

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)



Q3-2018

17th December 2018

Provisional Figures

Summary

- **Invasive meningococcal disease (IMD)**
 - 18 IMD cases were notified in Q3-2018; nine serogroup B, four serogroup W135, two each of serogroups C and Y and one with no organism detected
 - Of the two serogroup C cases, one was unvaccinated (aged 70-74 years), and the other had an unknown vaccination status (aged 20-24 years)
 - One of the nine serogroup B cases was <1 year of age and had no prior history of MenB vaccination recorded
 - Two deaths were reported (case fatality rate of 11.1%); one of the deaths (aged 20-24 years) was due to their infection (serogroup W135) and the other (aged 15-19 years) with a sergroup Y infection and a comorbidity risk, is awaiting a coroner's report at the time of writing
 - No outbreaks were reported
- **Other bacterial meningitis**
 - Three cases of invasive *Streptococcus pneumoniae* infections (IPD) presenting as meningitis were notified (age range <1 to 33-39 years)
 - One case of meningitis-related Group B Strep (*Streptococcus agalactiae*) (aged 1 week) and two cases of *Listeria monocytogenes* (serotype 1/2a and 4) (aged 70-79 years) were also reported
 - Five cases of bacterial meningitis due to pathogens not otherwise specified (NOS) were notified, among which were one case each of *Escherichia coli* (aged 2 months), *Streptococcus anginosus* (aged 20-24 years) and three whose causative pathogen was not identified
 - One bacterial meningitis, NOS death was reported, but the cause of death was not known
 - No outbreaks were reported
- ***Haemophilus influenzae***
 - Four cases of *H. influenzae* were reported (one of which was associated with meningitis, aged <5 years), all of which were non-typeable (age range 3 to 82 years)
 - No outbreaks or deaths were reported
- **Viral meningitis**
 - 117 cases of viral meningitis NOS, were reported, (aged 1 week to 87 years; median 3.1 months); all but two had their causative organism identified: 72 enterovirus, 17 human herpes virus type 6 (HHV 6), 19 parechovirus and seven varicella/herpes zoster virus
 - Two of the 17 notified HHV 6 cases were also positive for enterovirus (both aged <3 months).
 - Three of the 19 reported parechovirus VM cases were late notifications from 2016 and 2017
 - One festival related outbreak, involving eight echovirus 30 related viral meningitis cases (aged 16-25 years), occurred in HSE-South

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 17th December 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 Q3-2018, 18 cases of IMD were notified, 17 of which were classified as confirmed and one as possible. Nine were serogroup B, four were serogroup W135, two each were serogroups C and Y and one was not specified (Table 2).

One of the nine serogroup B cases was <1 year of age with no prior history of MenB vaccination recorded.

Details of the number of doses of the meningococcal C conjugate vaccine received, age group and outcome of the four serogroup C cases are presented in Table 3.

In Q3-2018 serogroup B disease accounted for 47.1% (n=9/18) of all IMD notifications, 23.5% (n=4) for serogroup W135 and 11.1% (n=2) each for serogroups C and Y (Figure 1, Appendix 1).

Table 2. Classification of IMD cases notified by Serogroup in Q3-2018

Case Classification	B	C	W135	Y	NG	29E	No organism detected	Total
Confirmed	9	2	4	2	0	0	0	17
Probable	0	0	0	0	0	0	1	1
Possible	0	0	0	0	0	0	0	0
Not specified	0	0	0	0	0	0	0	0
Total	9	2	4	2	0	0	1	18

Table 3. Details of the serogroup C cases notified in Q3-2018 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	20-24	Not specified	Unknown	-	-
2	70-74	Recovered	Unvaccinated	0	-

IMD Trends & Outbreaks

The number of IMD cases reported in Q3-2018 (n=18) was similar to the average number reported in the same quarter over the previous three years (average=16.0, 95% %CI 11.3-20.7); for serogroup B the average was 7.0 and for serogroup C it was 3.8 (Figure 1; Appendix 1). Third quarterly IMD cases have fallen by 66.0% since 2001 (from 53 to 18 cases) (Appendix 2). Also, since 2001, Q3 serogroup B cases have also declined by 76.3% (from 38 to 9 cases), the percentage of serogroup C cases decreased by 60.0% (from five to two cases) in that time (Appendix 1). No outbreaks of IMD were reported in Q3-2018.

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL) in Temple Street Children's Hospital to the HPSC on December 5th, 2018, all 17 classified confirmed IMD events on CIDR in Q3-2018 were included on it.

