURVEILLANCE CENTRE (HPSC)
IN COLLABORATION WITH
THE IRISH MENINGITIS & SEPSIS REFERENCE LABORATORY (IMSRL) &
THE NATIONAL VIRUS REFERENCE LABORATORY (NVRL)



Q1-2019

21st May 2019

Provisional Figures

Summary

- **Invasive meningococcal disease (IMD)**
 - 38 IMD cases were notified (crude incidence rate 0.80/100,000), with the highest incidence among infants (6.42/100,000); 34 of the cases were confirmed
 - Serogroup (Sg) was identified for 32 of the cases; seventeen (44.7%) SgB, seven (18.4%), SgC, five (13.2%) SgW, three (7.9%) SgY
 - Five SgB and four SgC cases among those eligible for routine vaccination (MenC or MenB) were identified; (details in report)
 - Changes in Sg distribution; in Q1-2019 a notable decline in the number of SgC cases since the peak in Q1-2017 (when 12 cases reported) is evident, SgB cases have declined in comparison to the previous year and the number of SgW cases in Q1-2019 is higher than in any Q1 of previous years
 - Six deaths were reported (case fatality rate of 15.8%), three were associated with SgB, one each with SgC and SgW, and one with no organism detected.
 - No outbreaks were reported
- **Other bacterial meningitis (specified and not otherwise specified)**
 - Ten cases of meningitis were related to invasive *Streptococcus pneumoniae* infections (IPD)
 - One case of Group B Strep (*Streptococcus agalactiae*) meningitis (aged 1 week)
 - One case of meningitis caused by tuberculosis
 - Five cases of bacterial meningitis due to pathogens not otherwise specified (NOS): one each of *Escherichia coli*, *Staphylococcus aureus* and *Staphylococcus capitis*. An additional two possible cases were reported
 - One death in a possible case was reported
 - No outbreaks were reported
- ***Haemophilus influenzae* invasive**
 - 23 cases of *H. Influenzae* were reported, none had meningitis. The majority of cases were due to non-typeable strains, one was due to type b (in an incompletely vaccinated infant) and two were type f, four were not typed
 - No outbreaks or deaths reported
- **Viral meningitis (specified and not otherwise specified)**
 - Seventy-seven viral meningitis cases were notified; most (69) were due to organisms not otherwise specified (NOS), eight were related to mumps infection
 - No outbreaks or deaths reported

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	No. doses	MenC			MenB	
		Oct '00-Jun '08	Jul'08-Jun '15	Jul'15-Sept '16	Oct '16-Present	
Routine	1 st dose	2 Months	4 Months	4 Months	6 Months	2 Months
	2 nd dose	4 Months	6 Months	13 Months	13 Months	4 Months
	3 rd dose	6 Months	13 Months	12 - 13 Years	12 - 13 Years	12 Months
	4 th 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 those <23 years of age

†Adolescent dose introduced in 2014

NA: Not applicable

Data presented in this reported were extracted from CIDR from the **21st May 2019**. **These figures are provisional**. Incidence rates for 2019 were calculated using the **2016** Census of Population as denominator data.

Results

Meningococcal Disease (invasive) (IMD)

IMD Cases by Serogroup & Case Classification

In Q1-2019, 38 cases of IMD were notified, 34 of which were classified as confirmed. No imported cases were reported during this period.

Serogroup B disease accounted for 44.7% (n=17/38) of all IMD notifications, 18.4% (n=7) for SgC, 13.2% (n=5) for SgW and 7.9% (n=3) for SgY (Table 2, Figures 1, 2, Appendix 1).

Ethnicity was recorded as White for eight cases (21.0%), two as Irish Traveller (5.3%) and 28 (73.7%) as not specified.

Details of the number of vaccine doses of among those eligible for vaccination with SgB disease and all SgC cases are presented in Table 3.

Table 2. Classification of IMD cases notified by Serogroup in Q1-2019

Case Classification	SgB	SgC	SgW	SgY	NG	Sg29E	No organism detected	Total
Confirmed	17	7	5	3	0	0	2	34
Probable	0	0	0	0	0	0	1	1
Possible	0	0	0	0	0	0	3	3
Not specified	0	0	0	0	0	0	0	0
Total	17	7	5	3	0	0	6	38

