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hpsc

Annual Epidemiological Report

December 2018

Influenza and Other Seasonal Respiratory Viruses in Ireland, 2017/2018

Key Facts – 2017/2018 Influenza Season

- The 2017/2018 influenza season was a severe season with a high impact on the Irish health system.
- GP influenza-like illness (ILI) consultations rates reached the highest levels since 2010/2011.
- Influenza hospitalisations, ICU admissions, influenza-associated deaths and influenza outbreaks exceeded all previous seasons on record, since surveillance began.
- Influenza activity was elevated and geographically widespread for an extended period.
- All age groups were affected; in particular those aged 65 years and older.
- Influenza B/Yamagata and influenza A(H3N2) were the predominant influenza viruses circulating during the season, with significant levels of influenza A(H1N1)pdm09 also circulating.
- The high level of influenza B viruses circulating resulted in a significant impact on the health system, not previously observed for influenza B in Ireland.

    - Sentinel GP ILI consultation peak rate: **100.8/100,000**
    - Number of notified influenza cases: **11,889**
    - Number of confirmed influenza cases hospitalised: **4,713**
    - Number of confirmed influenza cases admitted to ICU: **191**
    - Number of notified influenza cases that died: **255**
    - Number of acute respiratory infection/influenza outbreaks: **223**

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Background and Methods

HPSC has worked in collaboration with the National Virus Reference Laboratory (NVRL), the Irish College of General Practitioners (ICGP) and the Departments of Public Health on the influenza sentinel surveillance project since 2000. During the 2017/2018 influenza season, 62 general practices (located in all HSE-Areas) were recruited to report electronically, on a weekly basis, the number of patients who consulted with influenza-like illness (ILI). Sentinel GPs send combined nose and throat swabs to the NVRL from ILI patients each week. The NVRL routinely test sentinel GP and non-sentinel respiratory specimens for influenza and a panel of other seasonal respiratory viruses.

Other surveillance systems set up to monitor ILI/influenza activity include:

- Surveillance of all calls to GP out-of-hours (OOHs) centres, monitored for self-reported influenza. These data were provided by the Department of Public Health in HSE-NE.
- Surveillance of all confirmed influenza notifications, including hospitalisation status reported to the Computerised Infectious Disease Reporting System (CIDR) in Ireland
- Enhanced surveillance of hospitalised influenza cases aged 0-14 years
- Enhanced surveillance of all critical care patients with confirmed influenza
- Surveillance of all reported influenza deaths
- All-cause excess mortality monitoring associated with the European mortality monitoring group (EuroMOMO)
- A network of sentinel hospitals reporting admissions data
- Acute respiratory infections and influenza outbreak surveillance
- Monitoring influenza vaccine effectiveness (I-MOVE study)

Influenza and Respiratory Syncytial Virus (RSV) are notifiable diseases in Ireland under the Infectious Disease Regulations and cases should be notified to the Medical Officer of Health. Notifications are reported using the Irish Computerised Infectious Disease Reporting system (CIDR) which is described here. Further information on the process of reporting notifiable infectious diseases is available here. The case definitions used for influenza and RSV in 2017/2018 are available here. For this report, data on cases of influenza and RSV notified to CIDR during the 2017/2018 season were extracted from CIDR as of 24 October 2018.

This report summarises influenza and other seasonal respiratory virus activity in Ireland during the 2017/2018 influenza season. The 2017/2018 season commenced on 2nd October 2017 (week 40 2017) and ended on 20th May 2018 (week 20 2018). The data presented in this summary were based on all data reported to HPSC by the 24th October 2018.

Epidemiology of 2017/2018 Influenza Season

Sentinel GP Clinical ILI data

Influenza-like illness (ILI) consultation rates reported from the sentinel GP network in Ireland exceeded baseline levels for 13 consecutive weeks and medium intensity levels for seven consecutive weeks for all ages. Sentinel GP ILI consultation rates peaked at 100.8 per 100,000 population during week 3 2018 (the third week in January), the highest peak rate since the 2010/2011 season (figure 1). ILI rates first increased above baseline levels (17.5 per 100,000) during week 50 2017 and remained above this level for 13 consecutive weeks until mid-March 2018. The average length of time above baseline levels in Ireland is nine weeks. ILI rates for all ages were above medium intensity levels for the first seven weeks of 2018 (figure 1). ILI age specific rates peaked at 96.9/100,000 population in those aged 0-4 years, 130.8/100,000 population in the 5-14 year age group, 110.7/100,000 population in the 15-64 year age group and 98.2/100,000 in those aged 65 years and older. When age specific threshold levels were analysed, the medium threshold levels were exceeded for those aged 65 years and older during weeks 1, 2 and 4 2018 and for those aged less than 15 years during week 3 2018. The age specific rates in those aged 65 years and older did not exceed the high intensity threshold level which was exceeded during the 2016/2017 season.

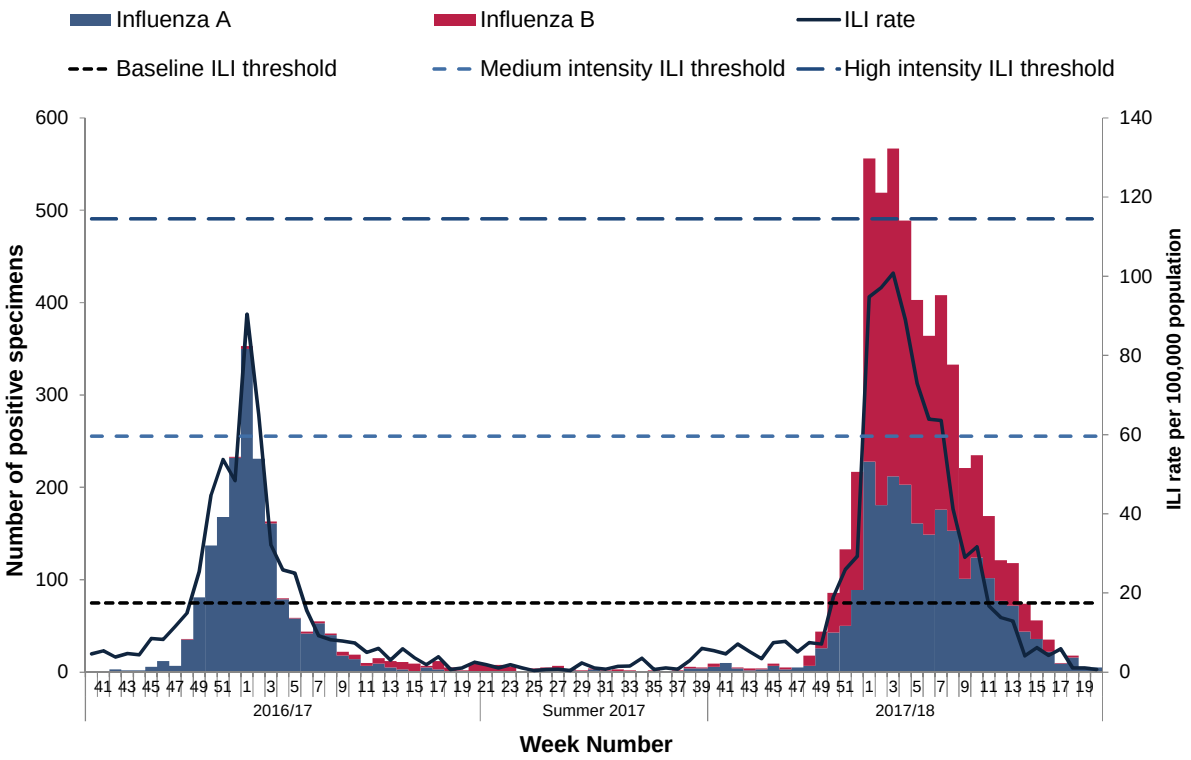

Figure 1. ILI sentinel GP consultation rates per 100,000 population, baseline ILI threshold, medium and high intensity ILI thresholds[a] and number of positive influenza A and B specimens tested by the NVRL, by influenza week and season 2016/17 and 2017/18, in Ireland.