IMD Cases by HSE Area and Age Group

The crude incidence rate in Q3-2018 was 0.4 cases per 100,000 population, ranging from the lowest (0.0/100,000) in HSE MW to the highest (0.8/100,000) in HSE NW (Appendix 3). The burden of IMD disease is typically highest in the <1 year of age group, but in Q3-2018 the incidence rate was highest in the 15-19 year age group was 2.0 cases per 100,000 population, followed by 1.6 cases/100,000 in the <1 year age group (Appendix 4).

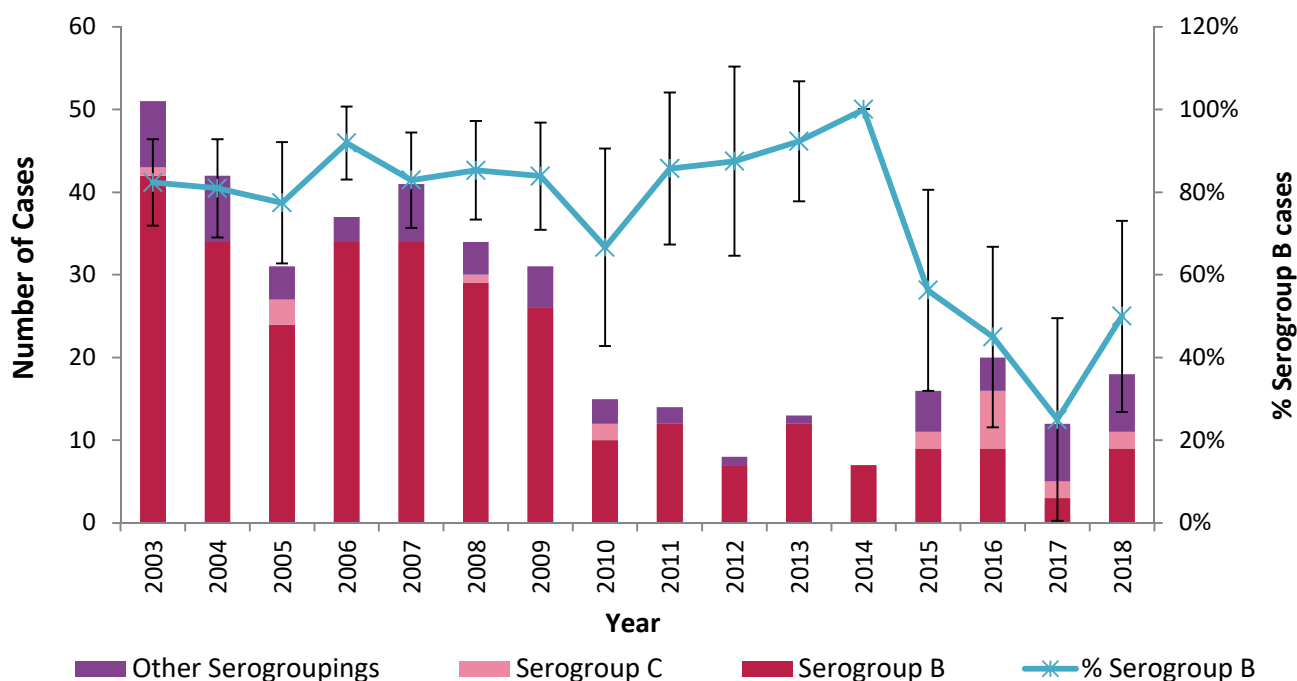


Figure 1. Number of IMD cases notified in Ireland by serogroup in Q3 of each year between 2003 and 2018 with percentage of quarterly cases attributable to serogroup B with 95% confidence intervals

IMD associated deaths

Two deaths were reported in Q3-2018 (case fatality rate of 11.1%), compared to 8.3% (n=1/12) in Q3-2017. One of the deaths (aged 20-24 years) was due to their infection (serogroup W135) and the other (aged 15-19 years) with a serogroup Y infection and a comorbidity risk, is awaiting a coroner's report at the time of writing (Appendix 5). The average number of deaths was 1.0 in the same quarter between 2015 and 2017.

Other Forms of Bacterial Meningitis

Streptococcus pneumoniae meningitis

In Q3-2018, three cases of invasive *S. pneumoniae* infections (IPD) presenting as meningitis were notified. The age range was <1 and 35-39 years (Appendix 6). No deaths were reported. One patient had a risk factor recorded.

Details of the vaccination status, age group, risk factor and serotype of these three 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 Q3-2018

Case No.	Age Group	Risk factors	PCV vaccination status	PPV vaccination status	Serotype
1	<1	No	Incompletely vaccinated (1 dose)	.	.
2	25-29	Yes	Unvaccinated	.	.
3	35-39	No	Unvaccinated	.	.

