Public Health England

Protecting and improving the nation's health

Surveillance of influenza and other respiratory viruses in the UK: Winter 2017 to 2018

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Executive summary

In the 2017 to 2018 season, moderate to high levels of influenza activity were observed in the UK with co-circulation of influenza B and influenza A(H3).

The impact of this co-circulation was predominantly seen in older adults, with a consistent pattern of outbreaks in care homes noted. In addition, very high impact in terms of laboratory confirmed influenza hospital and ICU/HDU admissions particularly amongst older adults were observed, although peak activity in general practice was variable (moderate in England, Scotland and Northern Ireland and high in Wales). Peak admissions rates of influenza to hospital and ICU were higher than seen in the previous 6 seasons. Levels of excess all-cause mortality were elevated particularly in the elderly, similar to the 2016 to 2017 season but were lower than in the 2014 to 2015 season in which influenza A(H3N2) also dominated, with the exception of Scotland where excesses were higher than in 2014 to 2015.

The UK, as with many Northern Hemisphere countries has reported that the majority of circulating influenza A(H3N2) and B-Yamagata circulating strains were genetically and antigenically similar to the Northern Hemisphere 2017/18 A(H3N2) vaccine strains in the trivalent and quadrivalent vaccines respectively.

Influenza vaccine uptake in 2017 to 2018 in England was higher than the 2016 to 2017 season across all of the target groups in particular in the 65+ year olds (72.6%) and in healthcare workers (68.7%). In 2017 to 2018, the universal childhood influenza vaccine programme with live attenuated influenza vaccine (LAIV) was again offered to all healthy 2 and 3 year olds across the UK, plus to all children of school age Reception, Year 1, 2, 3 and 4 in England and Wales, where 4 year olds were vaccinated in schools for the first time. Uptake achieved in these groups were higher than the previous season. For the pilot programme in England for the remaining children of primary school age (4 to 11 years), an overall uptake of 62.4% was achieved in the 2017 to 2018 season.

In Scotland and Northern Ireland, where vaccination is offered to all primary school children, the uptake in the 2 to <5 year olds (not yet in school) was 56.9% and 50.6% respectively and the uptake in all primary school children (4 to 11 year olds) was 73.0% and 76.5% respectively.

Activity from other circulating seasonal respiratory viruses was lower compared to levels reported in recent years. 2 novel respiratory viruses which emerged in 2012 to 2013, Middle East Respiratory Syndrome coronavirus (MERS-CoV) in the Middle East and avian-origin influenza A(H7N9) in Eastern China, have continued to result in human cases in affected countries in 2017 to 2018.

Surveillance and public health measures established in the UK for travellers returning with severe respiratory disease from these regions are on-going while the risk remains. No laboratory confirmed imported human cases of these viruses in the UK were detected in 2017 to 2018.

Background

Surveillance of influenza and other respiratory viruses in the United Kingdom (UK) is undertaken throughout the year and collated by the Influenza Surveillance Team at Public Health England's National Infection Service (PHE NIS) on behalf of the countries of the UK, with weekly outputs published during the winter season between October (week 40) and May (week 20) the period when influenza typically circulates[1]. This is in collaboration with teams within PHE, Health Protection Scotland[2], Public Health Wales[3] and the Northern Ireland Public Health Agency[4], who are each responsible for producing reports for their countries. A variety of data sources are collated to provide information on circulating influenza strains (including antigenic and genetic characterisation) and antiviral resistance monitoring, timing of influenza activity and to provide rapid estimates of influenza-related burden within the community, on the health service and in relation to excess all-cause mortality. In addition, in-season and end-of-season monitoring of seasonal influenza vaccine uptake is undertaken.

Background information on the data sources covered in this report has been previously described[5]. The Moving Epidemic Method (MEM)[6] is used by the European Centre for Disease Prevention and Control to standardise reporting of influenza activity across Europe. It has been adopted by the UK and is publicly presented for GP influenza-like illness (ILI) consultation rates for each UK scheme and for the proportion of samples positive for influenza through the respiratory DataMart scheme. For the first time this season the MEM thresholds for the UK Severe Influenza Surveillance (USISS) schemes have been presented publicly.

During the 2017 to 2018 season, the roll-out of the licensed live attenuated influenza vaccine (LAIV) has continued across the UK. In England, LAIV was offered to all 2 and 3 year olds through primary care and to children of school age Reception, Year 1, Year 2, Year 3 & Year 4 (4 to 9 year olds) through schools this year.

Additional influenza vaccination activity for children was also carried out with strategies varying by country of the UK. In England, there were geographically discrete pilots targeting children of school age Year 5 to 6. In Wales, all 4 year olds were offered LAIV in school, whereas in Scotland and Northern Ireland, all 2 to 5 year old (not yet in school) and all primary school age children were offered LAIV vaccination.

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[1] Public Health England (PHE). https://www.gov.uk/government/collections/seasonal-influenza-guidance-data-and-analysis
[2] Health Protection Scotland. http://www.hps.scot.nhs.uk/resp/index.aspx
[3] Public Health Wales. http://www.wales.nhs.uk/sites3/page.cfm?orgid=457&pid=34338
[4] Public Health Northern Ireland. http://www.publichealth.hscni.net/directorate-public-health/health-protection/influenza
[5] Health Protection Agency. Surveillance of influenza and other respiratory viruses in the UK: 2011-2012 report. Available from: http://webarchive.nationalarchives.gov.uk/20140714084352/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317134705939
[6] Vega T, et al. Influenza surveillance in Europe: establishing epidemic thresholds by the Moving Epidemic Method. Influenza and Other Respiratory Viruses 2012. doi: 10.1111/j.1750-2659.2012.00422.x.

PHE also carries out surveillance for novel respiratory viruses, including Middle East Respiratory Syndrome Coronavirus (MERS-CoV) which was first recognised in September 2012, and human infection with avian influenza such as influenza A(H7N9) which emerged in Eastern China in 2013; influenza A(H5N1) which emerged in China in 2003 and influenza A(H5N6) which has been seen in China since 2013.

This report describes influenza activity experienced in the UK in the period from week 40 2017 (week ending 08/10/2017) to week 15 2018 (week ending 15/04/2018). This includes observations and commentary from the childhood vaccination programme and activity of other seasonal and novel respiratory viruses.

Observations

Community surveillance

Syndromic surveillance

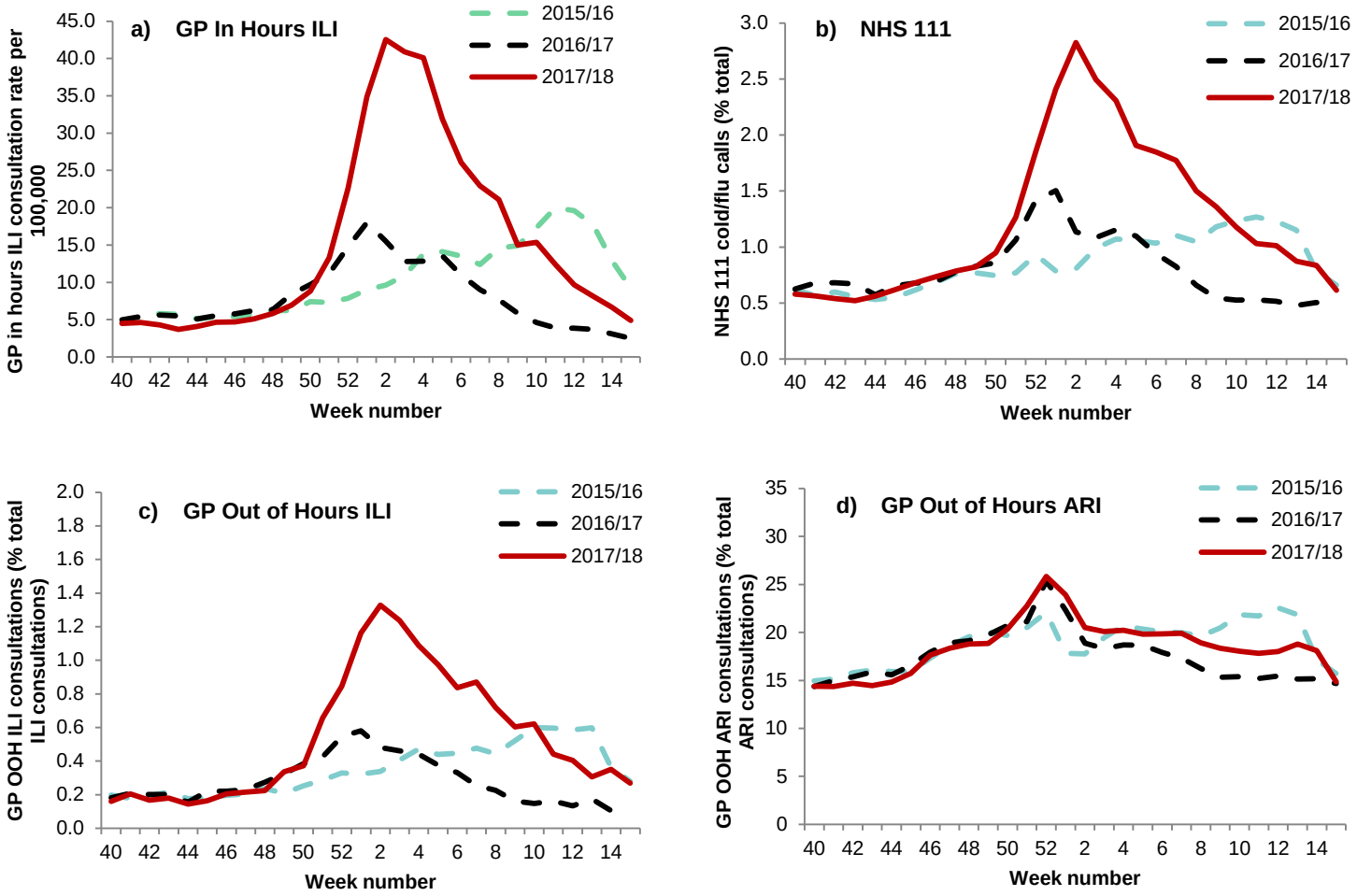
In England, national PHE syndromic surveillance systems, including GP in hours and out of hours consultations, sentinel emergency department attendances (EDSSS) and NHS 111 calls monitor a range of indicators sensitive to community influenza activity for example NHS 111 cold/flu calls and GP consultations for influenza-like illness (ILI)[1].