[a] For further information on the Moving Epidemic Method (MEM) to calculate ILI thresholds: http://www.ncbi.nlm.nih.gov/pubmed/22897919

Virological Data from National Virus Reference Laboratory

Sentinel GP virological data

The NVRL tested 1586 sentinel GP specimens for influenza virus during the 2017/2018 season; 874 (55%) sentinel specimens were positive for influenza: 303 influenza A (234 A(H3N2), 65 A(H1N1)pdm09 and 4 A not subtyped) and 571 influenza B. This was the highest number of specimens tested and influenza positive detections by the Irish sentinel GP network in any influenza season and also the highest number of influenza B positive specimens detected in any season. Thirty-five percent of all confirmed influenza sentinel cases were positive for influenza A and 65% for influenza B. Of subtyped influenza A sentinel specimens (n=299), 78% were positive for A(H3N2) and 22% were positive for A(H1N1)pdm09. Overall, 77% (1079/1408 with known vaccination status) of ILI patients tested for influenza were *not* vaccinated with the 2017/2018 seasonal influenza vaccine.

Non-sentinel virological data[b]

The NVRL tested 17,692 non-sentinel respiratory specimens during the 2017/2018 season, 4382 (25%) of which were positive for influenza: 2029 influenza A (1515 A(H3N2), 452 A(H1N1)pdm09 and 62 A (not subtyped)) and 2353 influenza B. Forty-six percent of all confirmed influenza non-sentinel cases were positive for influenza A and 54% were positive for influenza B. Of subtyped influenza A non-sentinel specimens (n=1967), 77% were positive for influenza A(H3N2) and 23% were positive for influenza A(H1N1)pdm09.

Sentinel GP and Non-sentinel virological combined data

Influenza B, A(H3N2) and A(H1N1)pdm09 all circulated throughout the 2017/2018 influenza season, with proportions varying by setting. The number and proportion of influenza B viruses, exceeded influenza A detections, and reached the highest number and proportion detected in any season since this surveillance system began in 2000. In total 2924 positive influenza B specimens were detected by the NVRL during the 2017/2018 season. Influenza A accounted for 44% of all influenza positive specimens and influenza B for 56% tested by the NVRL during the 2017/2018 season, in comparison to 95% influenza A and 5% influenza B detected during the 2016/2017 season. Of the 2266 influenza A sentinel and non-sentinel specimens that were subtyped during the 2017/2018 season, influenza A(H3N2) accounted for 77% and influenza A(H1N1)pdm09 for 23%. Influenza positive specimens peaked during week 3 2018, with a total of 567 influenza positive specimens taken during this week and detected by the NVRL. Further details are included in Table 1 and figure 2.

Table 1. Number of sentinel and non-sentinel[b] respiratory specimens tested by the NVRL and positive influenza results, for the 2017/2018 season, in Ireland.

Specimen type	Total tested	No. flu positive	% flu positive	Influenza A				Influenza B
				A(H1)pdm09	A(H3)	A-not subtyped	Total influenza A	
Sentinel	1586	874	55.1	65	234	4	303	571
Non-sentinel	17692	4382	24.8	452	1515	62	2029	2353
Total	**19278**	**5256**	**27.3**	**517**	**1749**	**66**	**2332**	**2924**

[b] Non-sentinel respiratory specimens relate to specimens referred to the NVRL (other than sentinel GP specimens) from hospitals, primary care facilities not involved in sentinel surveillance, nursing homes and other institutions. Non-sentinel specimens may include more than one specimen from each case.

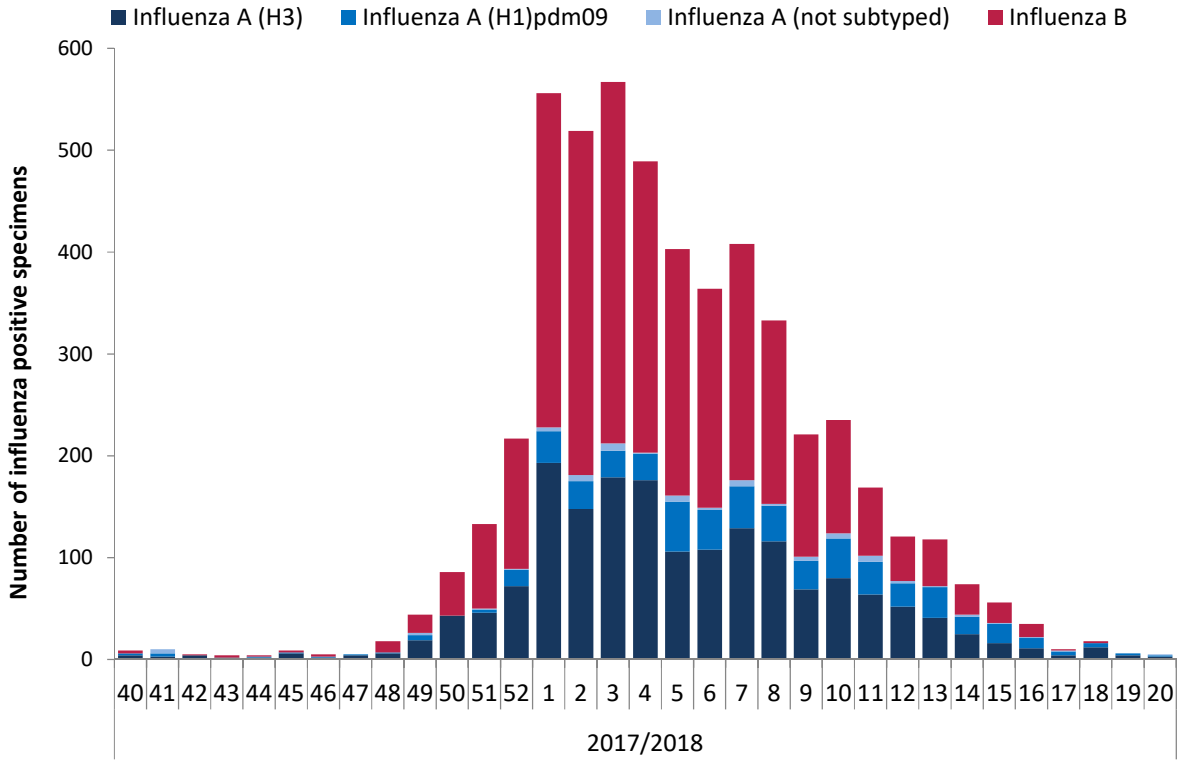

Figure 2. Number of positive influenza specimens (from sentinel and non-sentinel sources combined) by influenza type/subtype tested by the NVRL, by week (week specimen is taken) for the 2017/2018 influenza season, in Ireland.