* 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 *Streptococcus pneumoniae*)

One case of meningitis-related Group B Strep (*Streptococcus agalactiae*) (aged 1 week) and two cases of *Listeria monocytogenes* (serotype 1/2a and 4) (aged 70-79 years) was 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 Q3-2018. Among these three confirmed cases were one each of *Escherichia coli* (aged 2 months), *Streptococcus anginosus* (aged 20-24 years) and one case whose causative pathogen was not identified (Appendix 6). There was also one probable and one possible case reported, both aged <65 years, one of whom died and whose cause of death was not known. No imported cases were reported during this period.

Haemophilus influenzae (invasive) infections

H. influenzae Cases by Type, Case Classification

In Q3-2018, four cases of non-typeable *H. influenzae* (all case classified as confirmed) were notified (Figure 2). This total compares to an average of 8.7 cases for the same quarter in 2015 to 2017 (Table 5, Appendices 7, 8). Two of the cases were <5 years of age and two others were 65+ years.

Of all the Q3 cases reported between 2016 and 2018, 6.7% (n=3/22) had no clinical diagnosis reported (Table 6). In Q3-2018, non-typeable cases accounted for all four cases, considerably higher than the average of 70.5% recorded during the same quarter between 2008 and 2017 (Figure 4).

In the electronic listing provided by the Irish Meningitis and Sepsis Reference Laboratory (IMSRL) in Temple Street Children's Hospital to the HPSC on December 5th, 2018, all but one classified confirmed *H. influenzae* event on CIDR in Q3-2018 were included on it.

H. influenzae associated deaths

No deaths were reported in this quarter.

H. influenzae meningitis

One meningitis-related *H. influenzae* case was reported in Q3-2018 in a child aged <5 years (Table 6).

H. influenzae type b (Hib)

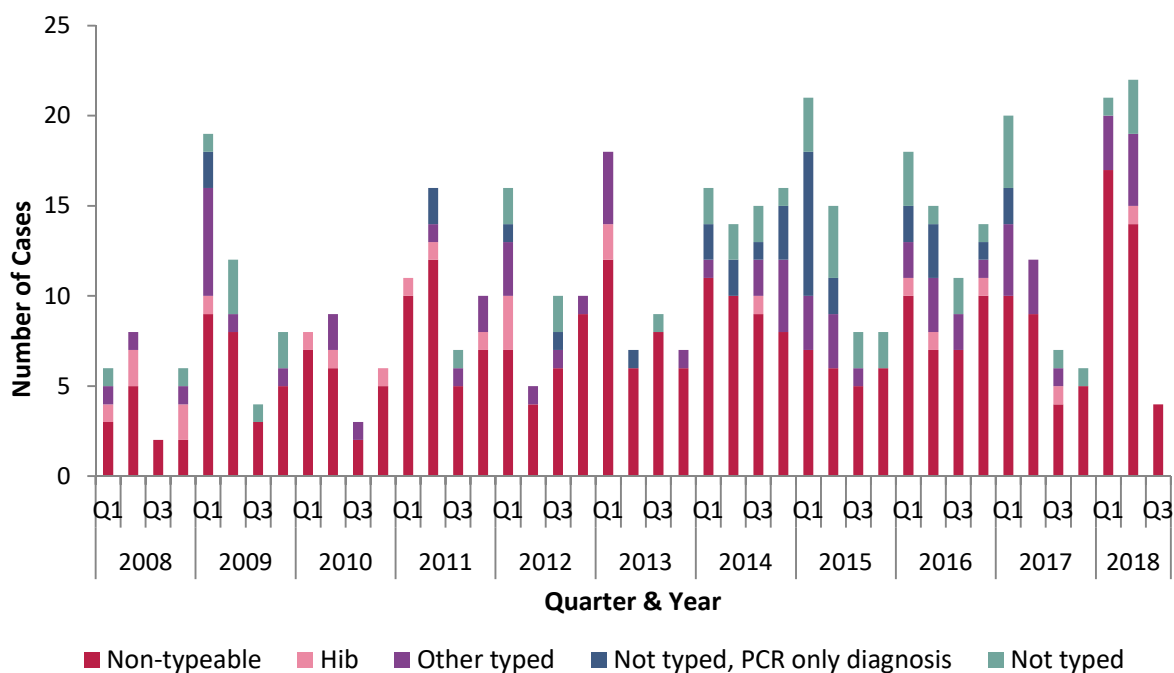
A true vaccine failure (TVF) is the occurrence of invasive Hib infection in an individual, despite having been fully vaccinated against Hib disease in the past. No Hib cases were reported in Q3-2018. The last reported TVF however was in Q4-2010, nearly eight years ago: an indication of the continuing 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 2, 3). 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 Q3-2018 four non-typeable cases was reported (aged 3 to 82 years), less than the average of 5.3 cases in the same quarter between 2015 and 2017 (Figure 4).