Syndromic surveillance indicators for GP in hours ILI consultations, GP out of hours ILI consultations and NHS 111 calls, all peaked in week 02 2018 at 42.5 per 100,000 population; 2.8% of consultations and 1.3% of all calls attributed to cold/flu respectively.

The trends and peaks for these systems all resemble those observed in the last notable influenza A(H3N2) season in 2016 to 2017, however they were at higher levels. Syndromic indicators for GP out of hours acute respiratory infections (ARI) consultations peaked in week 52 2017 at 25.8% of consultations, this was similar to the peaks noted in the 2016 to 2017 influenza A(H3N2) season (Figure 1).

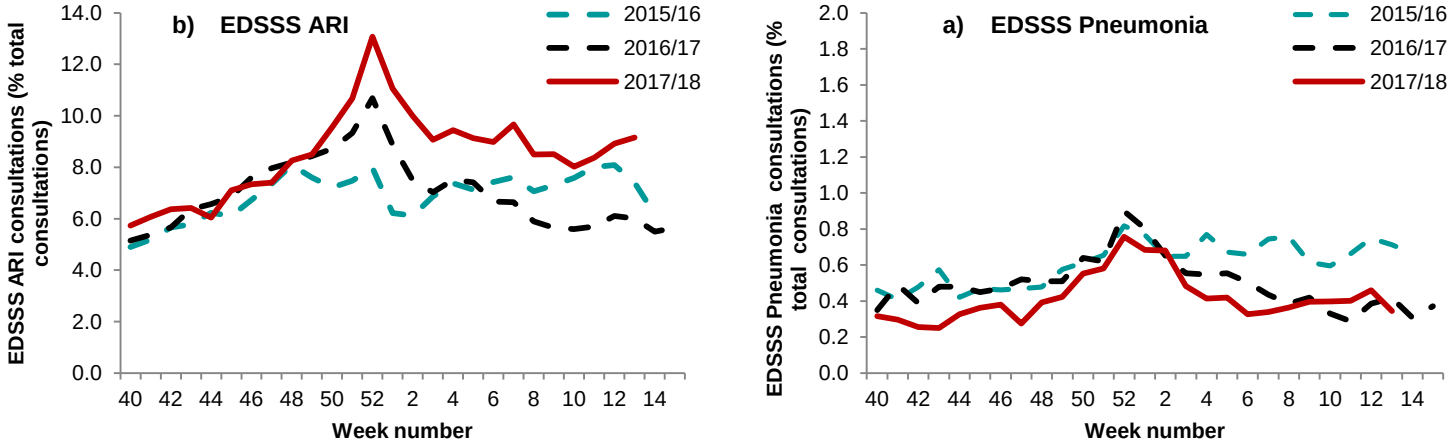
[1]Real Time Syndromic Surveillance, PHE. https://www.gov.uk/government/collections/syndromic-surveillance-systems-and-analyses

Figure 1. Weekly all age (a) GP in hours consultations for influenza like illness (ILI) (b) NHS 111 cold/flu calls (c) GP out of hours consultations for ILI (d) GP out of hours consultations for acute respiratory infections (ARI) for winter 2015 to 2018, England



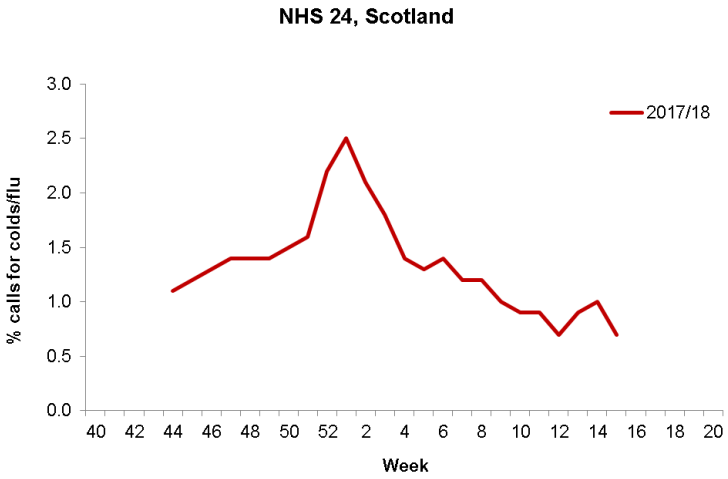
Syndromic indicators for sentinel emergency department attendances peaked during week 52 2017 for ARI and pneumonia consultations. This was similar to the peaks observed in the 2016 to 2017 and 2015 to 2016 seasons (Figure 2).

Figure 2. Weekly all age (a) EDSSS acute respiratory infection consultations and (b) EDSSS pneumonia consultations for winter 2014 to 2018, England



In Scotland, the weekly proportion of all calls to NHS 24 which mention cold/flu, was low and peaked in 01 2018 at 2.5% (Figure 3).

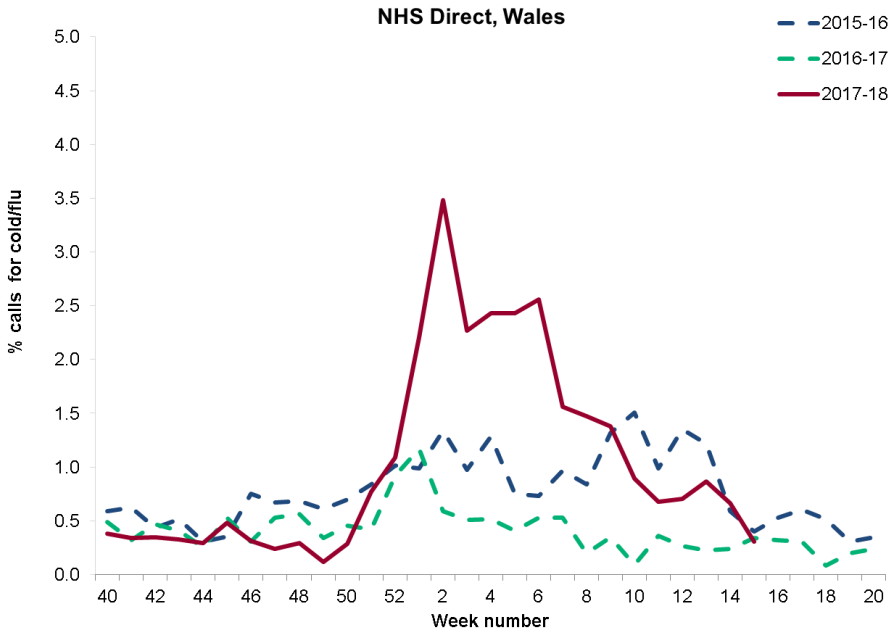
Figure 3. Proportion of calls for cold/flu (all ages) through NHS 24, Scotland, 2017 to 2018



* In October 2017, NHS24 changed over from a legacy system to a new IT system. Correlation between the data from the new system and historical data is being undertaken but is not yet available.

In Wales, the weekly proportion of all cold/flu calls made to NHS Direct Wales peaked in week 02 2018, similar to that of NHS 111 in England. For the majority of the 2017 to 2018 season in Wales, the proportion of cold/flu calls was higher than those observed in the previous 2 seasons (Figure 4).

Figure 4. Weekly proportions of calls for cold/flu (all ages) to NHS-Direct, Wales, 2015 to 2018



Outbreak reporting

Between week 40 2017 and week 15 2018, a total of 2,095 acute respiratory illness outbreaks in closed settings were reported in the UK to PHE compared to 1,114 in 2016 to 2017 and 656 in 2015 to 2016 (Table 1).

Of total outbreaks, 1,650 (78.9%) outbreaks occurred in care homes, 229 (11.0%) in hospitals, 159 (7.6%) in schools and 52 (2.5%) in other settings. This compares to 78.5% of outbreaks occurring in care homes in 2016 to 2017, the last influenza A(H3N2) dominated season. An increase in the other settings category was also noted, where the majority of outbreaks were from prisons/custodial institutions (22/52, 42.3%).

The peak number of outbreaks was observed in week 03 2018 with 239 outbreaks (70.3% in care homes) reported.