Influenza Virus Characterisation

For the 2017/2018 influenza season, genetic characterisation of influenza viruses circulating in Ireland was carried out by the NVRL, on a selection of influenza positive specimens (n=248): 85 influenza A(H3N2), 25 influenza A(H1N1)pdm09 and 138 influenza B.

- All influenza A(H1N1)pdm09 viruses characterised (n=25) during the 2017/2018 season were group 6B.1 viruses, represented by A/Michigan/45/2015. This was the dominant global influenza A(H1N1)pdm09 variant and was included in the 2017/2018 northern hemisphere vaccine and is also included in the 2018/2019 influenza vaccine. The circulating viruses were a good match with the vaccine component. All viruses carry the characteristic amino acid mutations for this group and additional substitutions S74T and S164T. Smaller groups of viruses also contained the substitutions T120A, N38D, S183P or R223Q. There is no evidence that these substitutions were associated with antigenic change. Neuraminidase genes were sequenced for ten A(H1N1)pdm09 viruses and all were confirmed as the N1 gene of the circulating group of viruses, 6B.1, with no mutations associated with antiviral resistance identified. Antigenic characterisation was performed on 17 specimens and confirmed that the viruses were a good match for the 2017/2018 vaccine. In the HI analysis, the test viruses (n=17) were recognised well by the antiserum raised against the 2017/2018 vaccine virus, A/Michigan/45/2015.

- Influenza A(H3N2) viruses have been evolving rapidly with substantial genetic diversity observed, particularly within the haemagglutin (HA) genes of the 3C.2a subgroup. During the 2017/2018 season, new subclades and genetic subgroups were defined. The majority of influenza A(H3N2) viruses characterised in Ireland in the 2017/2018 season fell in the 2017/2018 vaccine component clade, 3C.2a represented by A/Hong Kong/4801/2014 (77.6%, n=66/85). Of these 66 3C.2a viruses, 92.4% were in the 3C.3a2 subgroup and 7.6% were 3C.2a3 viruses. A further 17.7% (n=15) of A(H3N2) viruses fell in the 3C.2a1 subclade, represented by A/Singapore/INFIMH-16-0019/2016, all of which were in the subgroup 3C.2a1b. The 3C.2a1 subclade was dominant in Ireland in the 2016/2017 season. Additionally, four viruses (4.7%) were characterised as 3C.3a viruses, represented by A/Switzerland/9715293/2013. The HA genes of the 3C.3a viruses carry the characteristic substitutions A138S, F159S and N225D in HA1 and also carry additional mutations S91N, N144K and F193S. This strain has been identified sporadically throughout Europe since 2013 but in 2016/2017 was present in 15% of Irish A(H3N2) viruses.
- The vast majority of influenza B viruses (97.1%, n=134/138) sequenced in Ireland during the 2017/2018 season, were B/Yamagata lineage viruses, all falling into clade 3, represented by B/Phuket/3073/2013. All circulating influenza B/Yamagata viruses reported globally during the 2017/2018 season were clade 3 viruses. The B/Yamagata lineage virus was not included in the northern hemisphere trivalent vaccine for 2017/2018 used in Ireland and across most of Europe. All circulating B/Yamagata viruses have been associated with the AA mutations L172Q and M251V in the haemagglutinin gene with some additional mutations. Influenza B/Victoria viruses circulated at a low level throughout Europe during the 2017/2018 season, with the vast majority circulating globally falling into the B/Brisbane/60/2008 vaccine clade. During the 2017/2018 season, two new groups of B/Victoria viruses emerged within this clade containing deletions within the HA1 gene. All four B/Victoria viruses detected in Ireland during the 2017/2018 season fell into one of these new deletion groups (Δ162-163). The haemagglutinin of this genetic group (Δ162-163) also encodes additional substitutions D129G and I180V in HA1. These new B/Victoria deletion viruses are antigenically distinct from previously circulating B/Victoria variants and consequently, a B/Victoria deletion virus, B/Colorado/06/2017-like virus, was chosen as the B vaccine component virus for the 2018/2019 northern hemisphere trivalent vaccine.

Further information on the WHO recommendations on the composition of influenza virus vaccines is available on the WHO website.[1]

Other Seasonal Respiratory Viruses

During the 2017/2018 season, RSV positive detections were at very high levels, with 1534 (8.7%) positive detections reported by the NVRL from non-sentinel sources, peaking in early January 2018. High levels of human metapneumovirus (hMPV) (n=990; 5.6%) and adenovirus (n=521; 2.9%) were also reported from non-sentinel sources during the 2017/2018 season. In addition, 169 parainfluenza virus (PIV) type 1 (1.0%), 86 (0.5%) PIV-2, 136 (0.8%) PIV-3 and 61 (0.3%) PIV-4 positive detections were reported during the season.

RSV, hMPV, adenovirus, and PIV-1 & -2 non-sentinel positive detections reached the highest numbers ever reported by the NVRL for any season to date.

Of the 1586 sentinel GP ILI specimens tested during the 2017/2018 season, 32 (2.0%) were positive for RSV, 33 (2.1%) hMPV, 32 (2.0%) adenovirus, 12 (0.8%) PIV-1, one (0.1%) PIV-2, two (0.1%) PIV-3 and three (0.2%) PIV-4.

The total number of sentinel GP and non-sentinel specimens positive for seasonal respiratory viruses (including influenza, RSV, adenovirus, hMPV and parainfluenza virus types 1-4) peaked during week 1 2018 at 820, compared to 457 during week 1 2017. It should be noted that these data reported from the NVRL are analysed by the date the specimens were taken from patients.

Outbreaks

During the 2017/2018 season, 223 acute respiratory infection (ARI), influenza and RSV outbreaks were notified to HPSC, the largest number ever reported for any influenza season (table 2 and figure 3). Of the 223 outbreaks notified, 200 were reported as influenza outbreaks, 10 were associated with RSV, two with human metapneumovirus (hMPV), six with picornavirus (which includes both rhinovirus and enterovirus) and five ARI outbreaks with no pathogens identified. During the month of January 2018 alone, over 100 influenza outbreaks were notified.

Of the 200 notified influenza outbreaks, 79% (n=158) were in residential care facilities/other residential settings, 17.5% (n=35) were in acute hospital settings and 3.5% (n=7) were in other settings. Influenza outbreaks were reported from all HSE-Areas, with 42% (n=84) notified from the Eastern region (HSE-East). Ninety-nine (49.5%) outbreaks were associated with influenza B, 77 (38.5%) with influenza A, 17 (8.5%) with both influenza A and B and seven (3.5%) influenza outbreaks did not have an influenza type/subtype reported.

In total 53 deaths were reported associated with influenza outbreaks notified during the 2017/2018 season. For all influenza outbreaks, vaccination status was reported for patients and staff from 34 residential care/healthcare facilities, with over 80% (1494/1862) of patients and 36% (798/2230) of staff reported as vaccinated prior to these outbreaks.

Table 2. Number of Acute Respiratory Infection (ARI), Influenza and Respiratory Syncytial Virus (RSV) outbreaks notified by HSE-Area during the 2017/2018 season, in Ireland.

