Version 1.0

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)

Q3-2019 **9th December 2019**

Provisional Figures

Summary

- **Invasive meningococcal disease (IMD)**
  - Seven IMD cases were notified (crude incidence rate 0.15/100,000), with the highest incidence among 15-19 year olds (1.0/100,000); all cases confirmed
  - Serogroup (Sg) was identified for all cases; two (28.6%) each for SgB, SgC and SgY and one (14.2%) for SgW
  - No cases of SgB <1 year of age and of the two SgC cases (age range 19-20 years), one was incompletely vaccinated with three primary childhood doses received and the other had no vaccination history
  - No deaths or outbreaks reported

- **Other bacterial meningitis (specified and not otherwise specified)**
  - Two cases of meningitis were related to invasive *Streptococcus pneumoniae* infections (IPD)
  - Three cases of Group B Strep (*Streptococcus agalactiae*) meningitis (aged ≤1 month)
  - Three cases of listerosis (*Listeria monocytogenes*) (aged 10 months to 76 years): one with a 4b serotype, another with a 1/2a type and a third with no typing details
  - Four cases of bacterial meningitis due to pathogens not otherwise specified (NOS): two confirmed cases of *Escherichia coli*, one confirmed case with no organism details reported and one possible case (age range 1 week to 15 months).
  - No deaths reported

- ***Haemophilus influenzae* invasive**
  - Six cases of *H. Influenzae* were reported, one of which had meningitis: one type f, four non-typeable (including one which was meningitis-related) and one not typed (age range 18 to 83 years)
  - One case (aged 55-59 years) died with a non-typeable infection, but actual cause of death not reported
  - No outbreaks reported

- **Viral meningitis (specified and not otherwise specified)**
  - Two cases of mumps-related meningitis were reported (age range 16-23 years), both had received two doses of the MMR vaccine
  - One hospitalised case of chickenpox in a one month old
  - One hundred and eleven viral meningitis (VE) notifications (NOS) including:
    - 87 (78.4%) enterovirus (aged 2 weeks to 69 years; median 14.3 months);
    - 16 (14.4%) human herpes virus type 6 (HHV 6) (aged 1 month-56 years);
    - three (2.7%) varicella/herpes zoster virus (aged 13-20 years); two parechovirus; (1.8%) (aged 2 months each); one herpes simplex virus type 1 (aged 30-34 years) and two (1.8%) with an unspecified cause (aged 18-49 years)

- o No outbreaks or deaths were 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

		MenC				MenB
Schedule	**No. doses**	**Oct ’00-Jun ‘08**	**Jul’08-Jun ‘15**	**Jul’15-Sept ‘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 those <23 years of age
†Adolescent dose introduced in 2014
NA: Not applicable

MenACWYvaccine for adolescents recommended for adolescents academic year 2019/20. To be implemented for this cohort until 2020

Data presented in this reported were extracted from CIDR from the **9th December 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 Q3-2019, seven cases of IMD were notified, all of which were classified as confirmed. No outbreaks or imported cases were reported during this period.

Serogroups B, C and Y disease each accounted for 28.6% (n=2/7) of all IMD notifications and SgW for 14.3% (n=1) (Table 2, Figures 1-3, Appendix 1).

Ethnicity was recorded as White for one case (14.3%) and six (85.7%) as not specified.

There were no cases of SgB <1 year of age and of the two SgC cases (age range 19-20 years), one was incompletely vaccinated with three doses received and the other had no vaccination history reported.

Table 2. Classification of IMD cases notified by Serogroup in Q3-2019

Case Classification	SgB	SgC	SgW	SgY	NG	Sg29E	No organism detected	Total
Confirmed	2	2	1	2	0	0	0	7
Probable	0	0	0	0	0	0	0	0
Possible	0	0	0	0	0	0	0	0
Not specified	0	0	0	0	0	0	0	0
Total	**2**	**2**	**1**	**2**	**0**	**0**	**0**	**7**

Figure 1. **Number of IMD cases notified in Ireland by serogroup by quarter and year, 2015-2019**