Table 5. Number of *H. influenzae* cases notified in the third quarter of 2016, 2017 and 2018

Number of cases	Q3-2016	Q3-2017	Q3-2018
All <i>H. influenzae</i>	11	7	4
All <i>H. influenzae</i> <5yrs	1	1	2
All <i>H. influenzae</i> ≥65yrs	4	3	2
<i>H. influenzae</i> type b	0	1	0
<i>H. influenzae</i> type b <5yrs	0	0	0
<i>H. influenzae</i> type b ≥65yrs	0	1	0
<i>H. influenzae</i> non-typeable	7	4	4
<i>H. influenzae</i> non-typeable <5yrs	1	0	2
<i>H. influenzae</i> non-typeable ≥65yrs	1	2	2

**Figure 2. Quarterly number of *H. influenzae* cases by type since 2008****Table 6. Number of *H. influenzae* cases by clinical diagnosis notified in the third quarter of 2016, 2017 and 2018**

Number of cases	Q3-2016	Q3-2017	Q3-2018	Total	Total (%)
Septicaemia	7	2	1	10	53.3
Bacteraemia (without focus)	2	1	0	3	20.0
Pneumonia	2	0	0	2	0.0
Meningitis	0	0	1	1	6.7
Meningitis & septicaemia and/or other	0	0	0	0	0.0
Other	0	1	2	3	13.3
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	0	3	0	3	6.7
Total	11	7	4	22	100

Table 7. Number of *H. influenzae* cases by clinical diagnosis and type of infection, Q3-2018

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

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

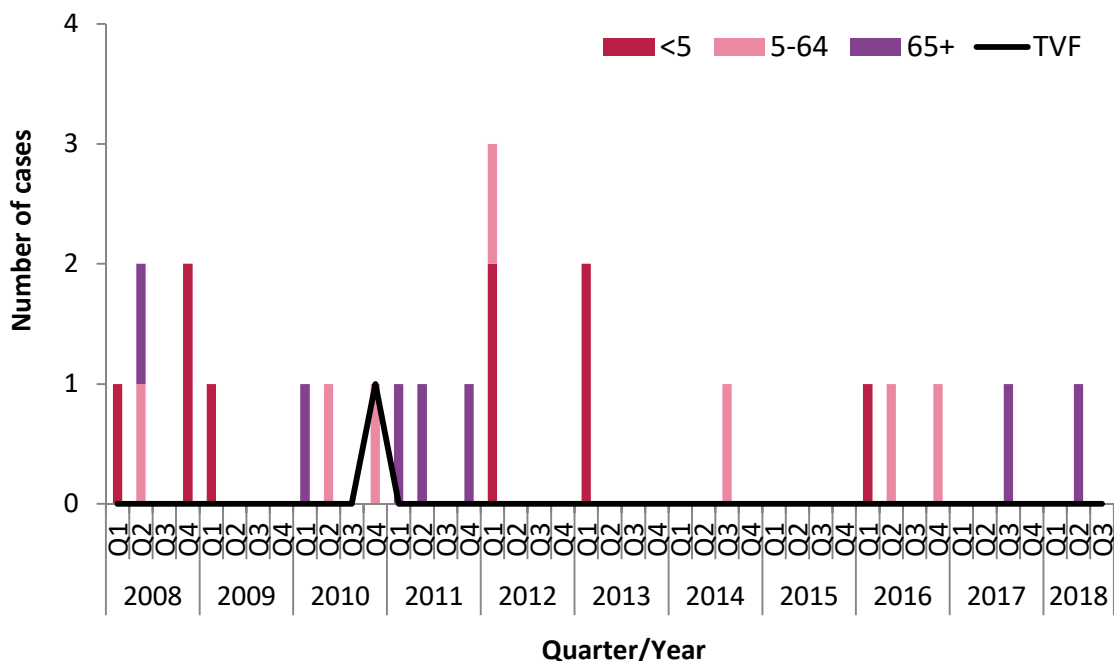


Figure 3. Quarterly number of Hib cases by age group and of true Hib vaccine failures (TVFs), since 2008