HSE-Area	ARI	Influenza	RSV	Total
HSE-East	0	84	3	87
HSE-Midland	1	10	0	11
HSE-Midwest	0	7	1	8
HSE-Northeast	0	14	3	17
HSE-Northwest	4	16	1	21
HSE-Southeast	0	24	0	24
HSE-South	4	26	2	32
HSE-West	4	19	0	23
Total	**13**	**200**	**10**	**223**

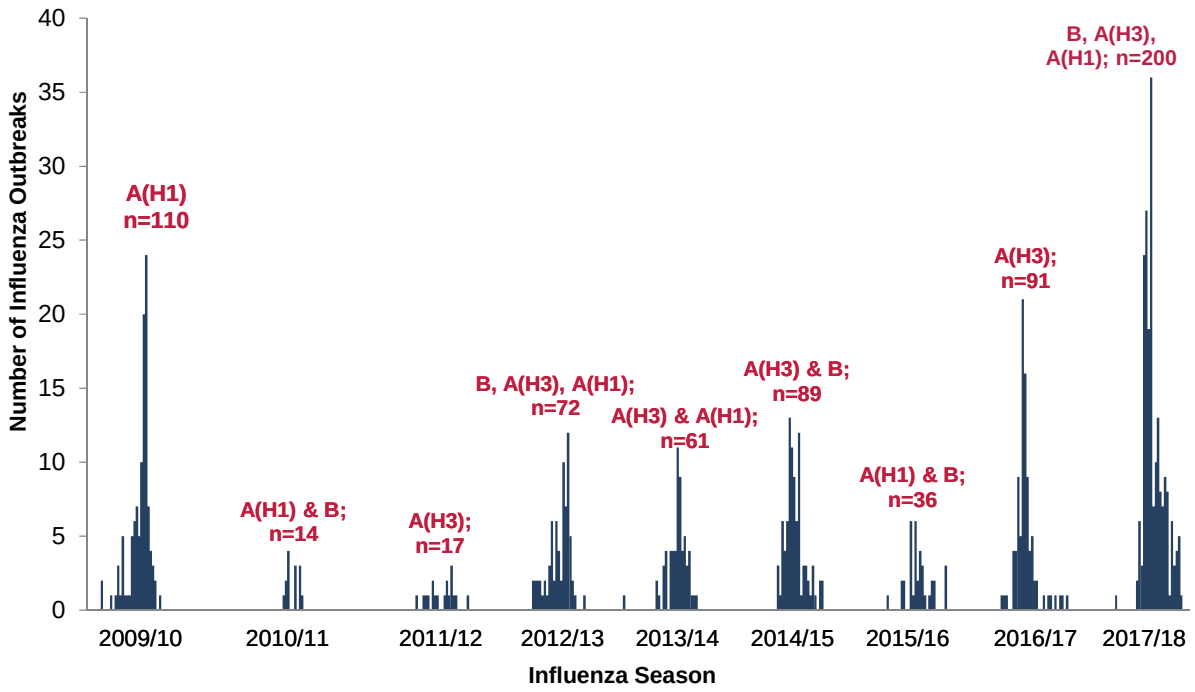

Figure 3. Number of notified influenza outbreaks and predominant influenza type/subtype by season, 2009/2010 to 2017/2018, in Ireland.

GP Out-Of-Hours (OOHs)

The percentage of influenza-related calls to GP out-of-hours services in Ireland, peaked during week 1 2018 at 9.5%, compared to the peak rate of 7.7% during week 1 2017 (figure 4). The peak in influenza-related calls was the highest peak since the 2010/2011 season.

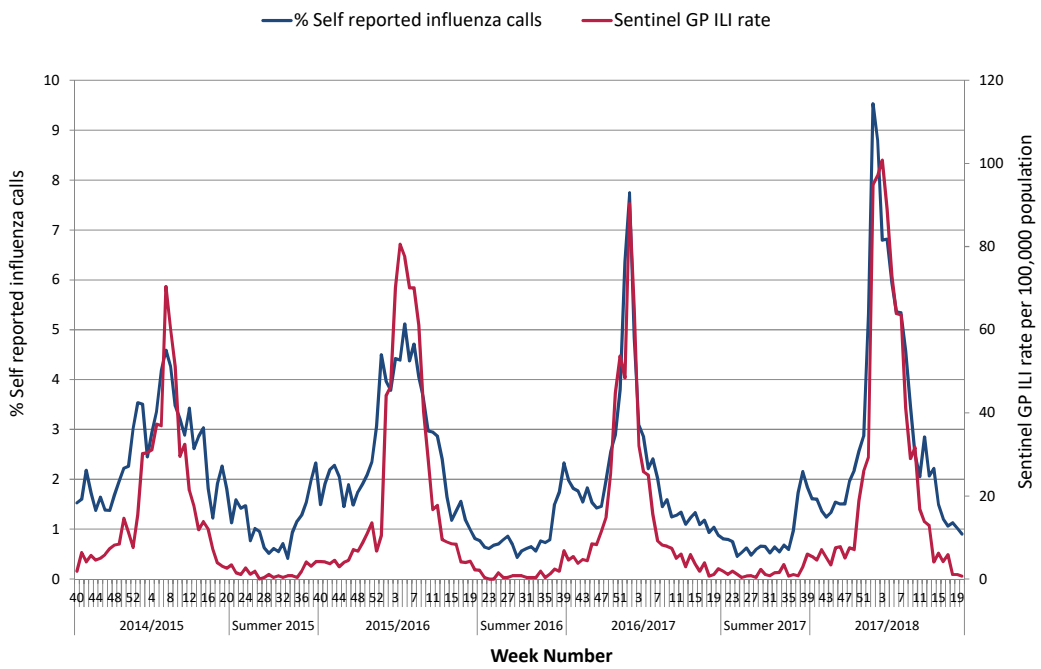

Figure 4. Self-reported influenza-related calls as a proportion of total calls to Out-of-Hours GP Co-ops and sentinel GP ILI consultation rate per 100,000 population by week and season, in Ireland

Sentinel hospital admissions

Hospital respiratory admissions reported from a network of sentinel hospitals during the 2017/2018 season, peaked at 535 during week 1 2018, this is the highest peak level in recent years (figure 5). The peak coincided with high levels of influenza. Total emergency admissions reported from the Irish sentinel hospital network peaked during the last week in January (week 4 2018; n=2975), one week following the peak in sentinel GP ILI consultation rates and coinciding with a time period when the sentinel GP ILI age specific rates for those aged 65 years was high.