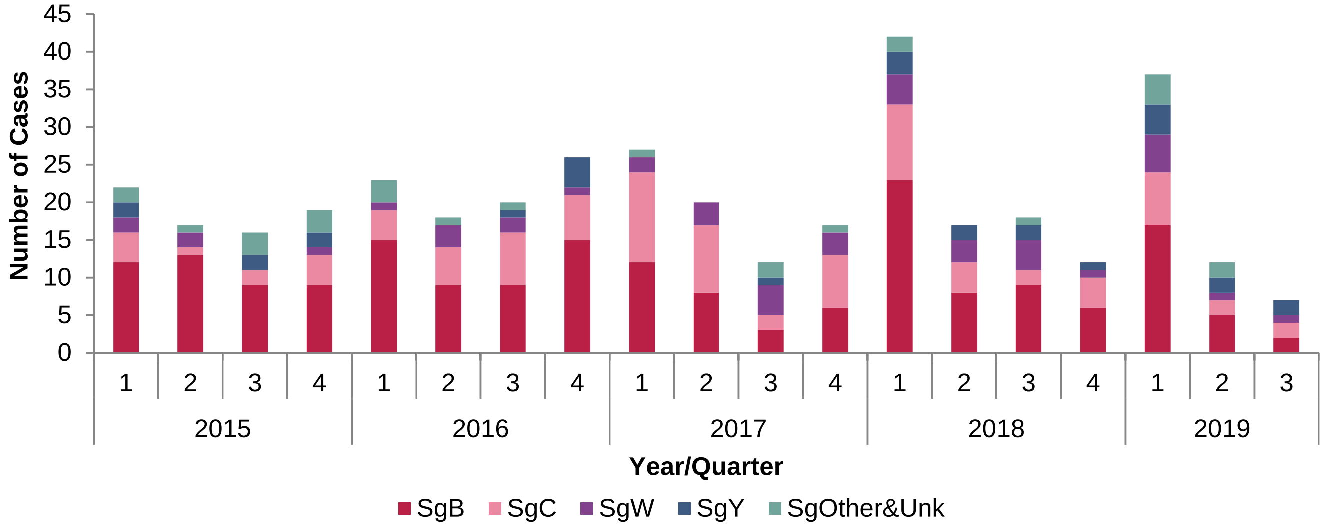
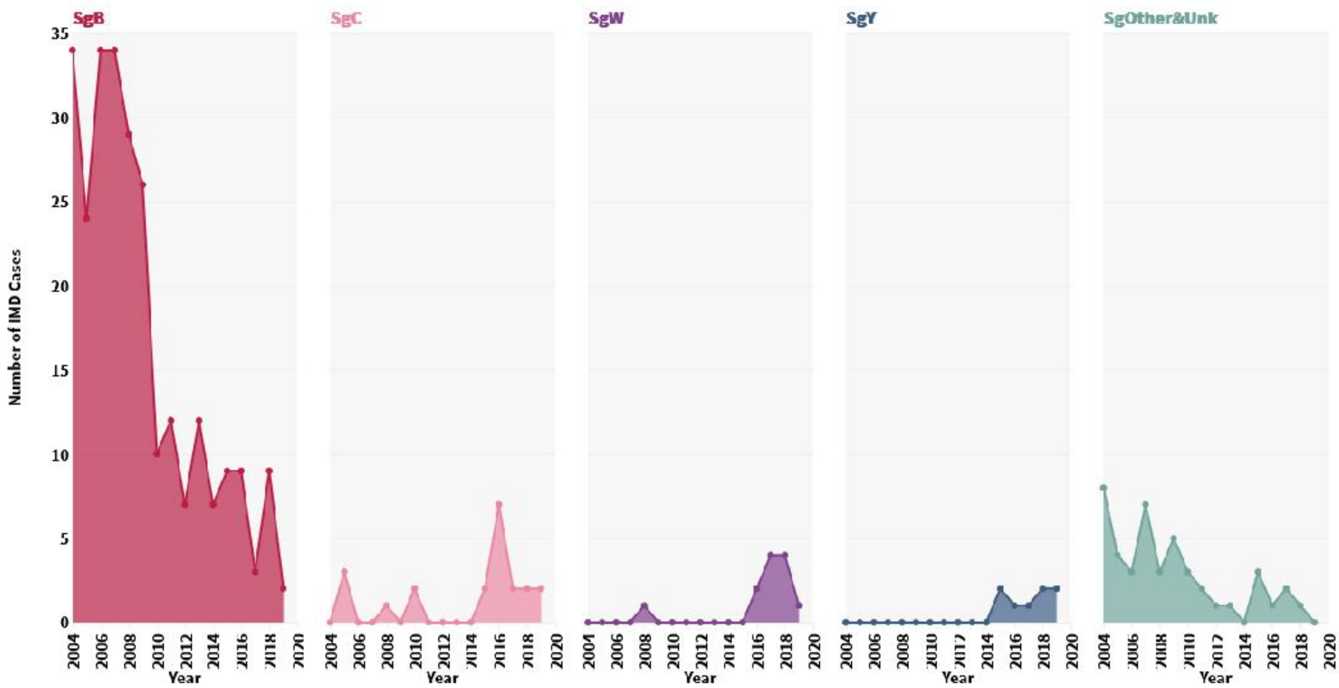


Figure 2. **Number of IMD cases notified in Ireland by serogroup (including SgB, SgC, SgW, SgY) in Q3 of each year between 2004 and 2019**



IMD Trends & Outbreaks

Overall, since 2004 there has been a marked decline in SgB, SgC is declining again after peaking in 2016, and SgW and Y have increased in recent years. The number of IMD cases reported in Q3-2019 (n=7) was significantly lower than the average number reported in the same quarter over the previous three years (average=16.7, 95%CI 11.8-21.5); for SgB the average was 7.0, for SgC it was 3.7, for SgW it was 3.3 and for SgY it was 1.3 (Appendix 1). The number of IMD cases reported in Q3 has fallen by 83.3% since 2004 (from 42 to 7 cases) (Appendix 2), most notably the SgB cases (93.8% decline from 32 to 2 cases). (Appendix 1).

All seven IMD cases and their serogroupings on CIDR in Q3-2019 were matched to records by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL) in Temple Street Children's University Hospital received on December 4th, 2019.

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q3-2019 was 0.15 cases per 100,000 population, with regional variation (range (0.0/100,000 in six HSE areas to 0.35/100,000 in HSE E) (Appendix 3). Incidence rate was highest in the 15-19 year of age group at 1.0 case per 100,000 population, followed by 0.7 cases/100,000 in the 1-4 year age group (Appendix 4). For the first time since 1999, there were no quarterly IMD cases in the <1 year age group.

IMD associated deaths

There were no deaths reported in Q3-2019; the average number of deaths in the same quarter between 2016 and 2018 was 1.0.

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q3-2019 two cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified with no serotype identified, one of whom was vaccinated with the PPV23 / Pneumovax vaccine. The age range was 73-77 years (Appendix 6). No deaths or imported cases were reported.

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

Three cases of meningitis-related Group B Strep (*Streptococcus agalactiae*) (aged ≤1 month), along with one other CSF PCR positive case of *S. agalactiae* (aged ≤1 week) were reported during Q3-2019; the latter case, however, was not labelled as having clinical meningitis or any other clinical description. Three cases of listerosis (*Listeria monocytogenes*) (aged 10 months to 76 years) were also reported: one with a 4b serotype, another with a 1/2a type and a third with no typing details.