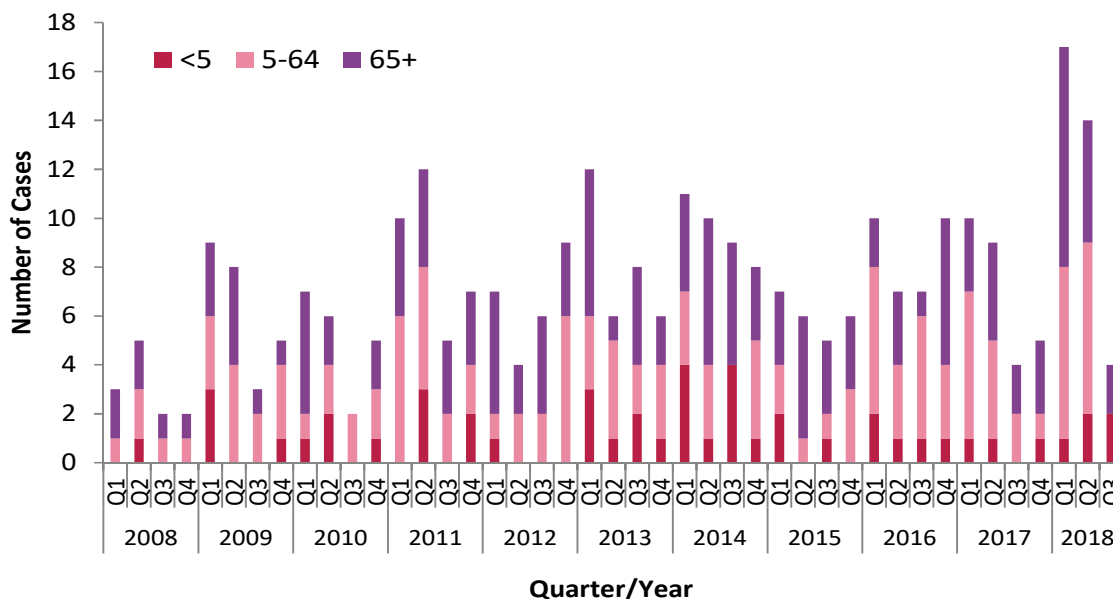


Figure 4. Quarterly number of non-typeable/non-capsulated cases by age group, since 2008

Viral Meningitis (Specified and Not Otherwise Specified)

One hundred and seventeen viral meningitis notifications (NOS) (aged 1 week to 87 years; median 3.1 months) were reported in Q3-2018 (Figures 5, 6). All had their causative organism identified: 74 (63.2%) enterovirus (aged 1 week to 68 years; median 15.4 years); 17 (14.5%) human herpes virus type 6 (HHV 6) (aged two weeks to 15 months); 19 (16.2%) parechovirus (aged two weeks to 23 months); and seven (6.0%) varicella/herpes zoster virus (aged five to 87 years). Two of the HHV 6 cases were also positive for enterovirus (both aged <3 months).

In Q3-2018, the highest frequency of cases occurred in children <1 year of age (n=64/117; 54.7%) and in adults aged 15-39 years (n=39/117; 33.3%) (Figure 5). Of the 64 cases <1 year of age reported in this quarter, 32 (50.0%) were attributable to enterovirus and 16 each (25.0%) to HHV 6 and parechovirus. 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 14 in Q3-2018), 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 6 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 Q3 percentage of all viral meningitis (VM) cases attributable to enterovirus since 2014 to date has been 78.3%. Details of enterovirus serotypes by age group in Q3-2018 are presented in Table 8 and shows that the numbers of cases are highest in the <1 and 15-39 year age groups.

The proportion of non-enterovirus viral meningitis in Q3-2018 was 38.5%. Three of the parechovirus VM cases were late notifications from 2016 and 2017. Forty-eight late notifications of parechovirus-related VM cases that occurred between 2015 to 2017 were not reported to CIDR until Q4-2018. This means that the proportion of all non-enterovirus VM cases currently recorded on CIDR for these same years, is less than what is actually the case because they do not include those late notifications.

All but one of the Q3-2018 enterovirus related viral meningitis events in CIDR were matched to NVRL enterovirus typing records provided to the HPSC on January 9th, 2019.

One festival related outbreak involving eight echovirus 30 related viral meningitis cases (aged 16-25 years) occurred in HSE-South in Q3-2018.

Table 8. Enterovirus genotypes by age group (years) on CIDR in Q3-2018

(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		0	0	0	0	0	0
	Enterovirus B	Coxsackievirus B3	2	0	0	0	0	2
		Coxsackievirus B5	4	0	0	1	0	5
		Echovirus 3	2	0	0	0	0	2
		Echovirus 6	1	0	0	5	1	7
		Echovirus 9	4	0	0	3	0	7
		Echovirus 11	1	0	0	1	0	2
		Echovirus 15	0	0	0	2	0	2
		Echovirus 18	7	0	0	1	0	8
		Echovirus 25	3	0	0	1	0	4
	Echovirus 30	2	0	0	13	0	15	
	Enterovirus C		0	0	0	0	0	0
	Enterovirus D		0	0	0	0	0	0
Unable to generate sequence		2	0	0	2	0	4	
Not specified		4	1	2	7	0	14	
Total			32	1	2	36	1	72*