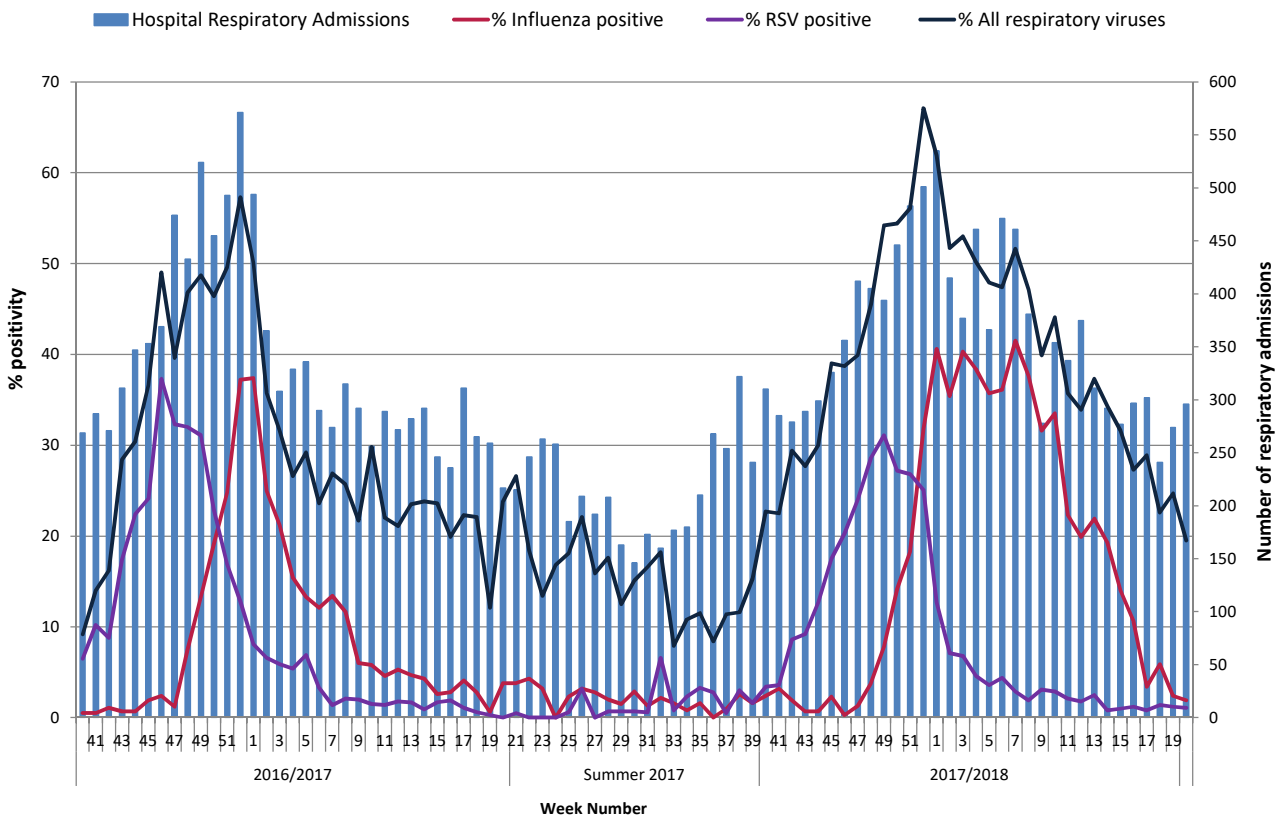

Figure 5. Number of respiratory admissions reported from the Irish sentinel hospital network and % positivity for influenza, RSV and all seasonal respiratory viruses tested* by the NVRL by week and season. **All seasonal respiratory viruses tested refer to non-sentinel respiratory specimens routinely tested by the NVRL including influenza, RSV, adenovirus, parainfluenza viruses and human metapneumovirus (hMPV).*

Influenza and RSV notifications

A total of 11,889 influenza cases were notified to HPSC on Ireland's Computerised Infectious Disease Reporting System (CIDR) during the 2017/2018 influenza season; the highest number of notified influenza cases reported since influenza became notifiable in 2004. Over one-third (36%) of cases nationally, were notified from the Eastern Region (HSE-East). Of the 11,889 notifications, 11,822 were reported as confirmed cases, 28 probable cases, 36 possible cases and three notified cases were reported with the case definition not specified. Of the 11,822 confirmed influenza cases, 5062 (42.8%) were positive for influenza A [1558 influenza A(H3N2), 588 influenza A(H1N1)pdm09 and 2916 influenza A (not subtyped)], 6719 (56.8%) were positive for influenza B and 41 (0.3%) were notified with influenza type/subtype not recorded (figure 6). Of the 2146 confirmed influenza A cases subtyped, 73% were influenza A(H3N2) and 27% were influenza A(H1N1)pdm09.

A total of 3158 RSV notifications were reported to HPSC during the 2017/2018 season; the highest number of RSV notifications reported since RSV was made notifiable in 2012.

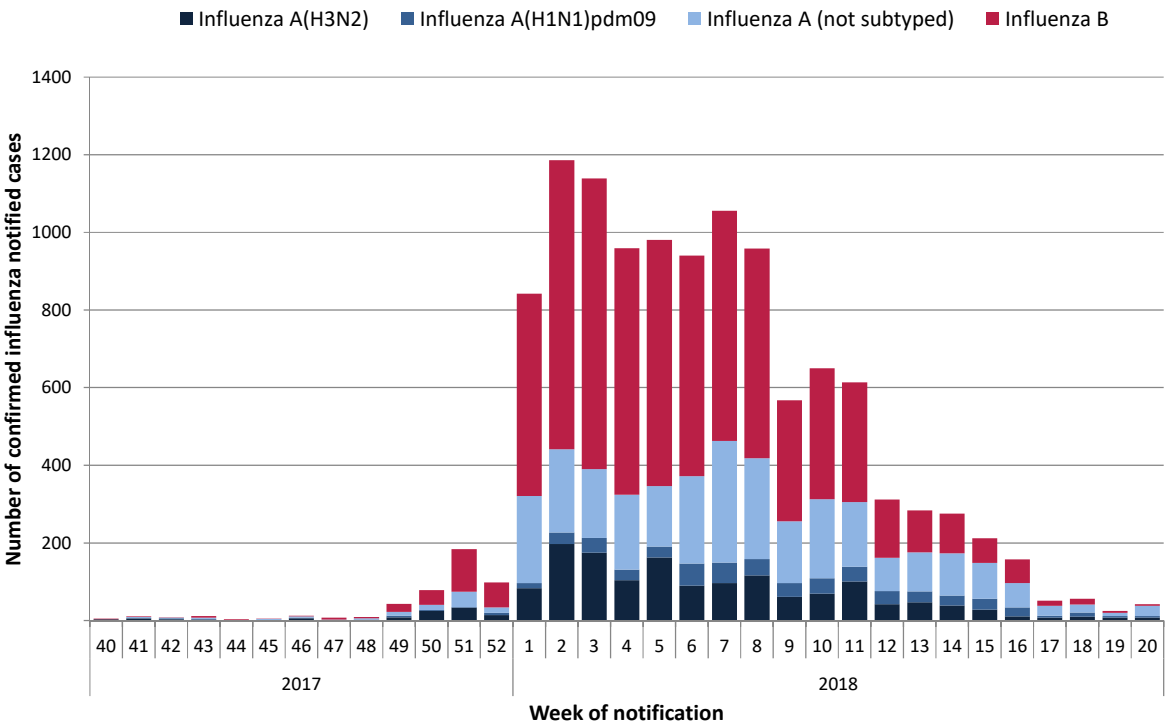

Figure 6: Number of confirmed influenza cases notified on Ireland's Computerised Infectious Disease Reporting System by influenza type/subtype and by week of notification for the 2017/2018 season. *Cases with influenza type not reported are excluded.*

Confirmed influenza cases – Pregnancy status

Enhanced surveillance data on pregnant women with confirmed influenza is not routinely collected. Therefore these data likely underestimate the actual number of pregnant women with laboratory confirmed influenza during the 2017/2018 season.