Bacterial meningitis (not otherwise specified)

Four cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified during Q3-2019. Among these cases were two cases of *Escherichia coli* (aged ≤2 months), one conformed case with no organism details reported and one possible case (age range 3 weeks to 15 months) (Appendix 6).

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q2-2019, six cases of *H. influenzae* were notified, all were case classified as confirmed (Figure 4): one type f, four non-typeable (including one which was meningitis-related) and one not typed (age range 18 to 83 years). This total compares to an average of 7.3 cases for the same quarter in 2016 to 2018 (Table 4, Appendices 7, 8). One case (aged 55-59 years) died with a non-typeable infection, but the actual cause of death was not reported.

No outbreaks or imported cases were reported during this period. Of all the Q3 cases reported between 2017 and 2019, 23.5% (n=4/17) had no clinical diagnosis reported (Tables 5, 6). In Q3-2019, non-typeable cases accounted for four of the six cases (66.7%), somewhat higher than the average of 62.3% recorded during the same quarter between 2009 and 2018 (Figures 3).

Table 3. Number of *H. influenzae* cases notified in the third quarter of 2017, 2018 and 2019

Number of cases	Q3-2017	Q3-2018	Q3-2019
All *H. influenzae*	7	4	6
All *H. influenzae* <5yrs	1	2	0
All *H. influenzae* ≥65yrs	3	2	2
H. influenzae type b	1	0	0
H. influenzae type b <5yrs	0	0	0
H. influenzae type b >=65yrs	1	0	0
H. influenzae non-typeable	4	4	4
H. influenzae non-typeable <5yrs	0	2	0
H. influenzae non-typeable ≥65yrs	2	2	1

Table 4. **Number of *H. influenzae* cases by clinical diagnosis notified in Q3 of 2017, 2018 and 2019**

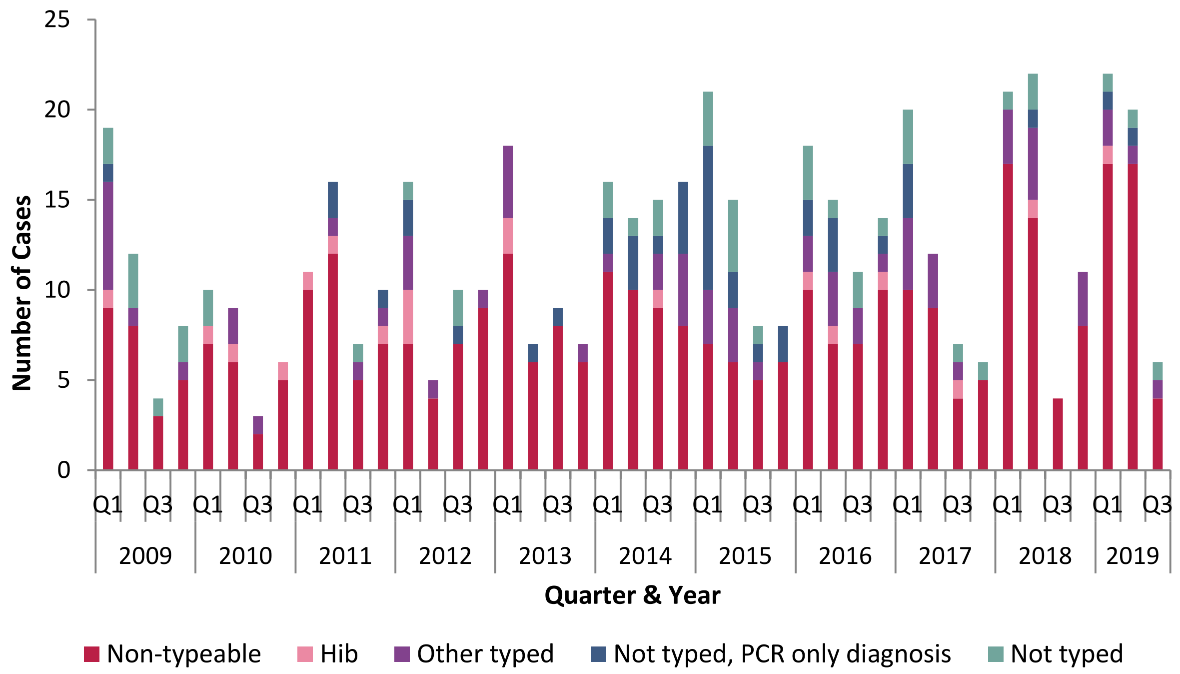
Number of cases	Q3-2017	Q3-2018	Q3 2019	Q3-2017 to 2019 Total	Q3-2017 to 2019 Total (%)
Septicaemia	2	1	1	4	23.5
Bacteraemia (without focus)	1	0	1	2	11.8
Pneumonia	0	0	0	0	0.0
Meningitis	0	1	1	2	11.8
Meningitis & septicaemia	0	0	0	0	0.0
Other	1	2	2	5	29.4
Cellulitis	0	0	0	0	0.0
Epiglottitis	0	0	0	0	0.0
Osteomyelitis	0	0	0	0	0.0
Septic arthritis	0	0	0	0	0.0
Clinical diagnosis not reported	3	0	1	4	23.5
Total	**7**	**4**	**6**	**17**	**100**

Table 5. **Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q3-2019**

Number of cases	Typed (a, b, d, e, f, d or not-b)	Non-typeable	Not typed*	Total
Septicaemia	0	1	0	1
Bacteraemia (without focus)	1	0	0	1
Pneumonia	0	0	0	0
Meningitis	0	1	0	1
Meningitis & septicaemia	0	0	0	0
Other	0	2	0	2
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	0	0	1	1
Total	**1**	**4**	**1**	**6**

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

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



Five of the six Haemophilus cases on CIDR in Q3-2019 were matched to records by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL) in Temple Street Children's University Hospital received on October 23rd, 2019, one of which was linked to a non-invasive laboratory specimen, peritoneal fluid.