Table 1. Number and percentage of UK outbreaks by institution type, 2015 to 2018

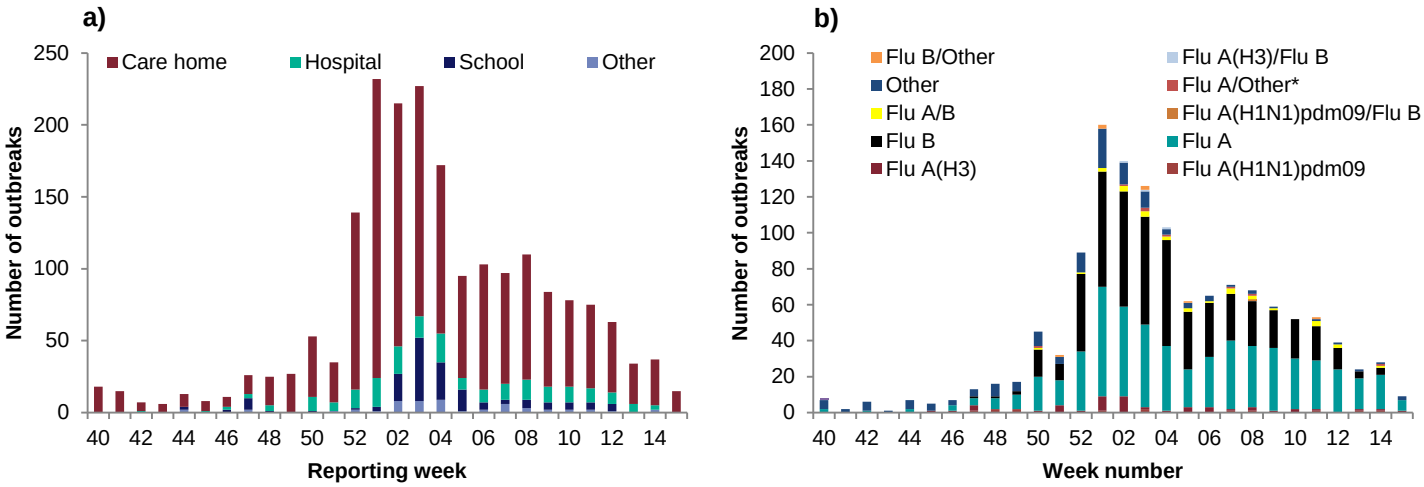
Outbreaks			
	2017/18	2016/17	2015/16
Total	2,095	1,114	656
Instituition type			
Care homes	1,650	875	231
Hospitals	229	162	108
Schools	159	61	275
Other	57	16	42

**Data for 2016/17 & 2015/16 is based on week 40 to week 20*

The week of outbreak onset information was available for 1,651 (81.7%) outbreaks, for which the peak occurred in week 01 2018 with 179 outbreaks and the majority reported from care homes (154/179, 86.0%).

Where information on virological testing were available, the majority of outbreaks were caused by influenza A(unknown subtype) (562/1,342; 41.9%) and influenza B (513/1,342; 38.2%). 46 outbreaks were caused by influenza A(H3), 13 outbreaks were caused by influenza A(H1N1)pdm09 and 126 outbreaks were caused by a range of other non-influenza viruses including respiratory syncytial virus (RSV), rhinovirus, human metapneumovirus (hMPV), seasonal coronavirus and parainfluenza (Figure 5).

Figure 5. Weekly number of outbreaks by (a) institution type and (b) virological test results where available by week of reporting, 2017 to 2018 UK



In England a total number of 1,832 ARI outbreaks were reported to Public Health England between week 40 2017 and week 15 2018 compared to 1,009 in the 2016 to 2017 season. The majority of outbreaks were from care homes settings (79.7%) similar to the previous season. Hospital outbreaks accounted for 9.1% of outbreaks; this is slightly lower than in the 2016 to 2017 season (13.5%). School outbreaks accounted for 8.4% of all outbreaks compared to 5.9% in the 2016 to 2017. An increase in the Other settings category of 2.8% of all outbreaks compared to 1.6% in 2016 to 2017 was also noted. Regionally, the majority of outbreaks occurred in the South region (34.3%) followed by the Midlands and East region (32.2%).

In Scotland, the number of ARI outbreaks reported to Health Protection Scotland (HPS) between week 40 2017 and week 15 2018 (132) was higher than season 2016 to 2017 (78). The majority of these outbreaks were reported from care home settings (68.9%), which was similar to the 2016 to 2017 season (69.3%). Hospital outbreaks also accounted for a similar proportion of outbreaks observed in the 2016 to 2017 season (28.0% in 2017 to 2018 compared to 30.7% in 2016 to 2017). School outbreaks were also observed in 2017 to 2018 season and accounted for 2.3% of all outbreaks, this compares to no school outbreaks observed in the 2016 to 2017 season.

In Wales, there were 88 outbreaks of ARI reported to the Public Health Wales Health Protection teams between week 40 2017 and week 15 2018 compared to 49 during the 2016/17 season. The majority were reported from care home settings (63.6%), followed by hospital settings (28.4%), community settings (4.5%) and school settings (3.4%). Influenza A was laboratory confirmed in 9 of the outbreaks reported this season, Influenza B was laboratory confirmed in 11 of the outbreaks and influenza A and B were confirmed in 5 outbreaks.

In Northern Ireland, 43 confirmed respiratory outbreaks were reported to the Public Health Agency, all of which were from care homes (27 influenza A(unknown subtype),

one influenza A(H3), ten influenza B, 4 RSV and one mixed infections of influenza A and B). This compares to a total of 13 confirmed influenza outbreaks in 2016 to 2017 and 7 confirmed influenza outbreaks in 2015 to 2016.

Medical Officers of Schools Association (MOSA) and PHE scheme

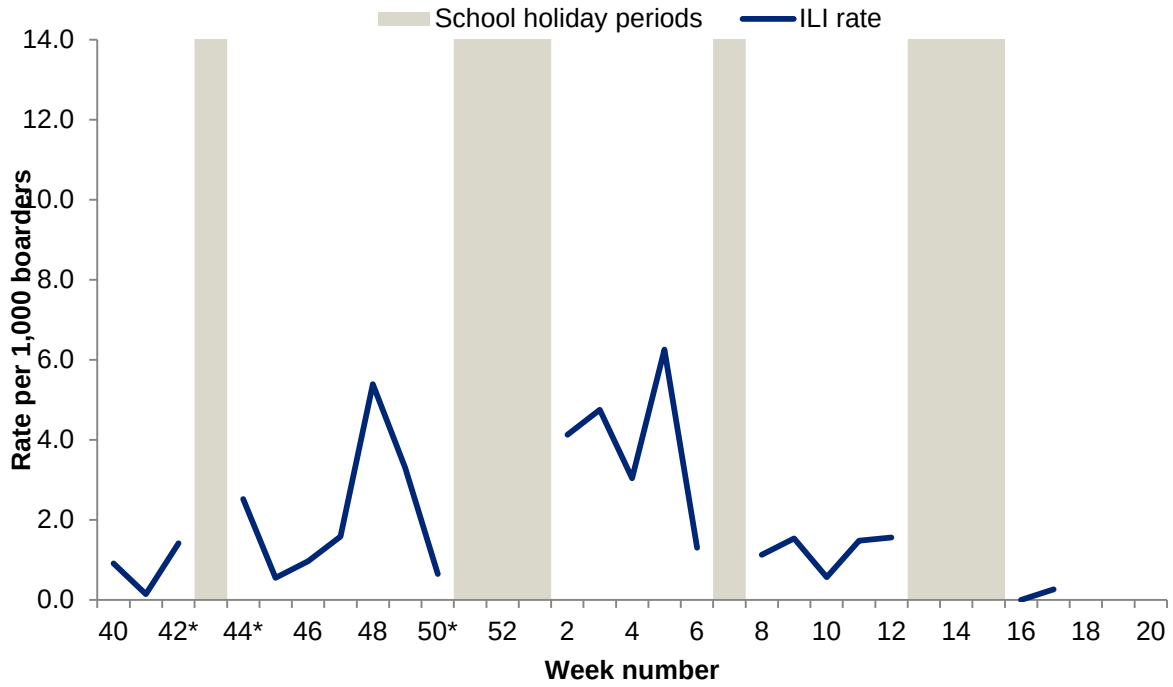
The Medical Officers of Schools Association (MOSA) was founded in 1884 and involves a network of more than 200 predominantly private and boarding schools around the United Kingdom[2,3].

Following the re-introduction of influenza A(H1N1) in 1978, which spread widely amongst children and younger people, Public Health England (PHE) and the Medical Officers of Schools Association (MOSA) developed a surveillance scheme to monitor respiratory illness in children attending MOSA (a network of private and boarding schools) schools in England. Since September 1983, the scheme has formed part of the routine surveillance activities of PHE.

Participating MOSA schools completed a general annual online survey, including questions on influenza vaccine policies for students, weekly surveys reporting how many boarders developed influenza-like-illness (ILI) as well as other respiratory related illnesses and a vaccine uptake survey by school year.

In 2017 to 2018, 21 MOSA schools agreed to participate in the scheme, including a total of 7,575 boarders. 97.5% of boarders were from secondary schools.
Figure 6 represents the weekly ILI rates observed through the scheme this season. ILI rates peaked in week 05 2018 at 6.3 per 1,000 boarders.

Figure 6. Weekly ILI rates per 1,000 boarders observed through participating MOSA schools in England, 2017 to 2018



*represents weeks where not all schools will be reporting due to varying school holiday periods.