A total of 72 confirmed influenza cases notified during the 2017/2018 season were reported as pregnant. Over half of these cases, 58% (n=42) were positive for influenza A [21 A(H3N2), 8 A(H1N1)pdm09 and 13 A (not subtyped)] and 42% (n=30) were positive for influenza B. The median age of cases was 33 years (IQR 25-36). Week of gestation was reported for 43 cases. The median week of gestation was 28 weeks (IQR 20-34). Of the 43 cases with reported week of gestation, 7% (n=3) were in the first trimester, 42% (n=18) were in the second trimester and 51% (n=22) were in the third trimester. Sixty-three cases were reported as hospital inpatients and three cases were reported as being admitted to critical care units. Influenza vaccination status was reported for 28 cases, 22 (79%) of whom were not vaccinated.

Confirmed influenza cases hospitalised

During the 2017/2018 season, 4713 (99/100,000 population) laboratory confirmed influenza hospitalised cases were notified (40% of all confirmed influenza cases notified), exceeding all previous seasons on record[c] (figure 7).

The median age of hospitalised influenza cases during the season was 63 years old. The highest age specific rate for hospitalised influenza cases was in those aged 65 years and older, with 2245 (352/100,000 population) cases reported in this age group. The age specific rates in those aged 65 years and older were at the highest rate ever recorded in this age group. Over one thousand hospitalised influenza cases in those aged 65 years and older (53%; n=1194) were notified in January/early February 2018 (weeks 1-6 2018).

During the 2017/2018 season, the proportion of influenza B hospitalised cases was 54% (46% were associated with influenza A); this is the highest proportion of influenza B hospitalised cases reported in any season to date (figure 7). Of subtyped influenza A cases, 69% were associated with influenza A(H3N2) and 31% with influenza A(H1N1)pdm09. Further data on confirmed influenza hospitalised cases for are detailed in tables 3 and 4.

[c] Surveillance of confirmed influenza hospitalised cases in all age groups began in 2009.

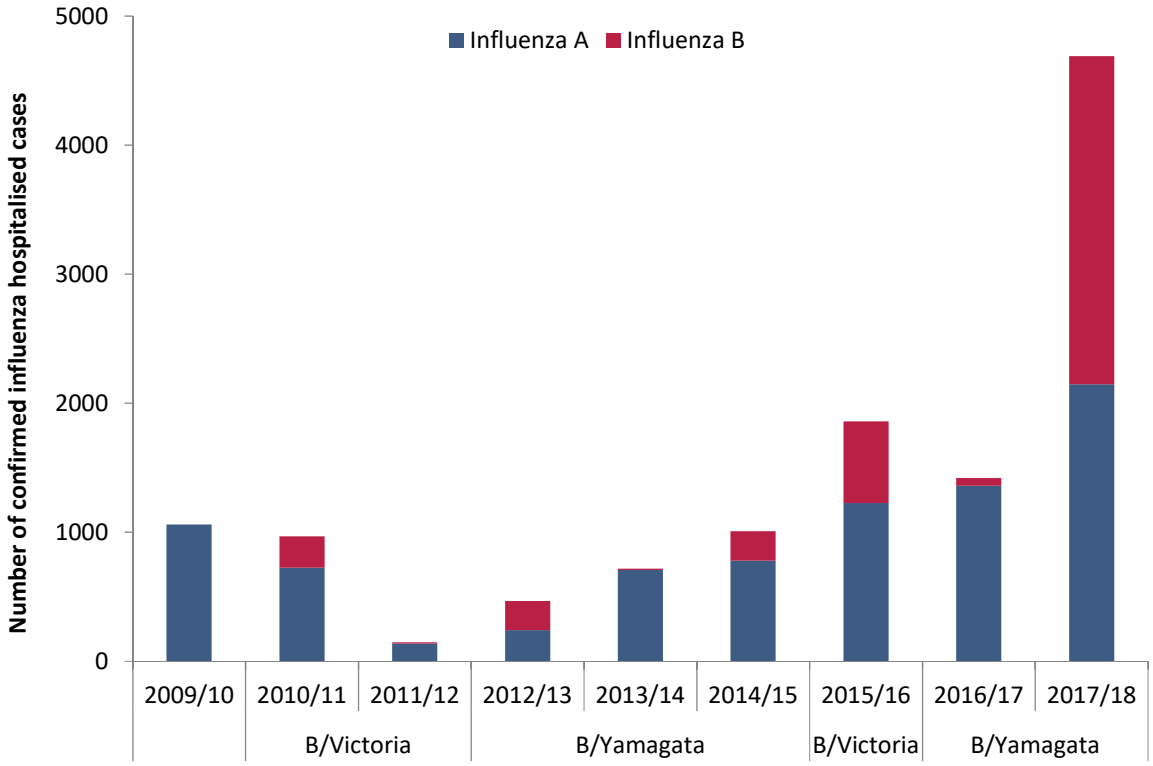

Figure 7. Number of confirmed influenza cases hospitalised by influenza type, predominant influenza B lineage and season, notified on Ireland's Computerised Infectious Disease Reporting System.

Table 3. Summary of confirmed influenza hospitalised cases for all ages by season, 2009/2010-2017/2018, in Ireland. *Rates for 2009/2010-2013/2014 are based on the 2011 CSO census; rates for 2014/2015-2017/2018 are based on the 2016 CSO census.*

Season	2009 pdm	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Predominant influenza	AH1pdm09	AH1pdm09; B	AH3	B; AH3 & AH1pdm09	AH3; AH1pdm09	AH3; B	AH1pdm09; B	AH3	B & AH3; AH1pdm09
Number of cases	1059	968	147	469	693	1009	1856	1425	4713
Crude rate /100,000	23	21	3	10	15	21	39	30	99
Proportion A:B	100:0	75:25	94:6	52:48	98:2	77:23	66:34	96:4	46:54
Median age	17	29	27	32	51	59	30	67	63
Hospital Deaths	25	42	6	22	34	47	75	67	194
Hospital Case Fatality Rate (CFR)	2%	4%	4%	5%	5%	5%	4%	5%	4%

Table 4. Age specific rates for confirmed influenza cases hospitalised and admitted to critical care during the 2017/2018 influenza season, in Ireland. Age specific rates are based on the 2016 CSO census.

	Hospitalised		Admitted to ICU	
Age (years)	**Number**	**Age specific rate per 100,000 pop.**	**Number**	**Age specific rate per 100,000 pop.**
0-4	652	196.7	19	5.7
5-14	451	66.8	20	3.0
15-24	157	27.2	4	0.7
25-34	178	27.0	4	0.6
35-44	298	45.2	16	2.1
45-54	288	46.0	12	1.9
55-64	443	87.0	31	6.1
≥65	2245	352.1	85	13.3
Unknown Age	1		0	
Total	**4713**	**99.0**	**191**	**4.0**

Enhanced surveillance hospital data on 0-14 year age group

A total of 2,573 confirmed influenza cases aged between 0 and 14 years were notified on Ireland's Computerised Infectious Disease Reporting System (CIDR) for the 2017/2018 influenza season, 1104 (42.9%) of these cases were reported as hospital inpatients. Over half of the hospitalised cases in this age group, 54.3% (n=600) were positive for influenza A [131 A(H3N2), 124 A(H1N1)pdm09 and 345 A (not subtyped)], 45.4% (n=501) were positive for influenza B and influenza type/subtype was not reported for 0.3% (n=3) of cases. The median age of cases was 4 years (IQR 1-7). Over 59% (n=653) of cases were aged between 0 and 4 years, with 16% (n=176) of cases aged less than one year.