Figures 4 and 5 present the number of type b cases (Hib) by age group and vaccination status since 2011 and the absence of total vaccine failures (TVFs) during that period. In Q3-2019, four non-typeable cases was reported (aged 18 to 66 years), less than the average of five cases in the same quarter between 2016 and 2018 (Figure 6).

Figure 4. Quarterly number of Hib cases by age group since 2011

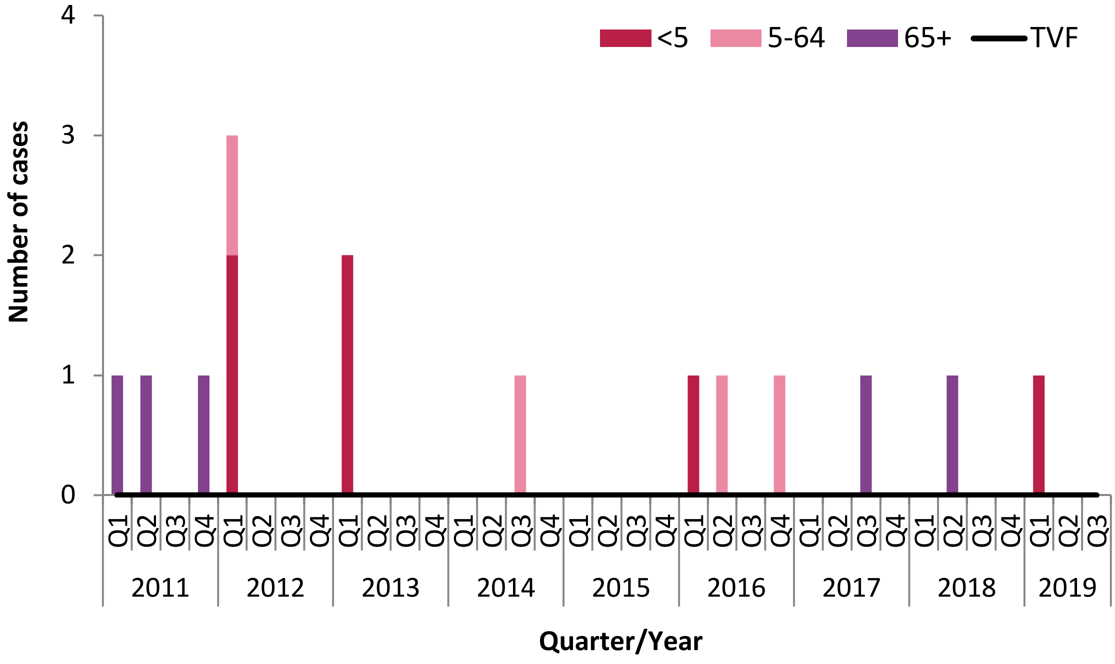


Figure 5. Quarterly number of Hib cases by vaccination status since 2011

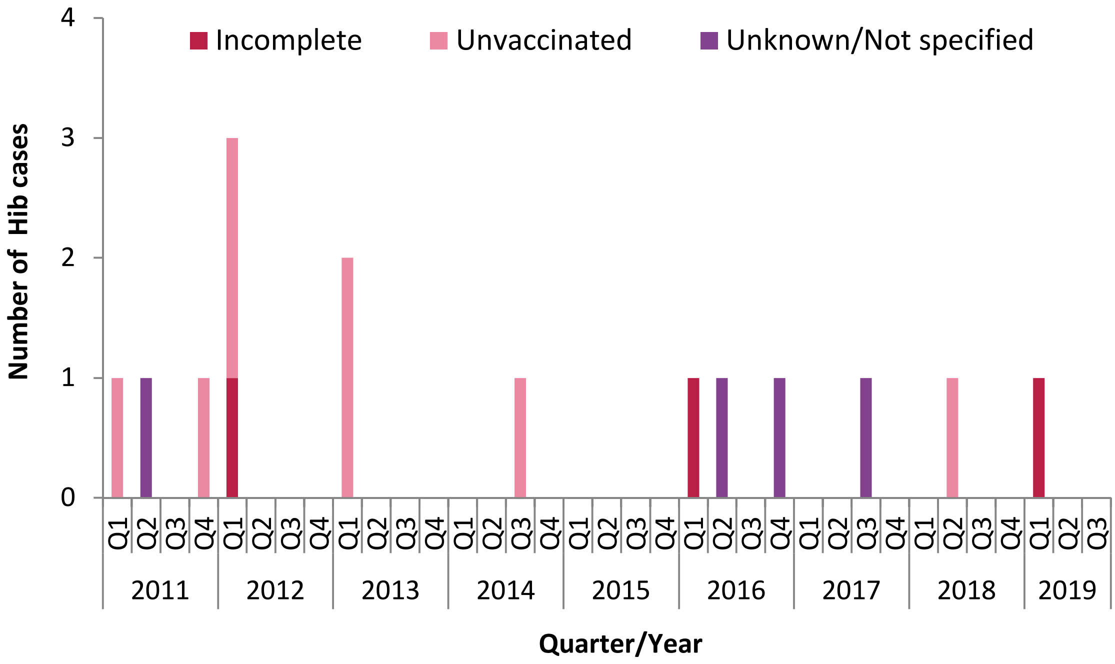
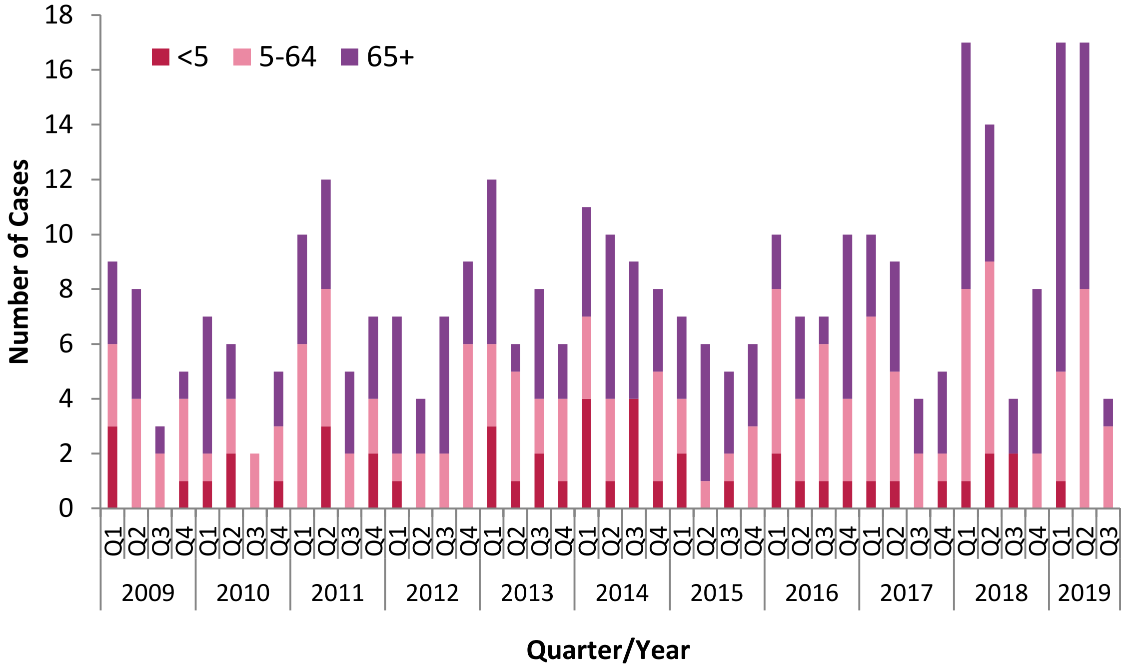


Figure 6. Quarterly number of non-typeable/non-capsulated cases by age group, since 2009



Viral Meningitis (Specified and Not Otherwise Specified)

Two cases of meningitis-related mumps were reported in Q3-2019 (age range 16-23 years), both had received two doses of the MMR vaccine. One hospitalised case of chickenpox with meningitis in a one month old was also reported at this time.

One hundred and eleven viral meningitis (VE) notifications (NOS) (aged 2 weeks to 69 years; median 11.5 months) were reported in Q3-2019 (Figures 7, 8). All but two had their causative organism identified: 87 (78.4%) enterovirus (aged 2 weeks to 69 years; median 14.3 