[2] MOSA-PHE scheme. https://www.gov.uk/guidance/sources-of-uk-flu-data-influenza-surveillance-in-the-uk#clinical-surveillance-through-primary-care
[3] MOSA website. http://www.mosa.org.uk/

Google influenza like illness (ILI) searches (internet-based surveillance)

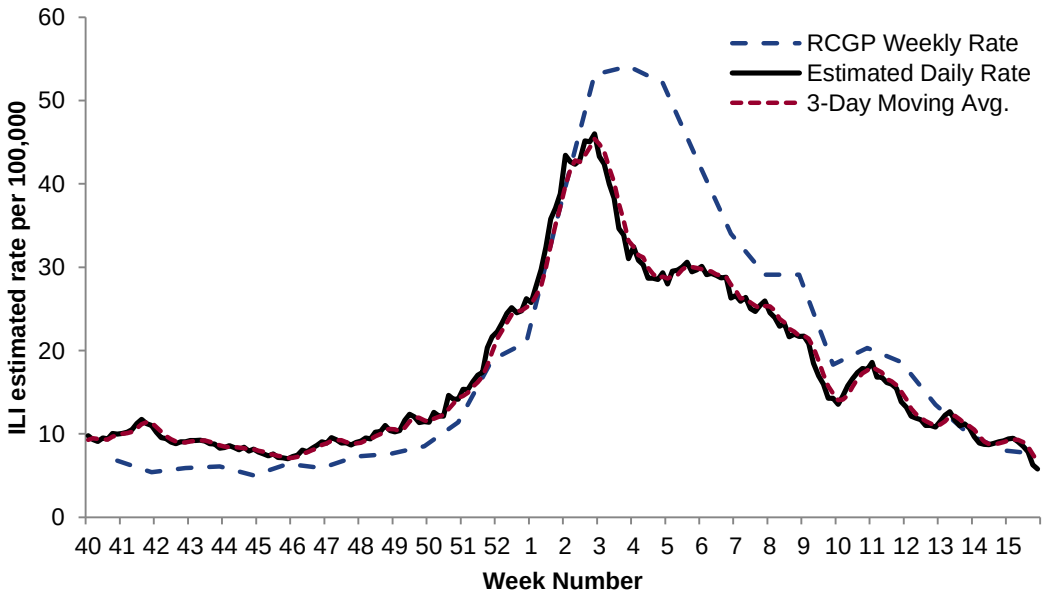
PHE have been collaborating with University College London (UCL) to assess the use of internet based search queries as a surveillance method for ILI, throughout England. This is part of work on early-warning surveillance systems for influenza, through the EPSRC IRC project i-sense [4].

Combining natural language processing and machine learning techniques, a non-linear Gaussian process model was developed by UCL[5,6] to produce real time estimates of ILI. The supervised model, trained on historical data from the Royal College of General Practitioners (RCGP) scheme[7] (2005/06 to 2016/17 seasons at national level), produced daily ILI estimates based on the proportion of ILI related search queries within a 10%-15% sample of all queries issued, which was extracted daily from Google's Health Trends Application Programming Interface (API).

Estimated rates of ILI started to increase in week 46, before peaking during week 02 2018 (Figure 7). This observed peak was one week earlier than that seen through the RCGP ILI consultation data which peaked during week 03 2018.

Due to the nature of daily data and its fluctuations in estimating rates based on searches, a 3-day moving average was applied to visualise the underlying trend.

Figure 7. Daily estimated ILI Google search query rates (and 3-day moving average) and RCGP ILI consultation rates per 100,000 population, 2017 to 2018



*The RCGP weekly ILI rate is plotted on the Sunday of each week.

[4] i.sense website. https://www.i-sense.org.uk/
[5] Lampos V *et al.* Enhancing feature selection using word embeddings: the case of flu surveillance. Proceedings of the 26th International Conference on the World Wide Web, April 03-07, 2017, Perth Australia.
[6] Lampos V *et al*. Advances in nowcasting influenza-like illness rates using search query logs. Scientific Reports. 2015 3;5. doi:10.1038/srep12760
[7] Royal College of General Practitioners Research and Surveillance Centre; www.rcgp.org.uk/clinical-and-research/our-programmes/research-and-surveillance-centre.aspx

Primary care consultations

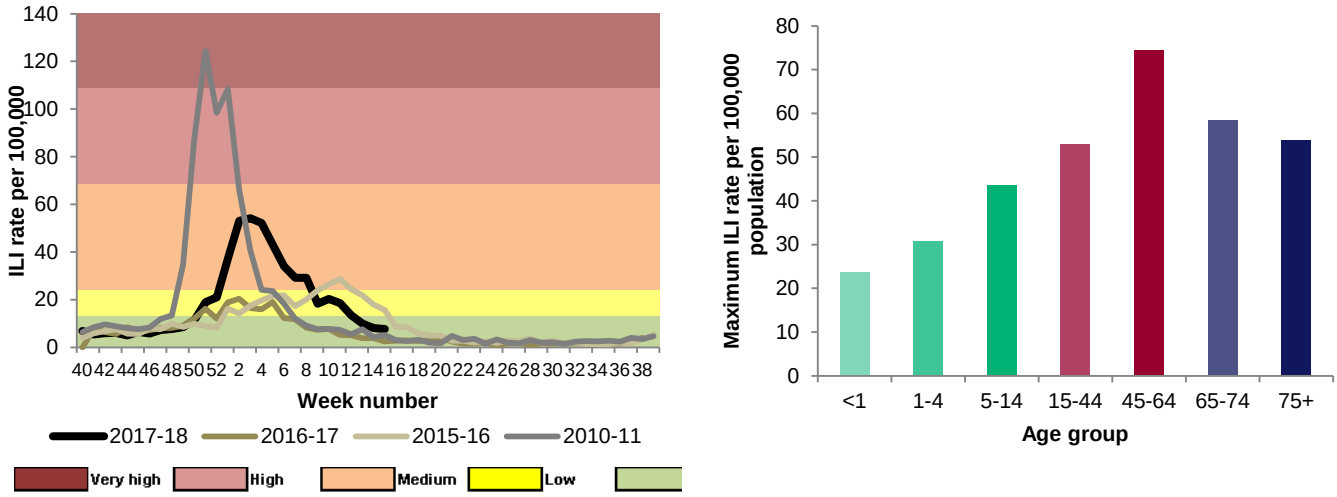
England

Weekly rates of General Practitioner (GP) consultations for influenza-like illness (ILI) through the Royal College of General Practitioners (RCGP) scheme[8] increased above the Moving Epidemic Method (MEM) baseline threshold for the 2017 to 2018 season of 13.1 per 100,000 in week 51 2017, peaking in week 03 2018 at 54.1 per 100,000, the highest peak rate seen since the 2010 to 2011 season. Rates remained at or above the threshold for 14 weeks until week 12 2018 in England (Figure 8).

In comparison to the last influenza A(H3N2) dominated season in the 2016 to 2017 season, the peak activity was greater but occurred during similar weeks (54.1 per 100,000 in week 03 in 2017 to 2018 compared to 20.3 per 100,000 in week 02 in 2016 to 2017). The number of weeks where the ILI rate was above baseline threshold in 2017 to 2018 was the same as that observed in the 2014 to 2015 season (14 weeks vs 14 weeks), a season which was dominated by the influenza A(H3) and B strains.

By age group, activity peaked at the highest levels in the 45-64 year olds (74.4 per 100,000 in week 02 2018) and 65-74 year olds (58.4 per 100,000 in week 02 2018).

Figure 8. Weekly all age GP influenza-like illness rates for 2017 to 2018 and past seasons, and peak rates by age group in 2017 to 2018, England (RCGP)



[8] Clinical surveillance through primary care.
https://www.gov.uk/guidance/sources-of-uk-flu-data-influenza-surveillance-in-the-uk#clinical-surveillance-through-primary-care

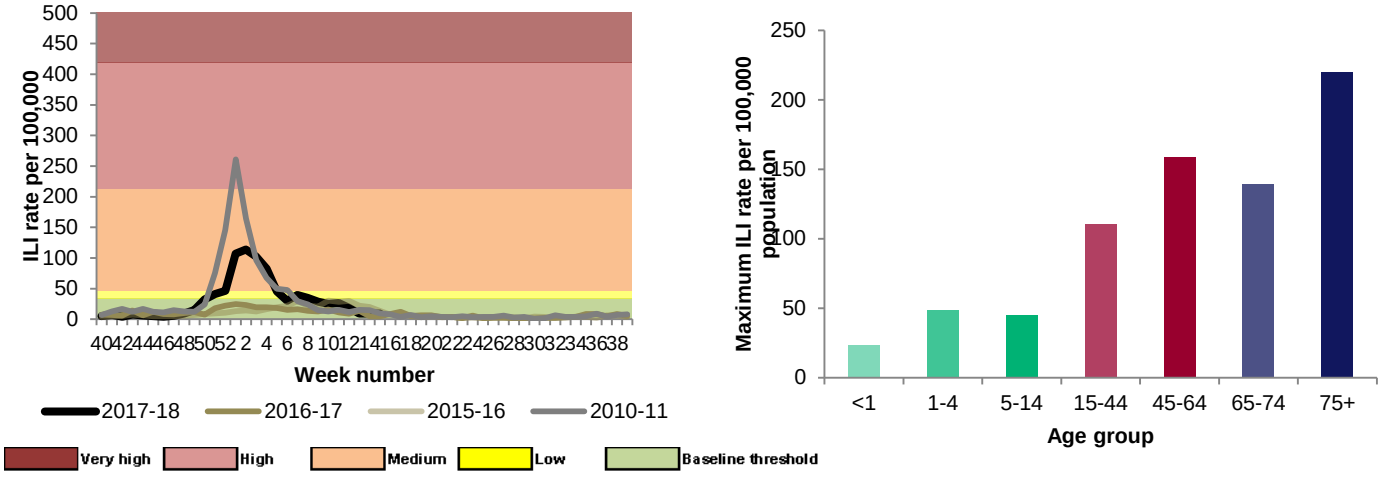
Scotland

Weekly GP consultations for ILI increased above the baseline MEM threshold of 34.5 per 100,000 in week 51 and peaked in week 02 2018 at 113.9 per 100,000. Rates remained above the baseline threshold for 10 weeks until week 08 2018 (Figure 9).