For analysis of enhanced variables, cases with missing data were excluded from calculations of proportions. The most frequently reported symptoms included: fever (95.4%), cough (82.4%) and fatigue (58.6%). The most frequently reported complications included secondary bacterial pneumonia (10.1%), other respiratory complications (7.8%) and primary influenza viral pneumonia (7.6%). Other complications not specified were reported for 8.1% of cases. The median length of stay in hospital was 2 days (IQR 1 - 3 days). Risk group status was reported for 511 (46.2%) hospitalised influenza cases in the 0-14 year age group, with 31% (n=159/511) of cases reported as belonging to a risk group for influenza. The most frequently reported risk groups included: chronic respiratory disease (including asthma) (52%; n=83/159), any condition that can compromise respiratory function (23%; n=37/159) and chronic neurological disease (18.9%; n=30/159). Of 159 cases belonging to a risk group for influenza, 23% (n=37/159) were reported as belonging to more than one risk group.

Of the 1104 confirmed influenza cases reported as hospitalised during the 2017/2018 influenza season, influenza vaccination status was reported for 421 (38.1%) cases. Of these 421 cases, 24 (5.7%) were reported as having received the influenza vaccine for the 2017/2018 influenza season. Of the 109 cases in reported risk groups for influenza and with known vaccination status, 86% were not vaccinated. Approximately, 48% of cases (n=245/515) commenced antiviral treatment.

Additional surveillance data on paediatric cases admitted to critical care units are detailed in the next section.

Confirmed influenza cases admitted to ICU

During the 2017/2018 season, 191 (4/100,000 population) laboratory confirmed influenza cases in all age groups were admitted to critical care units and reported to HPSC, exceeding all previous seasons on record.[2] Of the 191 cases admitted to critical care units, 152 were adults and 39 were paediatric cases[d].

Of the 191 critical care cases, 31 (16%) were infected with influenza A(H3N2), 14 (7%) with influenza A(H1N1)pdm09, 55 with (29%) influenza A (not subtyped) and 91 (48%) with influenza B. Age specific rates for confirmed influenza cases admitted to critical care units during the 2017/2018 season were highest in those aged 65 years and older (13.3 per 100,000 population) (table 4). The overall median age of all cases was 62 years.

Of the 39 paediatric cases aged between 0 and 14 years, data on underlying medical conditions were reported for 35 (90%) cases, 57% of cases were reported to have underlying medical conditions. The most frequently reported underlying medical conditions for paediatric cases were chronic neurological conditions, chronic respiratory disease and chronic heart conditions. Of the 137 (90%) adults with data reported for underlying medical conditions, 91% of cases were reported to have underlying medical conditions. The most frequently reported underlying medical conditions for adults were chronic heart conditions and chronic respiratory disease. Three cases were reported to be pregnant (enhanced data were only received for two of these cases). Sixty-two cases were reported as current/former smokers and 12 cases were reported to have alcohol related disease.

During the 2017/2018 season, 109 adult and 10 paediatric influenza cases admitted to critical care units were reported as requiring ventilation during their stay in critical care. The median length of stay in critical care for adult cases was 7 days and for paediatric cases was 2 days. Of the 123 (81%) adult cases with known vaccination status, 61% were not vaccinated. Of the 19 (49%) paediatric cases with known vaccination status, 89% were not vaccinated. Vaccination status was only known for 113 adults and six paediatric cases with underlying medical conditions, 58% of adults and 67% of paediatric cases with reported risk groups for influenza were not vaccinated. Of 162 cases with known antiviral status, 97% of adults and 95% of paediatric cases were reported to have received antiviral therapy. Forty-seven adults (47/152; 31%) and three paediatric influenza cases (3/39; 8%) admitted to critical care units during the 2017/2018 season died.

A summary of all confirmed influenza cases admitted to critical care units and reported to HPSC between 2009 and up to the 2017/2018 season is shown in table 5 for all ages.

[d] For the purposes of this surveillance system, paediatric cases refer to all cases aged 0-14 years.

Table 5. Summary of confirmed influenza cases admitted to critical care units and reported to HPSC, 2009 pandemic period to 2017/2018, in Ireland. *Rates for 2009/2010-2013/2014 are based on the 2011 CSO census; rates for 2014/2015-2016/2017 are based on the 2016 CSO census.*

	Confirmed Influenza Cases Admitted to Critical Care Units								
	2009 pdm period	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Predominant flu type/subtype	AH1pdm09	AH1pdm09; B	AH3	B; AH3 & AH1pdm09	AH3; AH1pdm09	AH3; B	AH1pdm09; B	AH3	B; AH3 & AH1pdm09
Total cases	100	121	15	39	83	69	161	51	191
Crude rate /100,000	2.2	2.6	0.3	0.8	1.8	1.4	3.4	1.1	4.0
% Influenza A:B	100:0	95:5	100:0	59:41	98:2	80:20	82:18	88:12	52:48
Median age (years)	34	49	60	39	50	63	51	67	62
Females	50%	53%	80%	49%	41%	41%	42%	33%	54%
Pregnant/postpartum	8	8	0	4	4	1	5	0	2
% Co-morbidities	82%	74%	93%	90%	85%	86%	83%	93%	85%
% Vaccinated	NA	17%	-	-	32%	47%	18%	31%	35%
Antiviral treatment	NA	NA	86%	88%	90%	83%	94%	84%	96%
ICU: Hospital ratio	9%	13%	10%	8%	12%	7%	9%	4%	4%
ICU Median LOS - Adult	12	14	5	9	9	9	9	5	7
ICU Median LOS - Paed.	8	7	3	5	8	3	5	3	2
Mechanical ventilation	86%	90%	77%	91%	94%	93%	92%	98%	85%
ECMO	5	10	0	0	2	1	11	0	1
Total deaths - all causes	18	35	5	11	27	23	47	20	50
Case fatality rate	18%	29%	33%	28%	33%	33%	29%	39%	26%

Mortality data

During the 2017/2018 influenza season, of the 11,889 influenza cases notified, 255 (2%) cases were reported as having died, the highest number of influenza deaths recorded in any season (table 6). The influenza case classification was confirmed for 242 of these cases, probable for five cases and possible for eight cases. Of the cases with reported influenza virus type/subtype, 47% of deaths were associated with influenza A and 53% with influenza B. Of 244 cases with known virology, 37 were associated with influenza A(H3N2), 5 with A(H1N1)pdm09, 67 with A (not subtyped), 123 with influenza B and 12 with influenza type/subtype not recorded. Influenza was reported as a cause of death (either on the death certificate or by the physician) for 191 cases. The median age of cases who died during the 2017/2018 influenza season was 81 years (interquartile range: 69-88). Six paediatric deaths were notified to HPSC in confirmed influenza cases aged less than 16 years. Eighteen deaths occurred in cases who were not vaccinated[e] and belonged to risk groups for influenza (13 cases were aged 65 years and older and five were aged less than 65 years).