months); 16 (14.4%) human herpes virus type 6 (HHV 6) (aged 1 month-56 years); three (2.7%) varicella/herpes zoster virus (aged 13-20 years); two parechovirus; (1.8%) (aged 2 months each); one herpes simplex virus type 1 (aged 30-34 years) and two (1.8%) with an unspecified cause (aged 18-49 years). Figure 8 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 Q3-2019, the highest frequency of VE, NOS cases occurred in infants <1 years of age (n=56/111; 50.5%) and in adults aged 15-39 years (n=37/111; 33.3%) (Figure 8). Of the 56 cases aged <1 year, 42 (75%) were attributable to enterovirus, 12 (21.4%) to HHV6 and two (3.6%) to parechovirus. In contrast, of the 37 cases aged 15-34 years, 33 (89.2% were attributable to enterovirus, the remainder consisted of two (5.4%) varicella/herpes zoster virus and one (2.7%) each of HHV6 and HSV1.

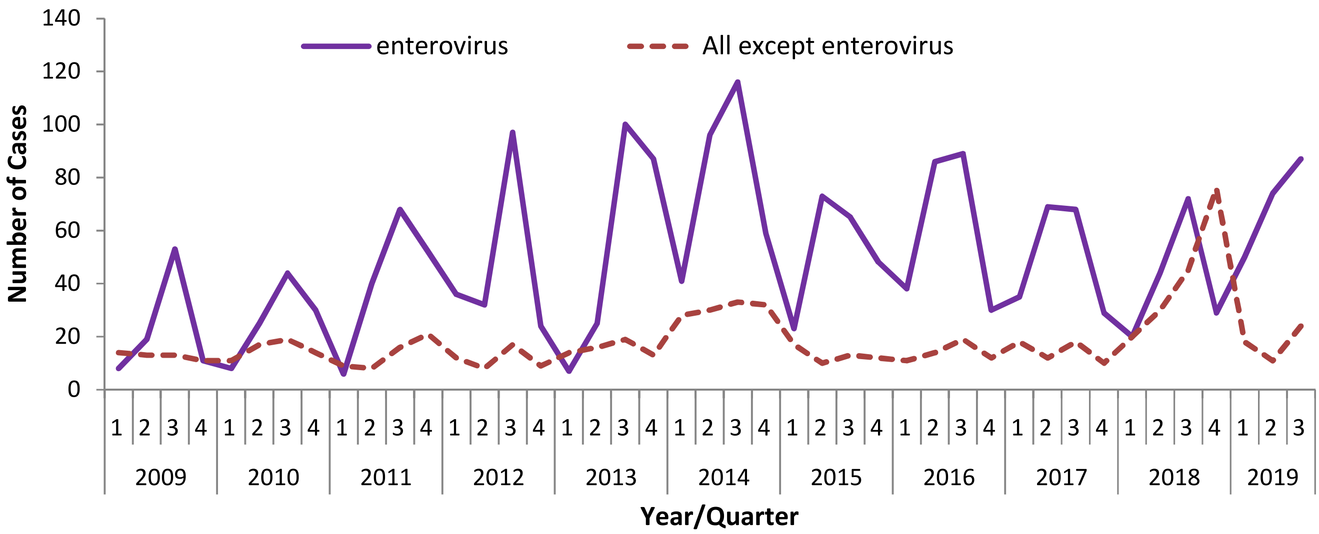
Caution is recommended regarding the detection of HHV6 DNA in cerebral spinal fluid (CSF) specimens, especially in those aged ≤3 months (90 days) (of which there were four in Q3-2019), as HHV 6 DNA can be chromosomally integrated. When this occurs the HHV 6 DNA can be inherited through the germ line and therefore when it is detected, it may not be clinically relevant.