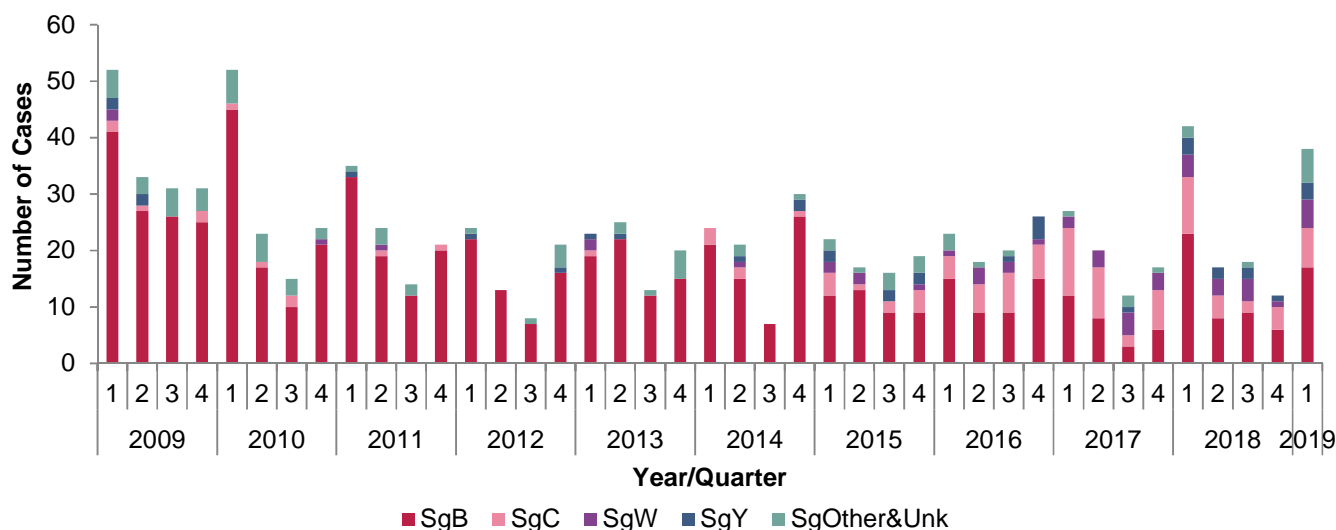


Figure 1. Number of IMD cases notified in Ireland by serogroup by quarter and year, 2009-2019

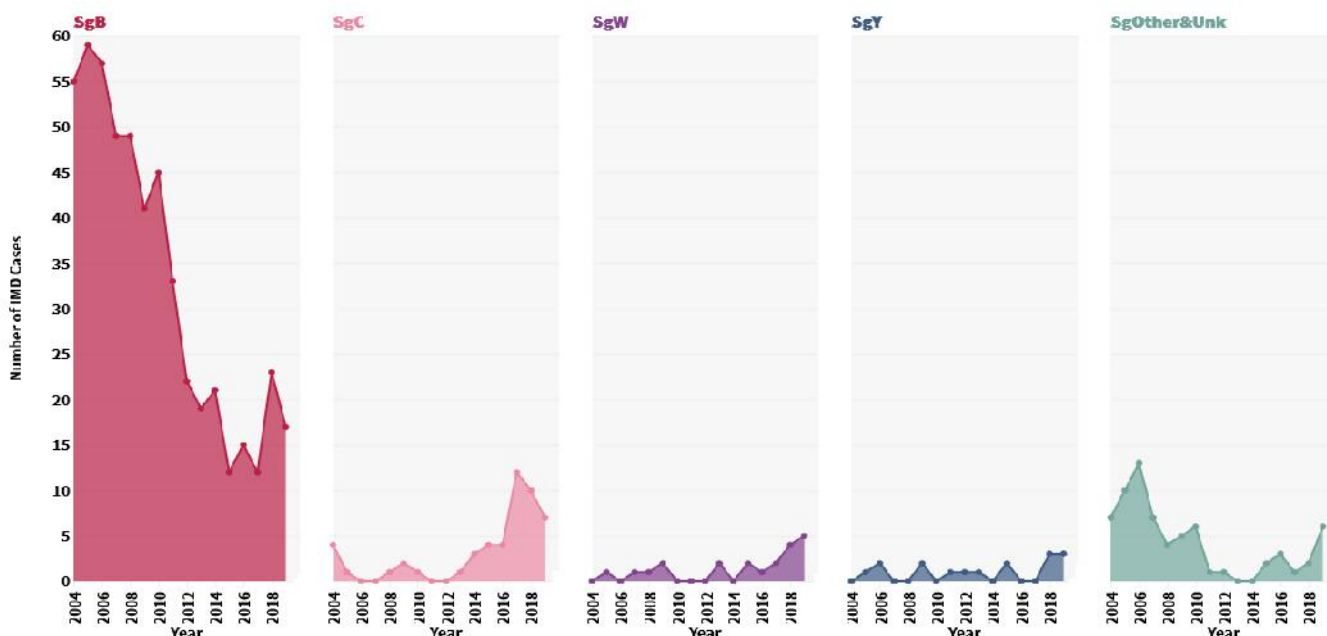


Figure 2. Number of IMD cases notified in Ireland by serogroup in Q1 of each year between 2004 and 2019

Table 3. Details of the serogroup B (under 2 years of age) and C cases notified in Q1-2019 including age group, outcome and age (in months) at last vaccination dose

Case No.	Sg/ Age Grp	Outcome	Vaccination Status	No. doses given	Age at (Last) Vaccination (Months)
1	B/<1 yr	Not specified	Age appropriately vaccinated	1	2.6
2	B/<1 yr	Still ill	Age appropriately vaccinated	2	4.3
3	B/1 yr	Recovering	Unvaccinated	0	-
4	B/1 yr	Died	Completely vaccinated	3	12.2
5	B/1 yr	Recovered	Completely vaccinated	3	12.7
6	C/<1 yr	Recovering	Not specified	Not specified	-
7	C/1 yr	Recovering	Unvaccinated	0	-
8	C/2 yrs	Recovered	Unvaccinated	0	-
9	C/20-24 yrs	Not specified	Completely vaccinated	Not specified	-
10	C/40-44 yrs	Not specified	Unvaccinated	0	-
11	C/40-44 yrs	Not specified	Unvaccinated	0	-
12	C/60-64 yrs	Died	Unvaccinated	0	-

IMD Trends & Outbreaks

The number of IMD cases reported in Q1-2019 (n=38) was higher than the average number reported in the same quarter over the previous three years, but not significantly so (average=30.7, 95% %CI 19.0-42.3); for SgB the average was 16.7 and for SgC it was 8.7 (Appendix 1). The number of IMD cases reported in Q1 has fallen by

42.4% since 2004 (from 66 to 38 cases) (Appendix 2) most notably the SgB cases (69.1% decline from 55 to 17 cases), however SgC cases have increased by 75.0% (from four to seven cases) in that time (Appendix 1). No outbreaks of IMD were reported in Q1-2019.

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL) in Temple Street Children's University Hospital to the HPSC on May 13th, 2019, all but one of the classified confirmed IMD events on CIDR in Q1-2019 were included on it at the time of writing.