Overall seasonal ILI activity was more intense compared to the last influenza A(H3N2) dominated season in 2016 to 2017 (peak of 24.6 per 100,000 in 2016 to 2017 compared to 113.9 per 100,000 in the 2017 to 2018).

By age group, the highest levels of activity were seen in 75+ year olds (219.8 per 100,000) and 45-64 year olds (159.0 per 100,000). Overall throughout the current season the lowest rates of influenza activity were seen among the youngest ages (in particular the <1 year olds).

Figure 9. Weekly all age GP influenza-like illness rates for 2017 to 2018 and past seasons, and peak rates by age group in 2017 to 2018, Scotland



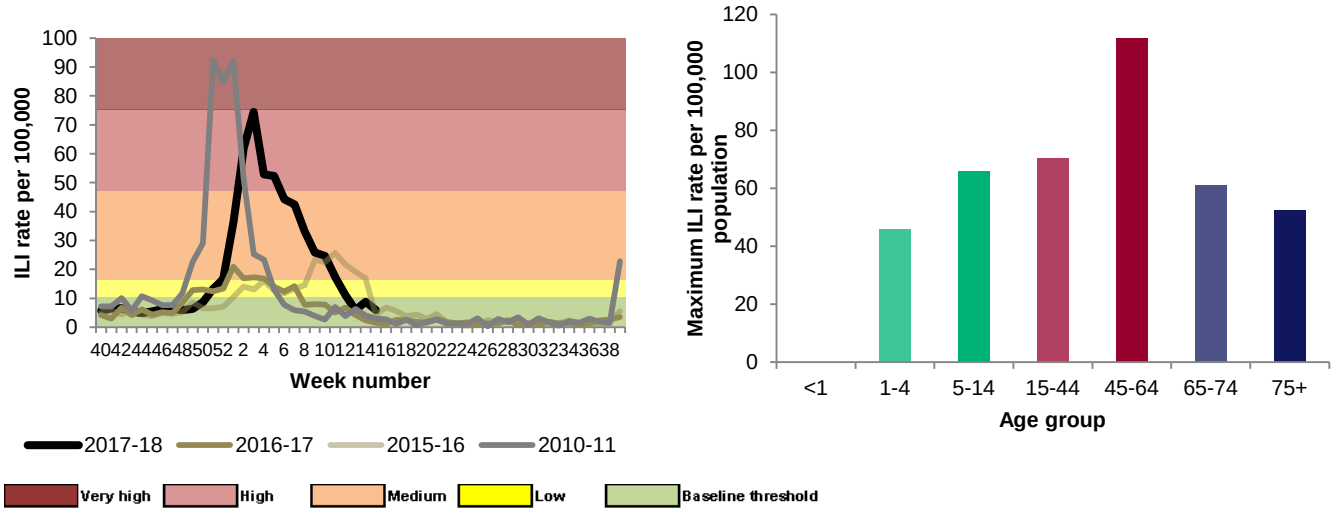
Wales

Weekly GP consultations for ILI in Wales increased above the MEM threshold of 10.4 per 100,000 in week 51 2017 and peaked in week 03 2018 at 74.5 per 100,000. Rates remained at or above the threshold for 14 weeks until week 12 2018 and reached the high intensity threshold levels (Figure 10).

In comparison to the last influenza A(H3N2) dominated season in 2016 to 2017, the peak activity was higher (74.5 per 100,000 in 2017 to 2018 compared to 20.9 per 100,000 in 2016 to 2017).

By age group, the highest levels of activity were seen in the 45-64 year olds (111.6 per 100,000) and 15-44 year olds (70.6 per 100,000).

Figure 10. Weekly all age GP influenza-like illness rates for 2017 to 2018 and past seasons, and peak rates by age group in 2017 to 2018, Wales



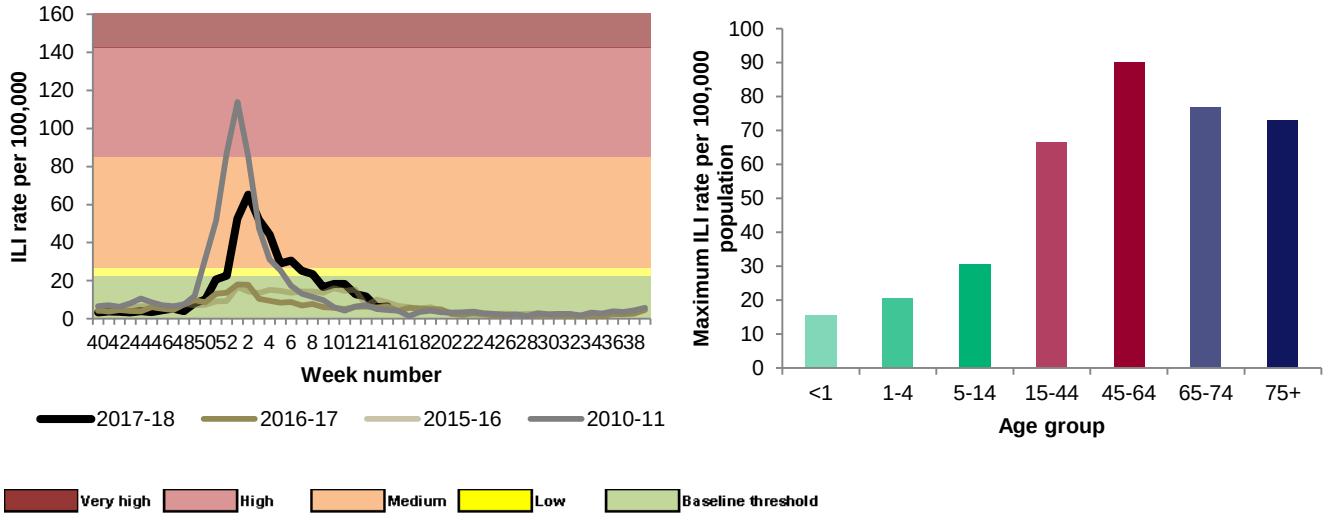
Northern Ireland

Weekly GP consultations for ILI in Northern Ireland increased above the baseline MEM threshold of 26.6 per 100,000 in week 01 2018 and peaked in week 02 2018 at 65.2 per 100,000. This compared to a peak of 18.1 per 100,000 in week 01 in 2016 to 2017, the last influenza A(H3N2) dominated season (Figure 11).
To note, since the beginning of the 2017 to 2018 season, the GP population coverage for the collection of influenza/influenza-like illness data has increased from 12% in previous seasons to 98% of the Northern Ireland population. Historical calculations of rates and MEM thresholds have been adjusted to take this change into account.

By age group, the highest levels of activity were seen in the 45-64 year olds (89.9 per 100,000) and 65-74 year olds (76.7 per 100,000) in week 02 2018 respectively (Figure 11).

[9] Public Health Agency – Northern Ireland, Influenza bulletins.
http://www.publichealth.hscni.net/publications/influenza-weekly-surveillance-bulletin-northern-ireland-201718

Figure 11. Weekly all age GP influenza-like illness rates for 2017 to 2018 and past seasons, and peak rates by age group in 2017 to 2018, Northern Ireland



Secondary care surveillance

Influenza surveillance in secondary care is carried out through the UK Severe Influenza Surveillance Systems (USISS), which were established after the 2009 influenza pandemic. There are 2 schemes established:

- the USISS sentinel hospital scheme, which is a sentinel network of acute trusts in England who report weekly aggregate numbers on laboratory confirmed influenza hospital admissions at all levels of care
- the USISS mandatory ICU scheme, which is a national mandatory collection which collects the weekly number of laboratory confirmed influenza cases admitted to Intensive Care Units (ICU) and High Dependency Units (HDU) and number of confirmed influenza deaths in ICU/HDU across the UK

For the first time in 2017 to 2018, the MEM method has been applied to the USISS schemes (using the previous 6 seasons' rates of admission) to calculate thresholds to show the impact of influenza activity throughout the season[10].

USISS Sentinel

Through the USISS sentinel scheme, a total of 9,996 hospitalised confirmed influenza cases (cumulative rate of 3.59 per 100, 000 trust catchment population) were reported from 25 participating sentinel NHS acute trusts across England from week 40 2017 to week 15 2018. This compares to a total of 1,575 cases (cumulative rate of 0.76 per 100, 000 trust catchment population) from 22 participating trusts in 2016 to 2017 and a total of 2,781 cases (cumulative rate 0.90 per 100,000 trust catchment population) from 26 participating trusts in 2015 to 2016. This season represents the highest number and rate observed since the beginning of the scheme (Figure 14).

The number and rate of hospital admissions peaked in week 02 2018 (1,009 admissions, 9.4 per 100,000 trust catchment population). Amongst cases reported, influenza B was the dominant subtype reported up to week 15 2017, with the highest number of cases observed in the 65+ year olds (Figure 13).

This peak was higher than the 2016 to 2017 season, where the peak was in week 05 2017 with 167 admissions and a rate of 2.6 per 100,000 trust catchment population (Figure 12).