*excludes two HHV 6 cases which were also reported as having enterovirus

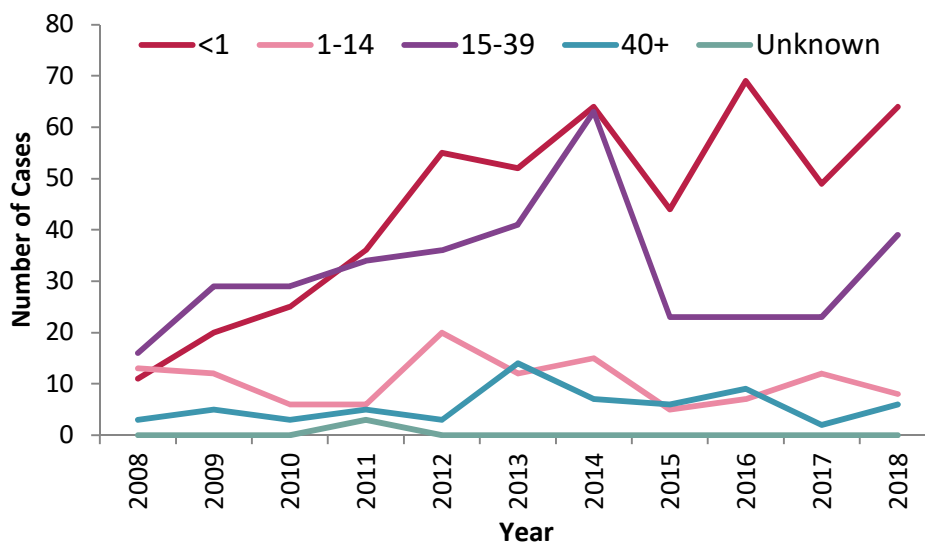


Figure 5. Quarter 3 number of viral meningitis (NOS) cases in Ireland by age group (years), 2008-2018

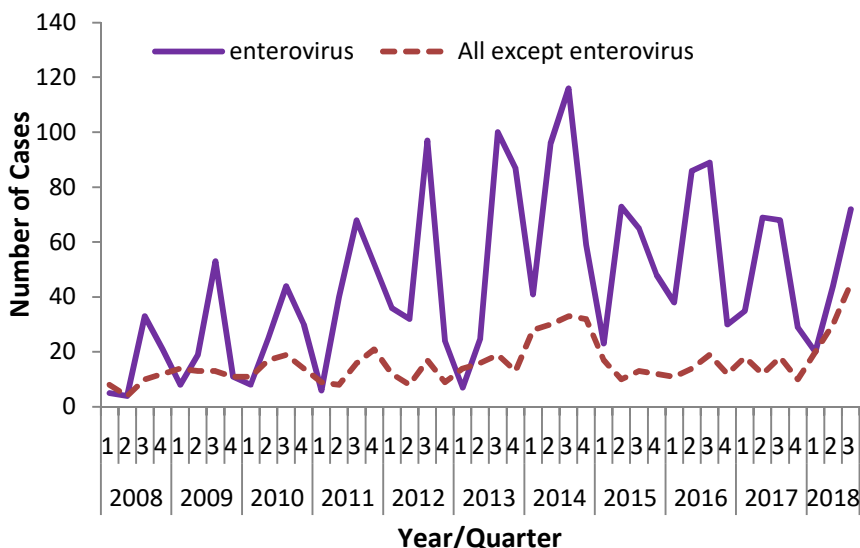


Figure 6. Number of viral meningitis (NOS) cases caused by enterovirus and all except enterovirus by quarter and year, 2008-2018

Acknowledgements

- HPSC wishes to thank all who provided data for this report: Departments of Public Health, the Irish Meningitis & Sepsis Reference Laboratory (IMSRL) in Temple Street Children’s Hospital, National Virus Reference Laboratory (NVRL) and other Microbiology Laboratories

NOTES

Invasive IMD and other bacterial meningitis notifications:

- The collection of specimens for all bacterial meningitis diagnostic testing should be performed as per recommendations outlined in the HPSC's 'Guidelines for the Early Clinical and Public Health Management of Bacterial Meningitis (including Meningococcal Disease). Report of the Scientific Advisory Committee of HPSC' published in January 2012, a copy of which is available at: <http://www.hpsc.ie/a-z/vaccinepreventable/bacterialmeningitis/guidance/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 3, 2003-2018

Serogroup	Q3-2003	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
B	42	34	24	34	34	29	26	10	12	7	12	7	9	9	3	9
C	1	0	3	0	0	1	0	2	0	0	0	0	2	7	2	2
W135	0	0	0	0	0	1	0	0	0	0	0	0	0	2	4	4
Y	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2
Non-groupable (NG)	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
No organism detected	8	8	4	3	7	2	5	3	2	1	1	0	2	1	1	1
Total	51	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18