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q1-2019 was 0.80 cases per 100,000 population, with regional variation (range (0.0/100,000) in HSE NW to 1.82/100,000) in HSE MW (Appendix 3). Incidence rate was highest in the <1 year of age group 6.4 cases per 100,000 population, followed by 3.0 cases/100,000 in the 1-4 year age group (Appendix 4).

IMD associated deaths

Six deaths were reported in Q1-2019 (overall case fatality rate (CFR) 15.8%), compared to 11.9% (n=5/42) in Q1-2018. Two of these deaths were reported as due to their infections: one (aged 20-24 years) due to SgB and the other (aged 35-39 years) due to SgW (Appendix 5). Of the other four deaths (two SgB, one SgC and one not grouped), three had their cause of death as pending (aged 35-85+ years) and for one, cause of death was not specified (aged <2 years). The average number of deaths was 3.7 in the same quarter between 2016 and 2018.

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q1-2019 ten cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified with no serotype identified. The age range was 8-73 years (Appendix 6). Two deaths were reported; one patient had not been vaccinated with the PPV vaccine, the other had an unknown PPV vaccination status.

Bacterial meningitis by other specified notifiable diseases (excluding *Haemophilus influenzae* and *Streptococcus pneumoniae*)

One case of meningitis-related Group B Strep (*Streptococcus agalactiae*) (aged 1 week), along with three other CSF PCR positive cases of *S. agalactiae* (aged 1 month) were reported during Q1-2019; the latter three cases, however, were not labelled as having clinical meningitis or any other clinical description. One case of tuberculosis-related meningitis (aged 35-44 years) was also reported. No deaths were reported in this quarter.

Bacterial meningitis (not otherwise specified)

Five cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q1-2019. Among these cases were one each of *Escherichia coli* (aged <1 month), *Staphylococcus aureus* (aged 60-64 years) and *Staphylococcus capitis* (aged 1 month) (Appendix 6). There were also two possible cases reported (aged 45-59 years), one of whom died. No imported cases or outbreaks were reported during this period.

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q1-2019, 23 cases of *H. influenzae* (all but one were case classified as confirmed) were notified (Figure 3), the highest quarterly number since 2004 when it was first made a notifiable disease: two cases of type f, one type b (in a four month old who was incompletely vaccinated with one dose of the Hib vaccine at 2.7 months of age), 16 non-typeable and four not typed. This total compares to an average of 19.7 cases for the same quarter in 2016 to 2018 (Table 4, Appendices 7, 8). No outbreaks, deaths, meningitis-related or imported cases or cases were reported during this period.

Of all the Q1 cases reported between 2017 and 2019, 28.1% (n=18/64) had no clinical diagnosis reported (Tables 5, 6). In Q1-2019, non-typeable cases accounted for 16 of the 23 cases (69.6%), higher than the average of 60.7% recorded during the same quarter between 2009 and 2018 (Figure 3).

In the electronic listing by the IMSRL to the HPSC on May 13th, 2019, all but four confirmed *H. influenzae* events on CIDR in Q1-2019 were included on it (three untyped and one non-typeable). There was also one untyped case reported to IMSRL that had not yet been notified to CIDR at the time of writing.

H. influenzae type b (Hib)

A true vaccine failure (TVF) is the occurrence of invasive Hib infection in an individual, despite having been fully vaccinated against Hib disease in the past. One Hib case was reported in Q1-2019, an incomplete vaccine failure in a four month old. The last reported TVF however was in Q4-2010, over eight years ago: 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 Q1-2019 16 non-typeable cases was reported (aged 1 to 96 years), more than the average of 12.3 cases in the same quarter between 2016 and 2018 (Figure 5).

Table 4. Number of *H. influenzae* cases notified in the first quarter of 2017, 2018 and 2019

Number of cases	Q1-2017	Q1-2018	Q1-2019
All <i>H. influenzae</i>	20	21	23
All <i>H. influenzae</i> <5yrs	4	1	2
All <i>H. influenzae</i> ≥65yrs	4	11	15
<i>H. influenzae</i> type b	0	0	1
<i>H. influenzae</i> type b <5yrs	0	0	1
<i>H. influenzae</i> type b ≥65yrs	0	0	0
<i>H. influenzae</i> non-typeable	10	17	16
<i>H. influenzae</i> non-typeable <5yrs	1	1	1
<i>H. influenzae</i> non-typeable ≥65yrs	3	9	10

Table 5. Number of *H. influenzae* cases by clinical diagnosis notified in Q1 of 2017, 2018 and 2019

Number of cases	Q1-2017	Q1-2018	Q1-2019	Q1-2017 to 2019 Total	Q1-2017 to 2019 Total (%)
Septicaemia	5	7	4	16	25.0
Bacteraemia (without focus)	3	4	1	8	12.5
Pneumonia	2	6	6	14	21.9
Meningitis	1	0	0	1	1.6
Meningitis & septicaemia	0	1	0	1	1.6
Other	1	2	1	4	6.3
Cellulitis	0	0	0	0	0.0
Epiglottitis	0	0	0	0	0.0
Osteomyelitis	0	0	0	0	0.0
Septic arthritis	1	0	1	2	3.1
Clinical diagnosis not reported	7	1	10	18	28.1
Total	20	21	23	64	100