[10] UK Severe Influenza Surveillance Schemes. https://www.gov.uk/guidance/sources-of-uk-flu-data-influenza-surveillance-in-the-uk#disease-severity-and-mortality-data

Figure 12. Weekly number of influenza confirmed admissions to hospital through the USISS sentinel scheme in England, with crude hospitalisation rate, week 40 2017 to week 15 2018

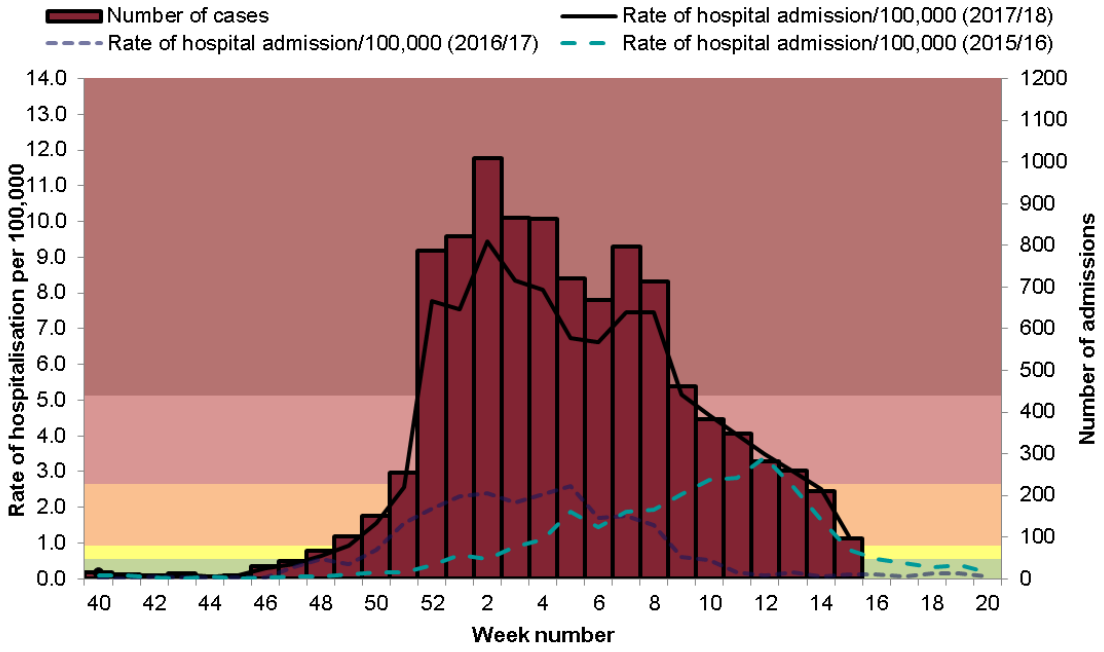


Figure 13. Cumulative influenza confirmed hospital admissions by age group and influenza type, through the USISS sentinel scheme, week 40 2017 to week 15 2018

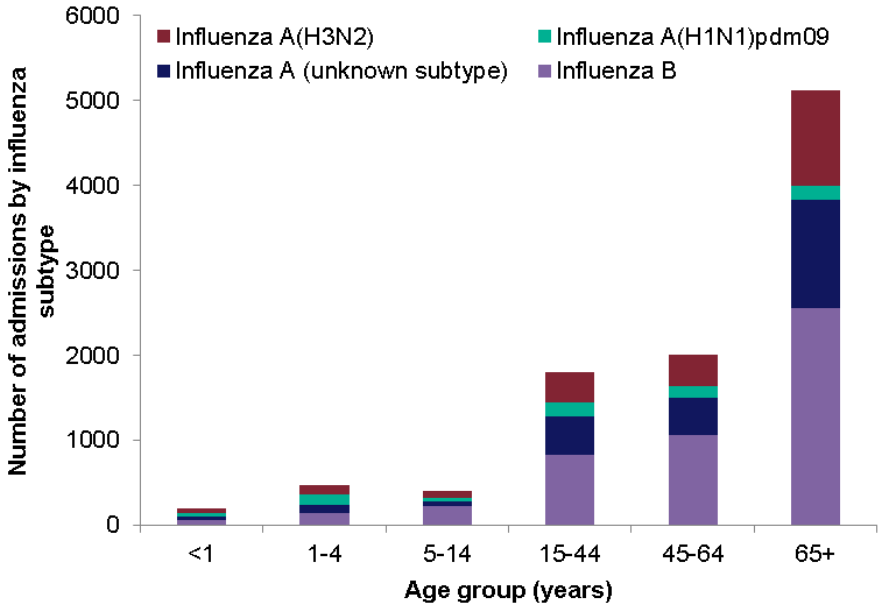
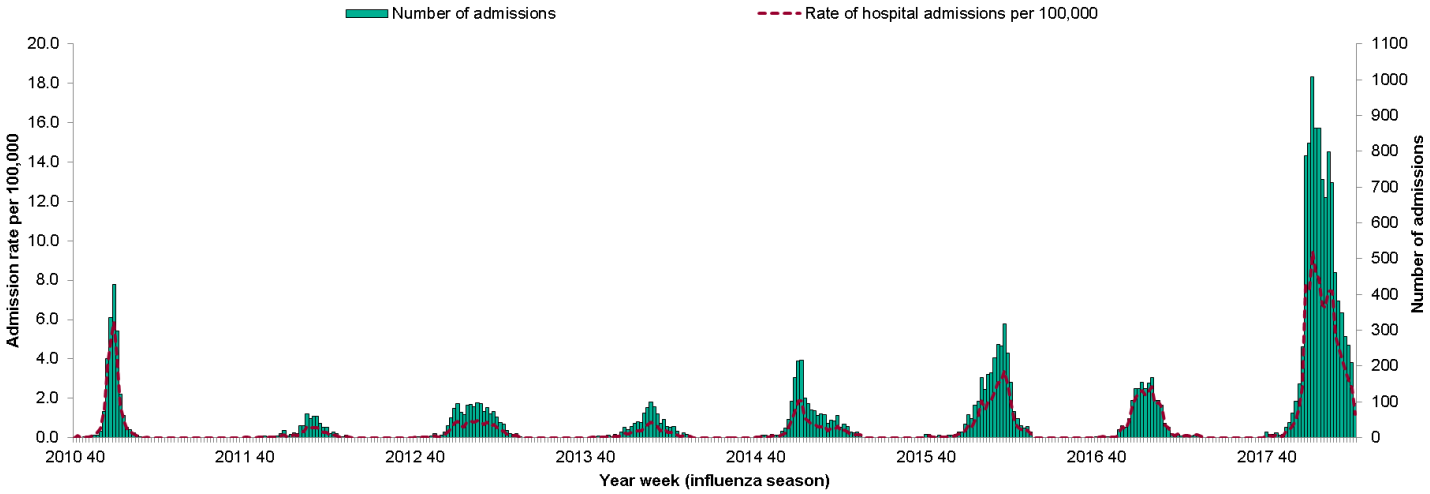


Figure 14 represents the weekly total number of influenza confirmed hospital admissions reported through the USISS sentinel scheme in England for the period from 2010 to 2018.

Figure 14. Weekly number of influenza confirmed hospital admissions to hospital through the USISS sentinel scheme with crude hospitalisation rate for all ages, 2010 to 2018



USISS Mandatory

Through the USISS mandatory scheme, a total of 3,454 ICU/HDU admissions of confirmed influenza were reported across the UK from week 40 2017 to week 15 2018, including 372 deaths, based on combined data from England, Scotland and Northern Ireland. In England, the total number of influenza confirmed admissions to ICU/HDU was 3,175 (rate of 0.22 per 100, 000 population) and 320 deaths during the same period (Figure 14).

The cumulative number of cases and deaths were higher compared to the 2016 to 2017 season (992 cases (rate of 0.06) and 112 deaths) and to the 2015 to 2016 season (2,173 cases (rate of 0.14 per 100, 000) and 166 deaths) in England. This season represents the highest number and rate observed since the beginning of the scheme (Figure 18).

ICU/HDU case numbers and admission rates peaked in week 02 2018 with 299 cases observed for that week and a rate of 0.58 per 100,000, which fell above the very high impact threshold (Figure 15).

Of the 3,454 ICU/HDU admissions in the UK, the majority were due to influenza A (1,806; 52.3%), with the remainder due to influenza B (1,648; 47.7%). Of the influenza A admissions, 1,131 (62.6%) were due to A(not subtyped), 433 (24.0%) were influenza A(H3N2) and 242 (13.4%) were reported to be influenza A(H1N1)pdm09 (Figure 15).

ICU/HDU admissions occurred in all age groups. Those aged 65+ years made up 42.0% of all cases and 32.0% of all cases were seen in the 45-64 year olds. In the

previous season which was dominated by influenza A(H3N2), the largest proportion of admissions also occurred in those in the 65+ and 45-64 year olds (Figure 16).

Within England, regional variation in the rate of confirmed influenza admissions to ICU/HDU was assessed using NHS England Local Team boundaries. The rate of ICU/HDU admission ranged from 4.27 per 100,000 per trust catchment population in South Central to 8.86 per 100,000 in Central Midlands in 2017/18 (Figure 17). Historical regional comparisons can be found in Appendix A.