The average Q3 percentage of all viral meningitis (VM) cases attributable to enterovirus since 2015 to date has been 77%. Details of enterovirus serotypes by age group in Q3-2019 are presented in Table 6 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

All but 11 of the 87 enterovirus related viral meningitis events in CIDR in Q3-2019 were matched to NVRL enterovirus typing records provided to the HPSC on December 4th, 2019 (Table 6); at the time of writing, there was one NVRL lab record in this same listing, an echovirus 13, that was unmatched to its corresponding CIDR event.

Of the 87 enterovirus-related VM cases in Q3-2019, 35 (40.2%) were in HSE E, compared to Q3-2018, when there were 72 cases reported with 22 (30.6%) (Appendices 12,13). Of the 87 cases in this quarter, 12 (13.8%) were attributable to echovirus B30 (Table 6), seven occurred in HSE E, three in HSE W and one each in HSE M and HSE MW.

Figure 7. Number of viral meningitis (NOS) cases caused by enterovirus and all except enterovirus by quarter and year, 2009-2019*

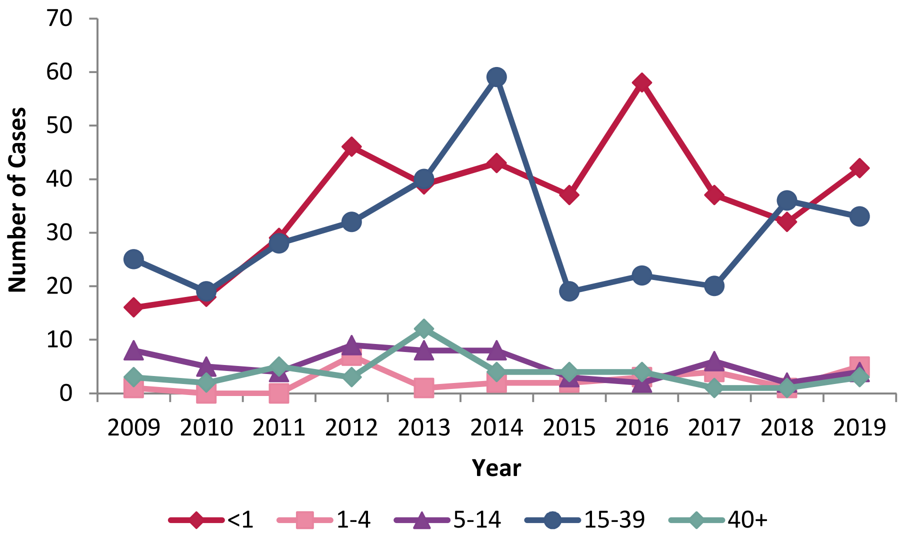


*Includes 52 late retrospective/late notifications of parechovirus in Q3 to Q4 in 2018, three in Q3 and 49 in Q4

Table 6. Enterovirus genotypes by age group (years) on CIDR in Q3-2019
(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	Coxsackievirus A2	0	1	0	0	0	1
		Coxsackievirus A6	0	1	0	0	0	1
	Enterovirus B	Coxsackievirus A9	4	0	0	2	0	6
		Coxsackievirus B1	2	0	0	2	0	4
		Coxsackievirus B4	3	0	0	0	0	3
		Coxsackievirus B5	1	1	0	1	1	4
		Echovirus 3	1	0	0	0	0	1
		Echovirus 7	5	0	0	1	0	6
		Echovirus 9	1	0	1	0	0	2
		Echovirus 11	2	0	0	2	0	4
		Echovirus 16	1	0	0	0	0	1
		Echovirus 13	2	0	0	0	0	2
		Echovirus 18	2	0	0	1	0	3
		Echovirus 21	3	2	2	4	0	11
		Echovirus 25	6	0	0	1	0	7
		Echovirus 30	3	0	1	6	2	12
	Unable to generate sequence	Enterovirus-Unable to generate sequence for this sample	0	0	0	2	0	2
	Not tested	Enterovirus -Not tested	3	0	0	3	0	6
	Not specified	Enterovirus-Not specified	3	0	0	8	0	11
Total			**42**	**5**	**4**	**33**	**3**	**87**

Figure 8. **Quarter 3 number of enterovirus-related viral meningitis (NOS) cases in Ireland by age group (years), 2009-2019**



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

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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 3, 2004-2019