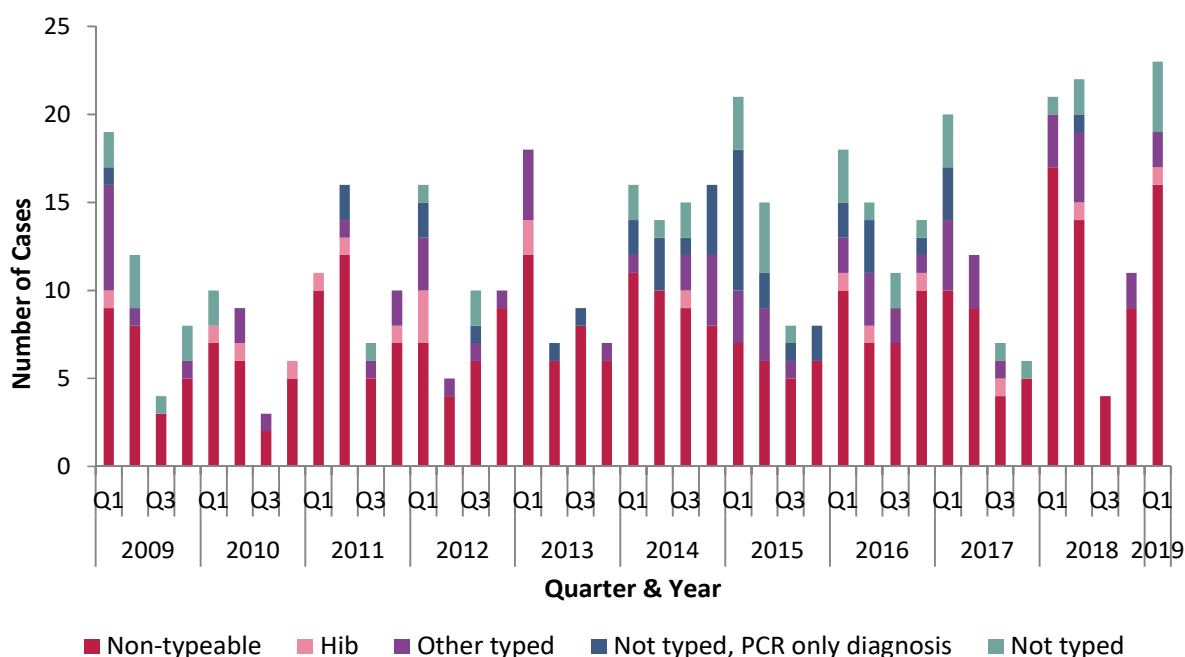


Figure 3. Quarterly number of *H. influenzae* cases by type since 2009

Table 6. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q1-2019

Number of cases	Typed (b, d, e, f, d or not-b)	Non-typeable	Not typed*	Total
Septicaemia	2	2	0	4
Bacteraemia (without focus)	0	1	0	1
Pneumonia	1	5	0	6
Meningitis	0	0	0	0
Meningitis & septicaemia	0	0	0	0
Other	0	0	1	1
Cellulitis	0	0	0	0
Epiglottitis	0	0	0	0
Osteomyelitis	0	0	0	0
Septic arthritis	0	1	0	1
Clinical diagnosis not reported	0	7	3	10
Total	3	16	4	23