Figure 15. Weekly number of influenza confirmed admissions to ICU/HDU through the USISS mandatory scheme in England, with crude ICU/HDU admission rate, week 40 2017 to week 15 2018

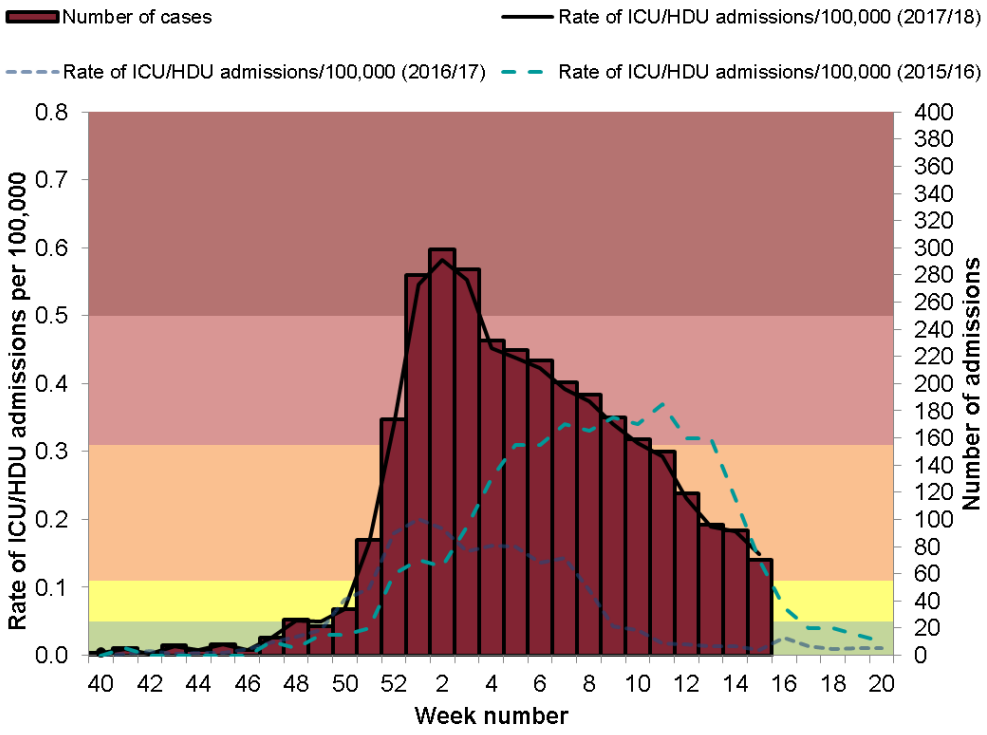


Figure 16. Cumulative ICU/HDU influenza confirmed admissions by age group and influenza type in the UK, through the USISS mandatory scheme, week 40 2017 to week 15 2018

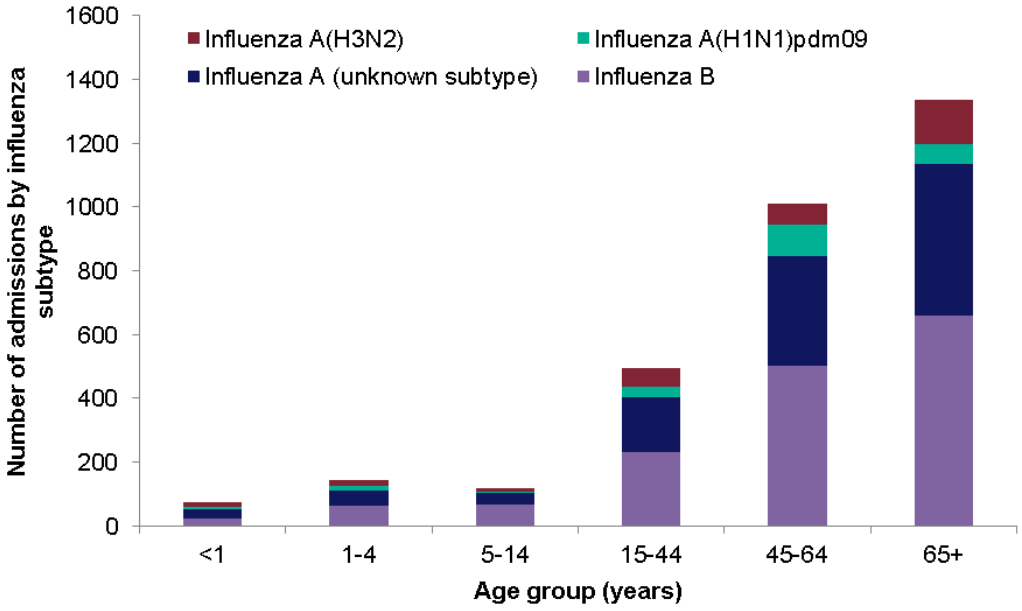


Figure 17. Overall rate of confirmed influenza ICU/HDU admissions through the USISS mandatory scheme by NHS England Local Teams, England, week 40 2017 to week 15 2018

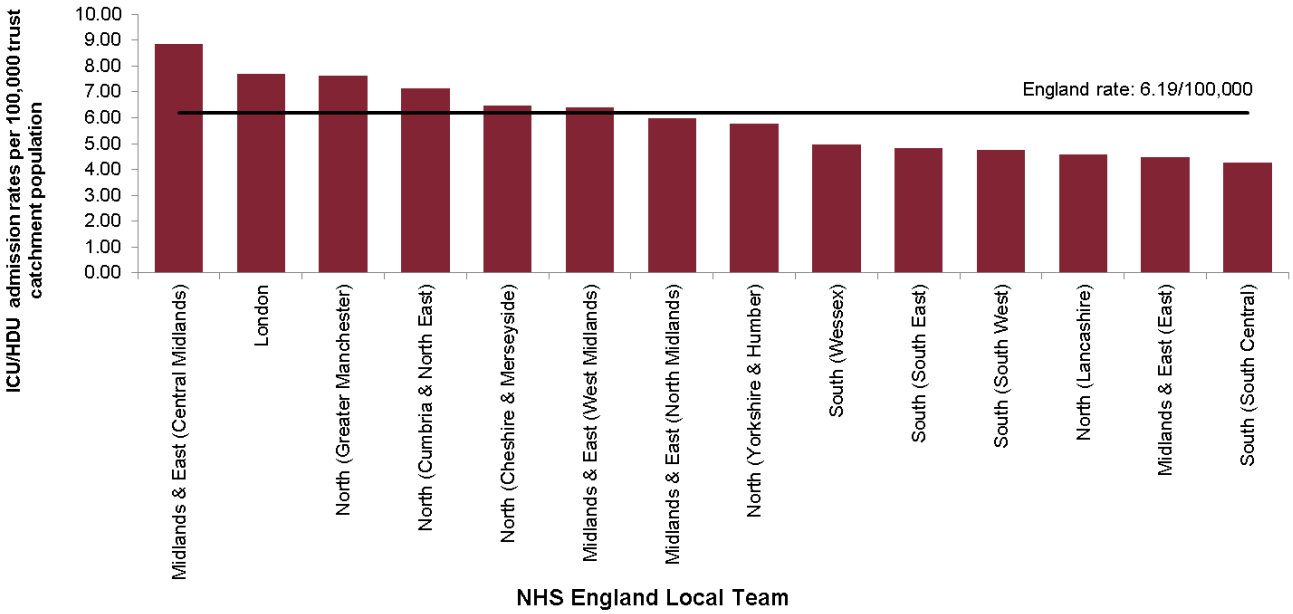
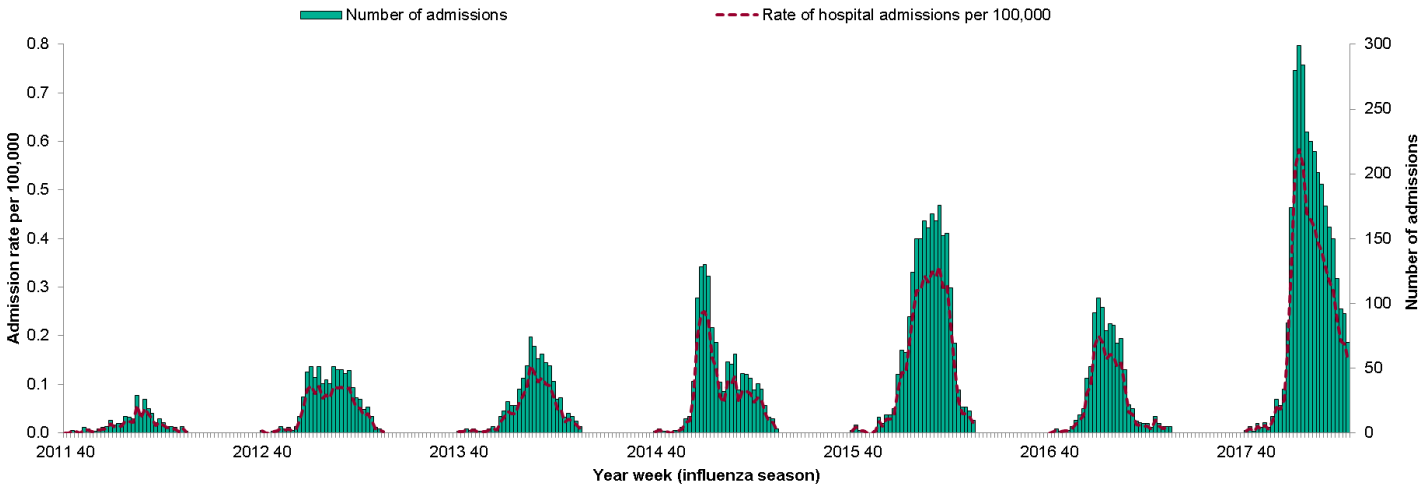


Figure 18. Weekly number of influenza confirmed ICU/HDU admissions to hospital through the USISS mandatory scheme with crude hospitalisation rate for all ages, 2011 to 2018 (up to week 15)