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	72	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	17	-55.3%
Q3	51	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18	-64.7%
Q4	75	43	43	44	37	48	31	24	21	21	20	30	19	26	17	-	-
Total	237	198	203	208	179	168	147	114	94	66	81	82	74	87	76	-	-

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

HSE Area	Q3-2003	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	Q3-2018 CIR*
E	12	12	16	14	12	11	15	3	6	2	3	2	5	10	3	5	0.29
M	6	0	2	0	1	4	2	0	0	2	0	1	0	0	2	2	0.68
MW	5	5	1	2	5	1	3	0	1	2	2	0	1	1	1	0	0.00
NE	6	6	2	5	6	3	2	1	1	0	1	1	3	2	0	1	0.22
NW	1	2	3	1	3	1	3	1	0	1	2	0	2	1	1	2	0.78
SE	7	10	0	5	3	4	0	3	1	0	2	1	3	1	1	3	0.43
S	13	6	5	6	7	7	3	4	3	1	1	1	2	4	2	3	0.59
W	1	1	2	4	4	3	3	3	2	0	2	1	0	1	2	2	0.44
Total	51	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18	0.38

* CIR, crude incidence rate per 100,000

Appendix 4. IMD Cases by Age Group in Quarter 3, 2003-2018

Age Group (Yrs)	Q3-2003	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	Q3-2018 CIR*
<1	21	13	10	15	13	11	11	4	4	2	7	3	5	6	2	1	1.61
1-4	14	18	12	7	11	9	7	6	4	2	1	2	0	2	3	4	1.49
5-9	1	1	2	3	4	1	3	1	0	0	0	0	1	1	2	1	0.28
10-14	3	1	1	0	4	2	1	0	1	0	0	0	1	2	0	1	0.31
15-19	5	3	1	6	5	5	5	0	1	1	2	1	4	2	1	6	1.98
20-24	1	3	1	3	0	2	1	0	3	1	1	0	0	2	2	2	0.73
25-34	1	3	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0.00
35-44	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0.00
45-54	1	0	0	1	1	0	1	1	0	2	0	1	1	2	0	0	0.00
55-64	3	0	2	0	1	3	1	0	0	0	0	0	1	2	0	1	0.20
65+	1	0	1	1	1	0	0	2	1	0	2	0	3	1	2	2	0.31
Total	51	42	31	37	41	34	31	15	14	8	13	7	16	20	12	18	0.38

* CIR, crude incidence rate per 100,000

Appendix 5. Deaths associated with IMD by Serogroup in Quarter 3, 2003-2018

Serogroup	Q3-2003	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
B	4	1	1	2	1	1	1	1	1	0	1	0	1	0	0	0
C	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Non-groupable (NG)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
29E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No organism detected	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5	3	1	2	1	1	1	1	1	0	1	0	2	0	1	2
%CFR* (Total)	9.8	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

* %CFR, case fatality ratio

Appendix 6. Other Bacterial Meningitis Cases by Causative Organism (Specified and Not Otherwise Specified) in Quarter 3, 2008-2018 (excluding *IMD* and *Haemophilus influenzae*)

Causative organism		Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018
Specified	<i>Leptospira</i> spp.	1	0	0	1	1	0	0	0	0	1	0
	<i>Listeria</i> spp.	0	1	2	0	1	0	1	0	2	0	2
	<i>Mycobacterium tuberculosis</i> #	2	3	2	0	0	0	0	2	0	0	0
	<i>Streptococcus pneumoniae</i>	3	3	4	4	7	5	4	6	3	5	3
	<i>Streptococcus agalactiae</i> *	na	na	na	na	4	2	0	0	1	4	1
	<i>Streptococcus pyogenes</i>	0	0	0	0	0	0	0	1	0	0	0
	<i>Salmonella</i> spp.	0	0	0	0	0	0	0	0	0	0	0
Not otherwise specified	<i>Citrobacter koseri</i>	1	0	0	0	0	0	0	0	0	0	0
	<i>Enterococcus faecalis</i>	1	1	0	0	0	0	0	0	0	0	0
	<i>Enterococcus faecium</i>	0	0	0	0	1	0	0	0	0	0	0
	<i>Escherichia coli</i>	3	0	0	0	4	0	4	4	1	5	1
	<i>Escherichia coli</i> / <i>Haemophilus influenzae</i>	0	0	0	0	0	0	0	0	1	0	0
	<i>Klebsiella pneumoniae</i>	0	0	0	0	0	0	1	0	0	0	0
	<i>Staphylococcus aureus</i>	1	1	0	1	1	0	0	1	0	0	0
	<i>Staphylococcus aureus</i> & <i>Staphylococcus capitis</i>	0	0	0	0	1	0	0	0	0	0	0
	<i>Staphylococcus capitis</i>	0	0	1	0	0	0	0	0	0	0	0
	<i>Streptococcus agalactiae</i>	1	1	3	7	0	0	0	0	0	0	0
	<i>Streptococcus anginosus</i>	0	0	0	0	0	0	0	0	0	0	1
	<i>Streptococcus salivarius</i>	0	0	0	0	0	1	0	0	0	0	0
	<i>Streptococcus suis</i>	0	0	0	0	0	0	1	0	0	0	0
	Unknown/Not specified	6	9	2	4	4	6	2	4	2	3	3
Total	19	19	14	17	24	14	13	18	10	18	11	177