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

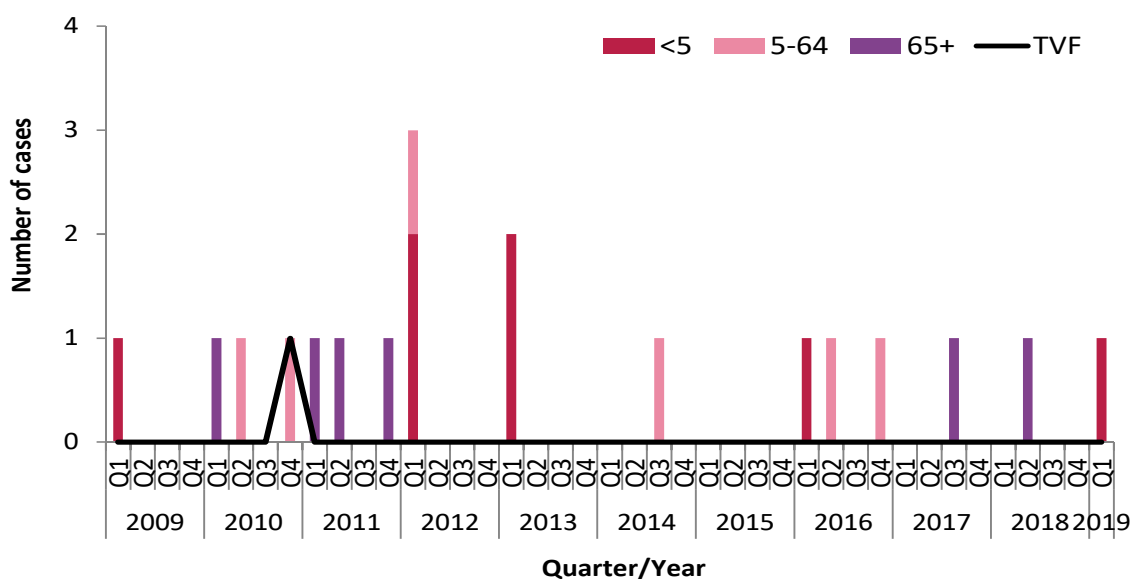


Figure 4. Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2009

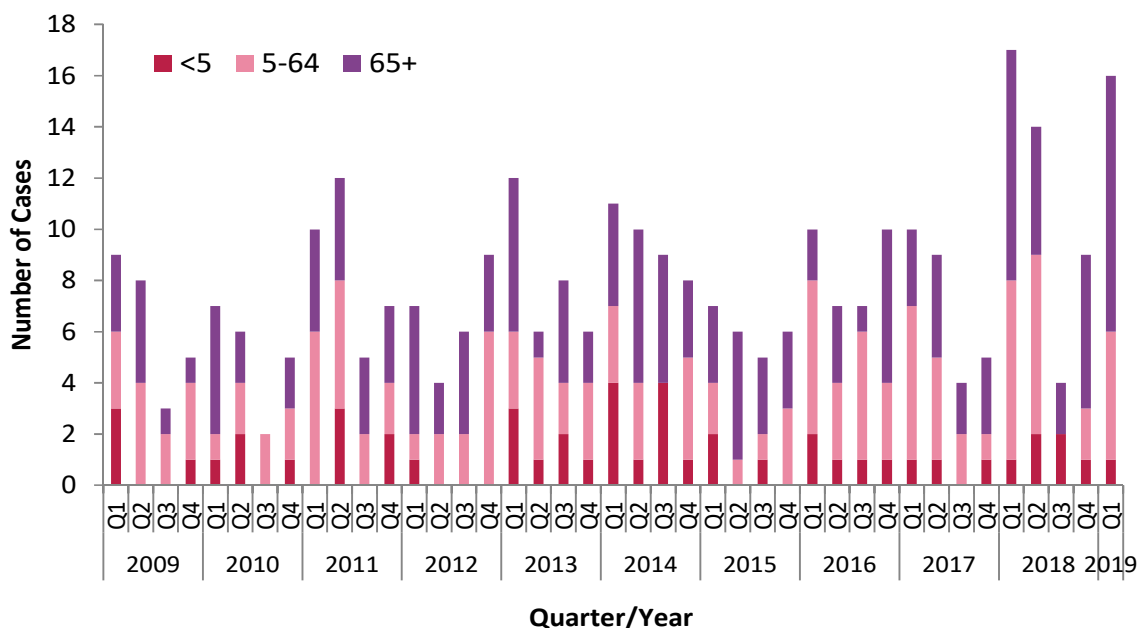


Figure 5. Quarterly number of non-typeable/non-capsulated cases by age group, since 2009

Viral Meningitis (Specified and Not Otherwise Specified)

Eight cases of mumps-related meningitis was reported in Q1-2019, all aged 15-24 years and all located in HSE W (n=7) and HSE MW (n=1): six had received two doses of the MMR vaccine, one patient had received one dose only and the vaccination status of the remaining cases was not reported. The last reported cases of mumps-related meningitis were in Q4-2018 (n=3) and prior to that in Q4-2015 (n=2).

Sixty-nine viral meningitis notifications (NOS) (aged 1 week to 53 years; median 9.7 months) were reported in Q1-2019 (Figures 6, 7). All but three had their causative organism identified: 49 (71.0%) enterovirus (aged 1 week to 42 years; median 1 year); 12 (17.4%) human herpes virus type 6 (HHV 6) (aged 1-14 months); three (4.3%) varicella/herpes zoster virus (aged 20-54 years); one (1.5%) parechovirus (aged one month); and one (1.5%) herpes simplex virus type 1 (aged 2 months). Figure 6 presents both the total number of viral meningitis NOS cases and those not caused by enterovirus by year and by quarter since 2009. No viral-meningitis outbreaks or deaths were reported in this quarter.

In Q1-2019, the highest frequency of cases occurred in infants <1 years of age (n=36/69; 52.2%) and in adults aged 15-39 years (n=23/69; 33.3%) (Figure 7). Of the 36 cases aged <1 year, 25 (69.4%) were attributable to enterovirus, nine (25%) to HHV6 and one (2.8%) each to parechovirus and HSV type 1. In contrast, of the 23 cases aged 15-34 years, 19 (82.6%) were attributable to enterovirus, two (9.0%) each to varicella zoster virus and not specified.

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 four in Q1-2019), 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.

The average Q1 percentage of all viral meningitis (VM) cases attributable to enterovirus since 2015 to date has been 64.4%. Details of enterovirus serotypes by age group in Q1-2019 are presented in Table 7 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

All of the Q1-2019 enterovirus related viral meningitis events in CIDR were matched to NVRL enterovirus typing records provided to the HPSC on May 20th, 2019.

Of the 49 enterovirus-related VM cases in Q1-2019, 18 (36.7%) were in HSE E and 14 (28.6%) in HSE S, compared to Q1-2018, when there were 20 cases reported, 9 (45%) in HSE-E and two (10%) in HSE-S (Appendices 12, 13). Of the 49 cases in this quarter, 17 (34.7%) were attributable to echovirus B30 (Table 7), five occurred in HSE E and 10 in HSE-S.

Table 7. Enterovirus genotypes by age group (years) on CIDR in Q1-2019
(Enterovirus genotyping targets the VP1 gene of the virus)

Genus	Species	Type	Age Group (years)					Total
			<1	1-4	5-14	15-39	40+	
Enterovirus	Enterovirus A	Coxsackievirus A6	2	1	0	0	0	3
		Coxsackievirus A16	2	0	0	0	0	2
		Coxsackievirus A8	1	0	0	0	0	1
		Coxsackievirus B1	3	0	0	0	0	3
		Coxsackievirus B3	1	0	0	0	0	1
	Enterovirus B	Coxsackievirus B4	1	0	0	0	0	1
		Coxsackievirus B5	1	0	0	0	0	1
		Echovirus 6	0	0	0	3	0	3
		Echovirus 9	1	0	1	2	0	4
		Echovirus 13	0	0	0	1	1	2
		Echovirus 18	0	0	0	1	0	1
		Echovirus 25	2	0	0	0	0	2
	Echovirus 30	7	1	1	8	0	17	
	Enterovirus C	-	0	0	0	0	0	0
	Enterovirus D	-	0	0	0	0	0	0
	Rhinovirus A	-	0	0	0	0	0	0
	Unable to generate sequence	-	0	0	0	0	0	0
Not specified	-	4	0	0	4	0	8	
Total			25	2	2	19	1	49