Serogroup	Q3-2004	Q3-2005	Q3-2006	Q3-2007	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019
SgB	34	24	34	34	29	26	10	12	7	12	7	9	9	3	9	2
SgC	0	3	0	0	1	0	2	0	0	0	0	2	7	2	2	2
SgW	0	0	0	0	1	0	0	0	0	0	0	0	2	4	4	1
SgY	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2	2
SgNG	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Sg29E	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
No organism detected	8	4	3	7	2	5	3	2	1	1	0	2	1	1	1	0
Total	**42**	**31**	**37**	**41**	**34**	**31**	**15**	**14**	**8**	**13**	**7**	**16**	**20**	**12**	**18**	**7**

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	37	-43.9%
Q2	47	57	55	44	31	33	23	24	13	25	21	17	18	20	17	12	-74.5%
Q3	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18	7	-83.3%
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 3, 2004-2019

HSE Area	Q3-2004	Q3-2005	Q3-2006	Q3-2007	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019	Q3-2019 CIR*
E	12	16	14	12	11	15	3	6	2	3	2	5	10	3	5	6	0.35
M	0	2	0	1	4	2	0	0	2	0	1	0	0	2	2	0	0.00
MW	5	1	2	5	1	3	0	1	2	2	0	1	1	1	0	0	0.00
NE	6	2	5	6	3	2	1	1	0	1	1	3	2	0	1	0	0.00
NW	2	3	1	3	1	3	1	0	1	2	0	2	1	1	2	0	0.00
SE	10	0	5	3	4	0	3	1	0	2	1	3	1	1	3	0	0.00
S	6	5	6	7	7	3	4	3	1	1	1	2	4	2	3	1	0.20
W	1	2	4	4	3	3	3	2	0	2	1	0	1	2	2	0	0.00
Total	**42**	**31**	**37**	**41**	**34**	**31**	**15**	**14**	**8**	**13**	**7**	**16**	**20**	**12**	**18**	**7**	**0.15**

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 3, 2004-2019

Age Group (Yrs)	Q3-2004	Q3-2005	Q3-2006	Q3-2007	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019	Q3-2019 CIR*
<1	13	10	15	13	11	11	4	4	2	7	3	5	6	2	1	0	0.00
1-4	18	12	7	11	9	7	6	4	2	1	2	0	2	3	4	2	0.74
5-9	1	2	3	4	1	3	1	0	0	0	0	1	1	2	1	0	0.00
10-14	1	1	0	4	2	1	0	1	0	0	0	1	2	0	1	0	0.00
15-19	3	1	6	5	5	5	0	1	1	2	1	4	2	1	6	3	0.99
20-24	3	1	3	0	2	1	0	3	1	1	0	0	2	2	2	1	0.37
25-34	3	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0.15
35-44	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0.00
45-54	0	0	1	1	0	1	1	0	2	0	1	1	2	0	0	0	0.00
55-64	0	2	0	1	3	1	0	0	0	0	0	1	2	0	1	0	0.00
65+	0	1	1	1	0	0	2	1	0	2	0	3	1	2	2	0	0.00
Total	**42**	**31**	**37**	**41**	**34**	**31**	**15**	**14**	**8**	**13**	**7**	**16**	**20**	**12**	**18**	**7**	**0.15**

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 3, 2004-2019

Serogroup	Q3-2004	Q3-2005	Q3-2006	Q3-2007	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019
SgB	1	1	2	1	1	1	1	1	0	1	0	1	0	0	0	0
SgC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SgW	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
SgY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
SgNG	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Sg29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**2**	**0**	**1**	**2**	**0**
%CFR* (Total)	7.1	3.2	5.4	2.4	2.9	3.2	6.7	7.1	0.0	7.7	0.0	12.5	0.0	8.3	11.1	0.0

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

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 3, 2009-2019 (excluding IMD and *Haemophilus influenzae*)

	Causative organism	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019	Q3:2009-2019
Specified	*Leptospira* spp.	0	0	1	1	0	0	0	0	1	0	0	3
	Listeria spp.	1	2	0	1	0	1	0	2	0	2	3	12
	Mycobacterium tuberculosis#	3	2	2	4	3	1	2	0	1	2	2	22
	Streptococcus pneumoniae	3	4	4	7	5	4	6	3	5	3	2	46
	*Streptococcus agalactiae**	na	na	na	3	1	0	0	1	0	0	1	6
	Streptococcus pyogenes	0	0	0	0	0	0	1	0	0	0	0	1
	Salmonella spp.	0	0	0	0	0	0	0	0	0	0	0	0
Not otherwise specified	*Enterococcus faecalis*	1	0	0	0	0	0	0	0	0	0	0	1
	Enterococcus faecium	0	0	0	1	0	0	0	0	0	0	0	1
	Escherichia coli	0	0	0	4	0	4	4	1	5	1	2	21
	Escherichia coli/Haemophilus influenzae	0	0	0	0	0	0	0	1	0	0	0	1
	Klebsiella pneumoniae	0	0	0	0	0	1	0	0	0	0	0	1
	Staphylococcus aureus	1	0	1	1	0	0	1	0	0	0	0	4
	Staphylococcus aureus & *Staphylococcus capitis*	0	0	0	1	0	0	0	0	0	0	0	1
	Staphylococcus capitis	0	1	0	0	0	0	0	0	0	0	0	1
	Streptococcus agalactiae†	1	3	7	0	0	0	0	0	0	0	0	11
	Streptococcus anginosus	0	0	0	0	0	0	0	0	0	1	0	1
	Streptococcus salivarius	0	0	0	0	1	0	0	0	0	0	0	1
	Streptococcus suis	0	0	0	0	0	1	0	0	0	0	0	1
	Unknown/Not specified	9	2	4	4	6	2	4	2	3	2	2	40
	Total	**19**	**14**	**19**	**27**	**16**	**14**	**18**	**10**	**15**	**11**	**12**	**175**