HPSC monitors excess all-cause deaths in Ireland. From mid-December 2017, a marked increase in all-cause excess mortality was observed for a period of 13 weeks, particularly amongst those aged 65 years and older. The timing of this excess mortality coincided with high levels of influenza circulation.

Table 6. Number (and crude rate* per 100,000 population) of notified influenza cases that died from all causes and were reported on Ireland's Computerised Infectious Disease Reporting System (CIDR) by influenza season, 2009/2010-2017/2018.

Season	2009 pdm	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Number of Deaths	32	43	12	38	58	66	84	95	255
Crude rate /100,000	0.7	0.9	0.3	0.8	1.3	1.4	1.8	2.0	5.4

**Rates for 2009/2010-2013/2014 are based on the 2011 CSO census; rates for 2014/2015-2017/2018 are based on the 2016 CSO census.*

[e] Limited surveillance data are reported on vaccination and risk group status. It is anticipated that the actual numbers are higher and caution is advised interpreting these data.

Discussion

The 2017/2018 influenza season was a severe season with high influenza-like illness (ILI) GP consultations rates and high influenza hospitalisation and ICU admission rates.[2] Influenza activity was elevated and geographically widespread for an extended period. All age groups were affected; however there was a high impact on those aged 65 years and older with very high hospitalisation rates in this age group, a record number of notified influenza outbreaks in nursing homes and excess deaths were reported from mid-December 2017 to mid-March 2018. Influenza associated hospitalisations were four times greater than the influenza hospitalisations reported during the 2009 influenza pandemic.

The National Virus Reference Laboratory (NVRL) reported the highest number of influenza viruses detected during the 2017/2018 season, since surveillance began in 2000. Very high levels of respiratory syncytial virus (RSV) and high levels of human metapneumovirus, adenovirus and parainfluenza virus (types 1 and 2) were also observed during the 2017/2018 season, compared to previous seasons. Coinfections of all seasonal respiratory viruses were reported throughout the season.

Influenza B/Yamagata and influenza A(H3N2) were the predominant influenza viruses circulating during the 2017/2018 season, with significant levels of influenza A(H1N1)pdm09 also circulating during the season. All influenza A(H1N1)pdm09 viruses characterised during the 2017/2018 season in Ireland were group 6B.1 viruses, represented by A/Michigan/45/2015. This is the dominant global influenza A(H1N1)pdm09 variant and was included in the 2017/2018 northern hemisphere vaccine and is also included in the 2018/2019 vaccine. The circulating A(H1N1)pdm09 viruses were a good match with the vaccine component. Influenza A(H3N2) viruses have been evolving rapidly with substantial genetic diversity observed, particularly within the haemagglutinin genes of the 3C.2a subgroup. During the 2017/2018 season, new subclades and genetic subgroups were defined and continue to require close monitoring. The majority of influenza A(H3N2) viruses characterised in Ireland in the 2017/2018 season fell in the 2017/2018 vaccine component clade, 3C.2a represented by A/Hong Kong/4801/2014. The 2017/2018 influenza season was a B/lineage mismatched season, when influenza B/Yamagata viruses circulated and a B/Victoria lineage virus was included in the trivalent vaccine. The vast majority of influenza B viruses sequenced by the NVRL were B/Yamagata lineage viruses, all falling into clade 3, represented by B/Phuket/3073/2013. The B/Yamagata lineage virus was not included in the northern hemisphere trivalent vaccine for 2017/2018 used in Ireland and across most of Europe. For the 2018/2019 influenza season in the northern hemisphere, WHO recommended trivalent influenza vaccines contain the following strains: an A/Michigan/45/2015 (H1N1)pdm09-like virus; an A/Singapore/INFIMH-16-0019/2016 (H3N2)-like virus; and a B/Colorado/06/2017-like virus (B/Victoria/2/87 lineage).[1]

Both influenza A and B viruses circulated throughout the 2017/2018 season in Ireland, with proportions varying by healthcare setting (in community, acute hospital and critical care settings). The high level of influenza B viruses circulating resulted in a significant impact on the Irish health system, not previously observed for influenza B. Since 2009, the proportion of influenza A hospitalised cases has exceeded the proportion of influenza B hospitalised cases every season in Ireland, with the exception of the 2017/2018 season (when 54% of

hospitalised influenza cases were associated with influenza B). During the 2012/2013 influenza season, the proportion of influenza B hospitalised cases was similar, although slightly lower (48% influenza B), compared to the 2017/2018 season. However the 2012/2013 influenza season was a mild season with a low impact on the Irish health system. It is important to note that during the 2012/2013 influenza season, B/Yamagata viruses circulated and were included in the trivalent vaccine, i.e. the circulating and vaccine B/lineage viruses were matched. This is in contrast to the 2017/2018 season which was a severe influenza season with high impact on the Irish health system.[2] The 2017/2018 influenza season was a B lineage-mismatched season, with influenza B/Yamagata viruses circulating and a B/Victoria lineage virus included in the trivalent vaccine. The Irish overall adjusted influenza vaccine effectiveness (VE) estimates in preventing influenza confirmed infection in primary care during the 2017/2018 season ranged from moderate to low levels across all age groups and all influenza types/subtypes. This indicates that despite the influenza B vaccine mismatch and high levels of influenza B viruses circulating, some cross protective immunity was observed for influenza B during the 2017/2018 season.[3]

During each season, influenza places a considerable burden on the Irish health system, with the highest disease burden in young children and the elderly. The number of influenza outbreaks reported during the 2017/2018 season was at the highest level ever recorded. The majority of these outbreaks affected the elderly in residential care facilities; however a significant number also occurred in acute hospital settings. Reported influenza vaccination status of patients/clients in these outbreaks was high, whilst vaccination status of staff was low, highlighting the need to continue improving influenza vaccine uptake amongst health-care workers in order to reduce influenza-related morbidity and mortality. The highest numbers of influenza-like illness (ILI) GP consultations, influenza hospitalisations and ICU admissions each season are in those aged 0-4 years and in those aged 65 years and older. Over 1,100 children and 2,245 adults aged 65 years and older were hospitalised with influenza during the 2017/2018 influenza season. In addition, 191 cases were admitted to critical care units and 255 notified influenza cases died during the 2017/2018 season. Despite this significant burden, influenza vaccination of children in high risk groups for influenza remains low. During the last two seasons, 86-88% of children hospitalised with influenza in high risk groups were not vaccinated.

Additional strategies are needed to reduce the morbidity and mortality associated with influenza in high-risk groups and elderly populations. The high burden of influenza in children and the elderly in Ireland calls for sustained efforts to improve protective measures. Surveillance programmes should continue to monitor the transmission of influenza, influenza severity, changes in circulating viruses, vaccination status and vaccine effectiveness. Increasing vaccine uptake levels, introducing alternative vaccination strategies, such as universal influenza vaccination of children and/ or the use of improved (adjuvanted/high dose) vaccines for the elderly, should be considered.

Further information available on HPSC website

- Further information about influenza is available at http://www.hpsc.ie/a-z/respiratory/influenza/
- Influenza surveillance reports are available at http://www.hpsc.ie/a-z/respiratory/influenza/seasonalinfluenza/surveillance/influenzasurveillancereports/
- Previous annual reports are available at http://www.hpsc.ie/abouthpsc/annualreports/

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