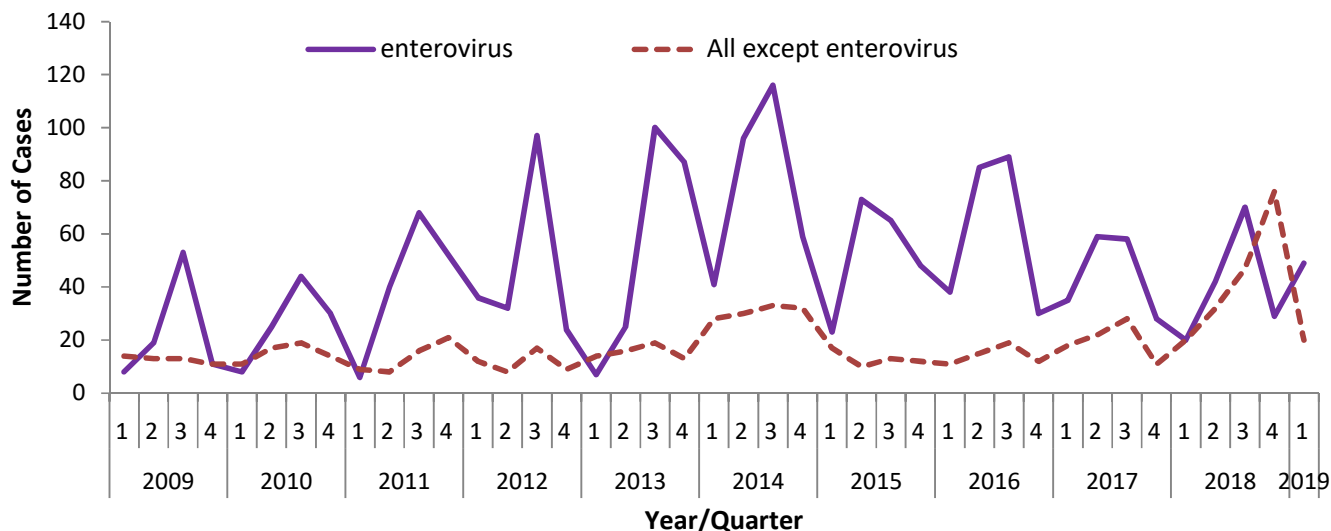


Figure 6. Number of viral meningitis (NOS) cases caused by enterovirus and all except enterovirus by quarter and year, 2009-2019*

*Includes 52 late retrospective/late notifications of parechovirus in Q3 to Q4 in 2018, three in Q3 and 49 in Q4

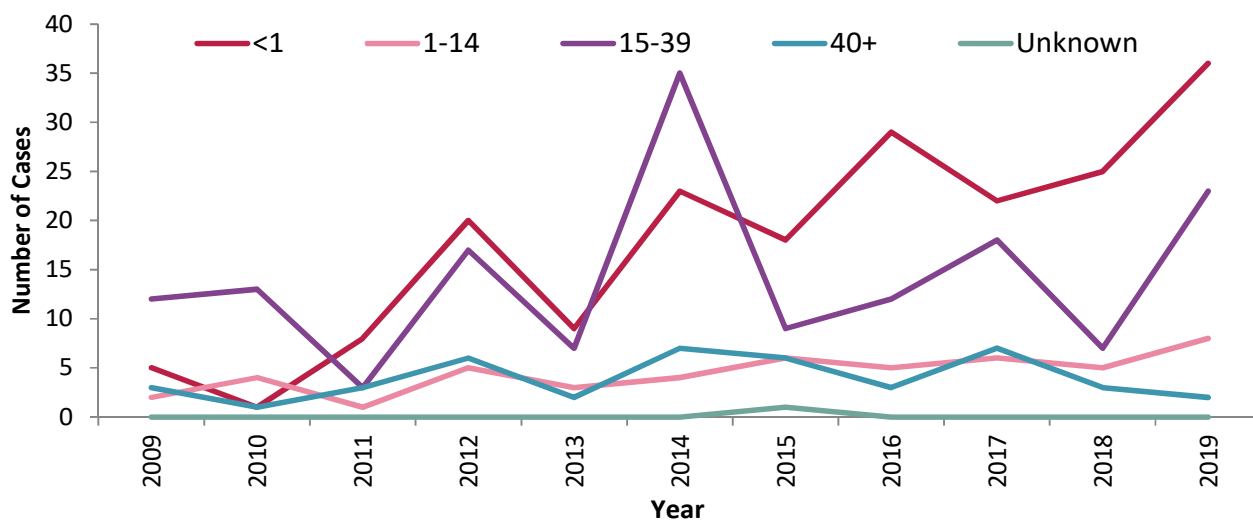


Figure 7. Quarter 1 number of viral meningitis (NOS) cases in Ireland by age group (years), 2009-2019

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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/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/>
- If there are more than two weeks between meningococcal positive sterile site laboratory results from the same patient then they should be regarded as two separate episodes and therefore two notifications should be reported to CIDR

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 (e.g. asplenia/hyposplenism/complement deficiency, haematopoietic Stem Cell Transplant recipients) are recommended the Hib vaccine). Please see NIAC guidance for further details
- 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/>
- If there are more than two weeks between *H. influenzae* positive sterile site laboratory results from the same patient then they should be regarded as two separate episodes and therefore two notifications should be reported to CIDR