#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 3, 2009-2019

Type	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019
a	0	0	0	0	0	0	0	0	0	0	0
b	0	0	0	0	0	1	0	0	1	0	0
d	0	0	0	0	0	0	0	0	0	0	0
e	0	0	0	0	0	0	0	1	0	0	0
f	0	1	0	0	0	2	0	1	0	0	1
not type-b	0	0	1	0	0	0	1	0	1	0	0
non-typeable	3	2	5	7	8	9	5	7	4	4	4
not typed*	1	0	1	3	1	3	2	2	1	0	1
Total	**4**	**3**	**7**	**10**	**9**	**15**	**8**	**11**	**7**	**4**	**6**

*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	22	+21.1%
Q2	12	9	16	5	7	14	15	15	12	22	20	+66.7%
Q3	4	3	7	10	9	15	8	11	7	4	6	+50.0%
Q4	8	6	10	10	7	16	8	14	6	11	-	-
Total	**43**	**28**	**44**	**41**	**41**	**61**	**52**	**58**	**45**	**58**	**-**	**-**
Meningitis	*0*	*0*	*1*	*0*	*0*	*2*	*1*	*0*	*0*	*1*	-	-
Type b meningitis	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	-	-

Appendix 9. *H. influenzae* Cases by HSE Area in Quarter 3, 2009-2019

HSE Area	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-203	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019	Q3-2019 CIR*
E	1	1	4	5	1	2	4	2	4	2	2	0.12
M	1	0	0	1	0	0	0	3	0	0	0	0.00
MW	0	1	1	2	0	2	0	0	1	0	2	0.52
NE	0	0	1	0	1	3	0	0	0	0	2	0.43
NW	0	0	0	1	1	0	1	2	1	1	0	0.00
SE	1	0	0	0	3	4	2	1	0	1	0	0.00
S	1	0	0	0	1	3	0	3	1	0	0	0.00
W	0	1	1	1	2	1	1	0	0	0	0	0.00
Total	**4**	**3**	**7**	**10**	**9**	**15**	**8**	**11**	**7**	**4**	**6**	**0.13**

* CIR, crude incidence rate per 100,000

Appendix 10. *H. influenzae* Cases by Age Group in Quarter 3, 2009-2019

Age Grp (Yrs)	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-203	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019	Q3-2019 CIR*
<1	0	0	0	0	0	4	1	0	0	0	0	0.00
1-4	0	0	1	1	3	3	1	1	1	2	0	0.00
5-9	0	0	0	0	0	0	0	0	0	0	0	0.00
10-14	0	0	0	0	0	0	0	0	0	0	0	0.00
15-19	0	1	0	1	0	0	0	0	0	0	1	0.33
20-24	0	1	0	0	0	1	1	1	1	0	0	0.00
25-34	1	0	2	1	1	0	1	1	0	0	1	0.15
35-44	1	0	0	1	0	0	0	3	1	0	0	0.00
45-54	0	0	0	0	0	0	0	0	0	0	1	0.16
55-64	1	0	0	0	1	1	0	1	1	0	1	0.20
65+	1	1	4	6	4	6	4	4	3	2	2	0.31
Total	**4**	**3**	**7**	**10**	**9**	**15**	**8**	**11**	**7**	**4**	**6**	**0.13**

* CIR, crude incidence rate per 100,000

Appendix 11. Viral Meningitis Cases, Not Otherwise Specified, by Causative Organism in Quarter 3, 2009-2019

Causative Organism	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019
enterovirus group A	0	0	0	0	0	0	0	0	4	0	2
enterovirus group B	0	0	1	2	2	0	2	0	49	55	66
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	1	0	0
enterovirus group not specified	53	44	67	95	98	116	63	89	14	17	19
human herpes virus type 6	2	6	8	8	13	8	3	9	13	17	16
varicella/herpes zoster virus	1	3	2	3	1	4	6	3	0	8	3
herpes simplex virus*	1	2	2	0	0	4	2	3	3	0	1
parechovirus	0	1	0	1	0	15	1	3	2	19	2
adenovirus	1	0	0	0	0	0	0	0	0	0	0
not specified	8	7	4	5	5	2	1	1	0	1	2
Total	**66**	**63**	**84**	**114**	**119**	**149**	**78**	**108**	**86**	**117**	**111**
% known causative organism	*87.9*	*88.9*	*95.2*	*95.6*	*95.8*	*98.7*	*98.7*	*99.1*	*100.0*	*99.1*	*98.2*

*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 3, 2009-2019

HSE Area	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2019
E	25	15	30	52	34	54	29	40	31	22	35
M	1	2	4	6	5	3	6	5	7	1	9
MW	1	1	8	3	11	4	6	7	1	1	2
NE	5	3	6	11	11	10	4	6	7	5	8
NW	2	8	0	4	6	3	6	3	5	7	4
SE	7	8	6	9	9	18	0	9	6	3	12
S	10	4	10	5	4	19	8	10	8	19	5
W	2	3	4	7	20	5	6	9	3	14	12
Total	**53**	**44**	**68**	**97**	**100**	**116**	**65**	**89**	**68**	**72**	**87**

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	50	+525.0%
Q2	19	25	40	32	25	96	73	86	69	44	74	+289.5%
Q3	53	44	68	97	100	116	65	89	68	72	87	+83.0%
Q4	11	30	52	24	87	59	48	30	29	29	-	-
Total	**91**	**107**	**166**	**189**	**219**	**312**	**209**	**243**	**201**	**165**	**-**	**-**