#TB meningitis figures for 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 3, 2008-2018

Type	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018
b	0	0	0	0	0	0	1	0	0	1	0
d	0	0	0	0	0	0	0	0	0	0	0
e	0	0	0	0	0	0	0	0	1	0	0
f	0	0	1	0	0	0	2	0	1	0	0
not type-b	0	0	0	1	1	0	0	1	0	1	0
non-typeable/non-capsulated	2	3	2	5	6	8	9	5	7	4	4
not typed*	0	1	0	1	3	1	3	2	2	1	0
Total	2	4	3	7	10	9	15	8	11	7	4

*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	22	+175%
Q3	2	4	3	7	10	9	15	8	11	7	4	+100%
Q4	6	8	6	10	10	7	16	8	14	6	-	-
Total	22	43	28	44	41	41	61	52	58	45	-	-
<i>Meningitis</i>	3	3	2	4	3	2	7	5	1	1	-	-
<i>Type b meningitis</i>	1	0	1	0	1	0	0	0	0	0	-	-

Appendix 9. *H. influenzae* Cases by HSE Area in Quarter 3, 2008-2018

HSE Area	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2018 CIR*
E	0	1	1	4	5	1	2	4	2	4	2	0.12
M	0	1	0	0	1	0	0	0	3	0	0	0.00
MW	1	0	1	1	2	0	2	0	0	1	0	0.00
NE	0	0	0	1	0	1	3	0	0	0	0	0.00
NW	0	0	0	0	1	1	0	1	2	1	1	0.39
SE	0	1	0	0	0	3	4	2	1	0	1	0.14
S	1	1	0	0	0	1	3	0	3	1	0	0.00
W	0	0	1	1	1	2	1	1	0	0	0	0.00
Total	2	4	3	7	10	9	15	8	11	7	4	0.08

* CIR, crude incidence rate per 100,000

Appendix 10. *H. influenzae* Cases by Age Group in Quarter 3, 2008-2018

Age Grp (Yrs)	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	Q3-2018 CIR*
<1	0	0	0	0	0	0	4	1	0	0	0	0.00
1-4	0	0	0	1	1	3	3	1	1	1	2	0.74
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	0	1	0	1	0	0	0	0	0	0	0.00
20-24	0	0	1	0	0	0	1	1	1	1	0	0.00
25-34	0	1	0	2	1	1	0	1	1	0	0	0.00
35-44	0	1	0	0	1	0	0	0	3	1	0	0.00
45-54	1	0	0	0	0	0	0	0	0	0	0	0.00
55-64	0	1	0	0	0	1	1	0	1	1	0	0.00
65+	1	1	1	4	6	4	6	4	4	3	2	0.31
Total	2	4	3	7	10	9	15	8	11	7	4	0.08

* CIR, crude incidence rate per 100,000

Appendix 11. Viral Meningitis Cases, Not Otherwise Specified, by Causative Organism in Quarter 3 2008-2018

Causative Organism	Q3-2008	Q3-2009	Q3-2010	Q3-2011	Q3-2012	Q3-2013	Q3-2014	Q3-2015	Q3-2016	Q3-2017	Q3-2018	
enterovirus group A	0	0	0	0	0	0	0	0	0	0	4	0
enterovirus group B	0	0	0	1	2	2	0	2	0	50	56**	
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	1	0
enterovirus group not specified/genotype could not be generated	33	53	44	67	95	98	116	63	89	14	18	
human herpes virus type 6	0	2	6	8	8	13	8	3	9	13	17	
varicella/herpes zoster virus	2	1	2	2	0	0	4	2	3	3	0	
herpes simplex virus*	0	0	1	1	0	0	0	2	1	2	0	
parechovirus	0	0	1	0	1	0	15	1	3	2	19	
adenovirus	2	1	3	2	3	1	4	6	3	0	7	
not specified	0	1	0	0	0	0	0	0	0	0	0	
Total	37	58	57	81	109	114	147	79	108	89	117	
% known causative organism	100	98.3	100.0	100	100	100	100	100	100	100	100.0	

*Includes types 1 and 2

**excludes two enteroviruses reported as having a coinfection of human herpes virus type 6 on CIDR