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

APPENDICES

Appendix 1. IMD Cases by Serogroup in Quarter 1, 2004-2019

Serogroup	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	Q1-2019
SgB	55	59	57	49	49	41	45	33	22	19	21	12	15	12	23	17
SgC	4	1	0	0	1	2	1	0	0	1	3	4	4	12	10	7
W135	0	1	0	1	1	2	0	0	0	2	0	2	1	2	4	5
SgY	0	1	2	0	0	2	0	1	1	1	0	2	0	0	3	3
NG	0	2	1	0	0	0	0	0	0	0	0	0	1	1	0	0
Sg29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	7	8	12	7	4	5	6	1	1	0	0	2	2	0	2	6
Total	66	72	72	57	55	52	52	35	24	23	24	22	23	27	42	38

NG=non-groupable

Appendix 2. IMD Cases by Quarter, 2004-2019

Qr	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2004-2019 change
Q1	66	72	72	57	55	52	52	35	24	23	24	22	23	27	42	38	-42.4%
Q2	47	57	55	44	31	33	23	24	13	25	21	17	18	20	17	-	-
Q3	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18	-	-
Q4	43	43	44	37	48	31	24	21	21	20	30	19	26	17	12	-	-
Total	198	203	208	179	168	147	114	94	66	81	82	74	87	76	89	-	-

Appendix 3. IMD Cases by HSE Area in Quarter 1, 2004-2019

HSE Area	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	Q1-2019	Q1-2019 CIR*
E	21	25	33	14	12	13	20	7	8	10	5	4	3	3	21	17	0.99
M	5	5	4	4	3	3	1	5	2	1	2	2	1	1	2	2	0.68
MW	3	7	5	6	6	5	8	3	3	2	1	0	2	3	3	7	1.82
NE	9	6	4	4	11	9	4	5	5	3	5	1	1	3	9	1	0.22
NW	5	4	3	6	2	1	6	4	1	2	3	3	6	1	1	0	0.00
SE	5	10	9	10	11	8	9	5	1	1	3	3	2	3	0	3	0.43
S	11	9	11	6	9	11	3	4	2	2	1	5	5	6	3	4	0.78
W	7	6	3	7	1	2	1	2	2	2	4	4	3	7	3	4	0.88
Total	66	72	72	57	55	52	52	35	24	23	24	22	23	27	42	38	0.80

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 1, 2004-2019

Age Group (Yrs)	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	Q1-2019	Q1-2019 CIR*
<1	14	19	18	16	12	12	12	11	9	4	5	4	6	5	4	4	6.42
1-4	21	32	25	20	18	15	22	9	4	7	8	8	3	5	13	8	2.97
5-9	8	4	8	1	8	4	4	6	4	3	2	2	2	1	5	2	0.56
10-14	5	2	3	5	4	3	2	1	1	1	0	0	3	2	2	2	0.63
15-19	6	6	10	6	4	7	6	2	1	3	3	5	5	2	6	3	0.99
20-24	5	3	2	2	4	4	1	1	0	1	2	1	2	1	1	4	1.46
25-34	1	0	0	3	0	2	2	2	0	0	0	0	0	0	1	1	0.15
35-44	1	1	3	1	0	0	0	1	1	1	1	1	0	3	1	4	0.54
45-54	1	2	2	0	1	2	0	2	3	0	1	0	0	1	2	2	0.32
55-64	2	3	0	1	2	0	1	0	0	2	0	0	0	2	2	3	0.59
65+	2	0	1	2	2	3	2	0	1	1	2	1	2	5	5	5	0.78
Total	66	72	72	57	55	52	52	35	24	23	24	22	23	27	42	38	0.80

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 1, 2004-2019

Serogroup	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	Q1-2019
SgB	4	4	2	2	3	3	2	1	1	1	1	0	1	0	1	3
SgC	1	0	0	0	1	0	0	0	0	0	0	0	0	4	2	1
SgW	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1
SgY	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
NG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sg29E	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	1	0	0	1
Total	5	4	2	2	5	3	2	1	2	1	1	0	2	4	5	6
%CFR* (Total)	7.6	5.6	2.8	3.5	9.1	5.8	3.8	2.9	8.3	4.3	4.2	0.0	8.7	14.8	11.9	15.8

* %CFR, case fatality ratio; NG=non-groupable

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 1, 2009-2019 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019	Q1:2009-2019
Specified	<i>Leptospira</i> spp.	0	0	0	0	0	0	0	0	0	0	0	0
	<i>Listeria</i> spp.	0	0	1	0	1	0	2	2	1	0	0	7
	<i>Mycobacterium tuberculosis</i> #	1	3	0	2	1	0	0	0	0	0	1	7
	<i>Streptococcus pneumoniae</i>	7	4	8	10	7	13	11	13	10	13	10	106
	<i>Streptococcus agalactiae</i> *	na	na	na	3	2	3	2	0	2	1	1	14
	<i>Streptococcus pyogenes</i>	0	1	0	0	2	0	2	0	1	0	0	6
	<i>Salmonella</i> spp.	0	0	0	0	0	0	0	0	0	0	0	0
Not otherwise specified	<i>Acinetobacter</i> spp.	0	0	0	0	0	0	0	0	0	1	0	1
	<i>Escherichia coli</i>	1	0	0	0	0	1	2	1	4	1	1	11
	<i>Staphylococcus aureus</i>	0	2	0	0	0	0	0	0	0	0	1	3
	<i>Staphylococcus capitis</i>	0	0	0	0	0	0	0	0	0	0	1	1
	<i>Streptococcus agalactiae</i> †	2	2	4	0	0	0	0	0	0	1	0	9
	<i>Streptococcus bovis</i> biotype II/2	1	0	0	0	0	0	0	0	0	0	0	1
	Unknown/Not specified	6	8	2	4	2	1	2	2	2	3	2	34
Total	18	20	15	19	15	18	21	18	20	20	17	200	

#TB meningitis figures for 2019 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 cases reported here are based on the difference between CIDR event creation date and date of birth, not the difference between onset date and date of birth

†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, 2009-2019

Type	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019
a	0	0	0	0	0	0	0	0	0	0	0
b	1	1	1	3	2	0	0	1	0	0	1
d	0	0	0	0	0	0	0	0	1	0	0
e	3	0	0	0	1	0	0	0	0	0	0
f	3	0	0	3	2	1	1	2	3	3	2
not type-b	0	0	0	0	1	0	2	0	0	0	0
non-typeable	9	7	10	7	12	11	7	10	10	17	16
not typed*	3	2	0	3	0	4	11	5	6	1	4
Total	19	10	11	16	18	16	21	18	20	21	23

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

Appendix 8. *H. influenzae* Cases by Quarter, 2009-2019

Qr	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2009-2019 change
Q1	19	10	11	16	18	16	21	18	20	21	23	+21.1%
Q2	12	9	16	5	7	14	15	15	12	22	-	-
Q3	4	3	7	10	9	15	8	11	7	4	-	-
Q4	8	6	10	10	7	16	8	14	6	11	-	-
Total	43	28	44	41	41	61	52	58	45	58	-	-
<i>Meningitis</i>	3	2	4	3	2	7	5	1	1	4	-	-
<i>Type b meningitis</i>	0	1	0	1	0	0	0	0	0	0	-	-

Appendix 9. *H. influenzae* Cases by HSE Area in Quarter 1, 2009-2019

HSE Area	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019	Q1-2019 CIR*
E	9	4	3	7	5	5	8	7	7	10	6	0.35
M	1	0	2	0	2	1	0	0	4	0	1	0.34
MW	4	0	0	1	1	2	2	1	3	1	4	1.04
NE	0	0	2	3	2	3	3	2	1	3	1	0.22
NW	0	0	1	1	2	0	1	1	1	1	0	0.00
SE	1	3	1	1	2	2	4	0	0	4	3	0.43
S	2	3	1	3	2	2	2	3	1	1	6	1.18
W	2	0	1	0	2	1	1	4	3	1	2	0.44
Total	19	10	11	16	18	16	21	18	20	21	23	0.48

* CIR, crude incidence rate per 100,000

Appendix 10. *H. influenzae* Cases by Age Group in Quarter 1, 2009-2019

Age Grp (Yrs)	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019	Q1-2019 CIR*
<1	2	0	0	3	2	3	8	2	3	1	1	1.61
1-4	4	1	0	1	3	3	4	2	1	0	1	0.37
5-9	3	0	1	2	1	1	1	1	1	0	1	0.28
10-14	1	0	0	0	0	0	0	1	1	1	0	0.00
15-19	0	0	0	0	0	0	1	0	1	1	0	0.00
20-24	0	0	0	1	0	0	0	1	0	0	0	0.00
25-34	1	2	0	0	2	1	1	4	0	0	1	0.15
35-44	1	0	3	0	0	0	1	1	1	2	1	0.13
45-54	0	0	1	1	0	1	0	1	6	2	1	0.16
55-64	1	0	1	2	2	1	0	0	2	3	2	0.39
65+	6	7	5	6	8	6	5	5	4	11	15	2.35
Total	19	10	11	16	18	16	21	18	20	21	23	0.48

* CIR, crude incidence rate per 100,000

Appendix 11. Viral Meningitis Cases, Not Otherwise Specified, by Causative Organism in Quarter 1, 2009-2019

Causative Organism	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019
enterovirus group A	0	0	0	0	0	0	0	0	0	0	6
enterovirus group B	0	0	0	1	0	0	0	0	21	15	35
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	8	8	6	35	7	41	23	38	14	5	8
human herpes virus type 6	0	1	3	4	6	11	4	9	9	14	12
varicella/herpes zoster virus	1	3	0	0	0	9	6	1	2	2	3
herpes simplex virus*	2	1	2	3	3	4	2	1	3	2	1
parechovirus	0	0	0	0	0	0	4	0	1	0	1
adenovirus	0	0	0	1	0	0	0	0	0	0	0
not specified	11	6	4	5	5	4	1	0	3	2	3
Total	22	19	15	48	21	69	40	49	53	40	69
% known causative organism	50.0	68.4	73.3	89.6	76.2	94.2	97.5	100.0	94.3	95.0	95.7

*Includes types 1 and 2; not included in this report are meningitis-related cases of neonatal (aged < 42 days) herpes simplex virus on or after 18/12/2019, if any

Appendix 12. Enterovirus-related Viral Meningitis Cases by HSE Area in Quarter 1, 2009-2019

HSE Area	Q1-2009	Q1-2010	Q1-2011	Q1-2012	Q1-2013	Q1-2014	Q1-2015	Q1-2016	Q1-2017	Q1-2018	Q1-2019
E	5	3	6	23	3	16	14	19	11	9	18
M	2	0	0	2	0	2	1	0	1	1	1
MW	0	1	0	3	0	3	1	2	4	0	1
NE	0	1	0	1	1	3	1	6	2	1	2
NW	0	2	0	0	1	1	0	3	0	1	4
SE	0	1	0	3	0	3	4	2	5	4	5
S	1	0	0	1	0	5	1	2	5	2	14
W	0	0	0	3	2	8	1	4	7	2	4
Total	8	8	6	36	7	41	23	38	35	20	49

Appendix 13. Enterovirus-related Viral Meningitis Cases by Quarter, 2009-2019

Qr	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2009-2019 change
Q1	8	8	6	36	7	41	23	38	35	20	49	+512.5%
Q2	19	25	40	32	25	96	73	85	59	42	-	-
Q3	53	44	68	97	100	116	65	89	58	70	-	-
Q4	11	30	52	24	87	59	48	30	28	29	-	-
Total	91	107	166	189	219	312	209	242	180	161	-	-