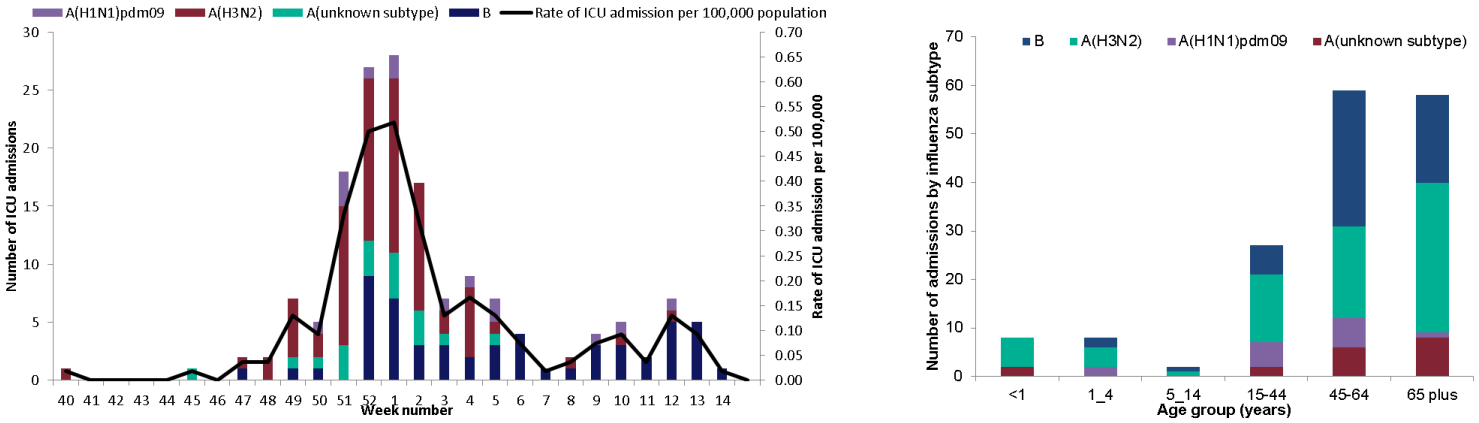


In Scotland there were less laboratory confirmed cases requiring intensive care management (ICU admissions) reported from week 40 2017 to week 15 2018 (162 admissions, rate of 3.00 per 100,000 population) compared to similar period in 2015 to 2016 (174 admissions, 3.21 per 100,000 population). The peak activity was in week 01 2018 and the majority of cases were due to influenza A(H3N2) (46.3%) and influenza B (34.0%) with a small percentage due to influenza A(not subtyped) (11.1%) and influenza A(H1N1)pdm09 (8.6%).

The largest number of cases was observed in the 45-64 year olds (36.4%) and 65+ year olds (35.8%) and the lowest number of cases was seen in the 5-14 year olds (1.2%) (Figure 19). This is similar but slightly higher than the proportion seen in the 2016 to 2017 season.

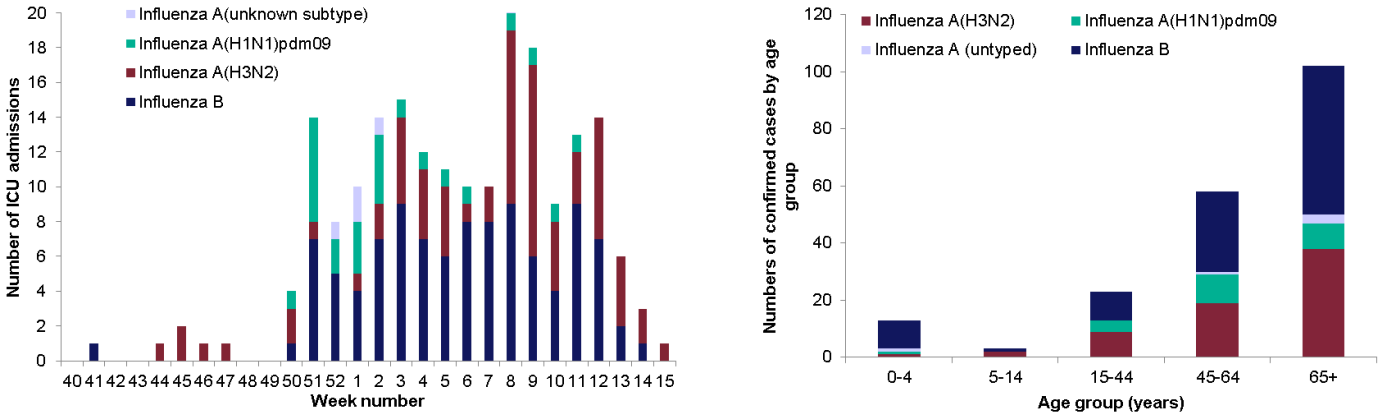
The case fatality rate (ie proportion of ICU cases which have died) of 23.5% (38/162) is in keeping with 2016 to 2017 (25.0%, 18/72) and 2015 to 2016 (28.2%, 49/174).

Figure 19. Weekly number of laboratory confirmed influenza ICU cases with crude rate of ICU admissions in Scotland, with crude ICU admission rate up to week 15 2018 and the cumulative number of ICU admissions by age group and influenza type up to week 15 2018, Scotland



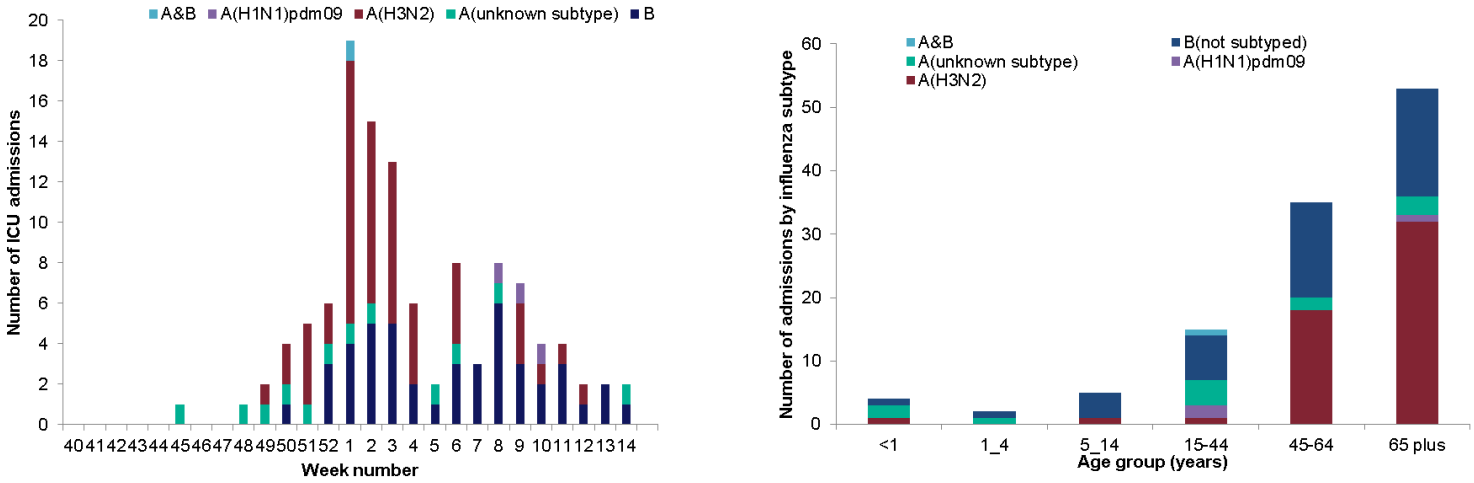
In Wales, 199 patients (rate of 6.4 per 100,000 resident population) in ICU were confirmed with influenza between week 40 2017 and week 15 2018 with peak activity in week 08 2018 (Figure 20). Influenza B accounted for 50.8% of these confirmed cases and 34.7% were due to influenza A(H3N2). Of the patients confirmed with influenza in ICU, 51.3% were aged 65+ years.

Figure 20. Weekly number of laboratory confirmed influenza ICU cases with crude rate of ICU admissions in Wales and the cumulative proportion of ICU admissions by age group up to week 15 2018, Wales



In Northern Ireland, there were 114 patients (rate of 6.1 per 100,000 resident population) in ICU with laboratory confirmed influenza between week 40 2017 and week 15 2018, with peak activity in week 01 2018. Influenza A(H3N2) accounted for 46.5% of these confirmed cases, influenza A(unknown subtype) accounted for 10.5% and 39.5% were due to influenza B. The majority of cases (46.5%) were in the 65+ years age group. 20 deaths (17.5% of ICU cases) were also reported in the ICU/HDU patients with laboratory confirmed influenza (Figure 21).

Figure 21. Weekly number of laboratory confirmed influenza ICU cases in Northern Ireland and the cumulative number of ICU admissions by age group and influenza type up to week 15 2018, Northern Ireland



USISS Severe Respiratory Failures Centre (SRF)

This surveillance system collects data on every patient accepted by a SRF Centre, whether for ExtraCorporeal Membrane Oxygenation (ECMO) or other advanced respiratory support, and whether or not the primary cause is known to be infection-related. There are 6 SRFs in the UK (5 in England and one in Scotland).

For the 2017 to 2018 season, of the 202 SRF admissions reported by the 6 SRFs between week 40 2017 and week 15 2018, 60 were laboratory confirmed influenza admissions reported to the 6 SRFs, including 27 influenza B, 13 influenza A(H1N1)pdm09, 6 influenza A(H3N2) and 14 influenza A(unknown subtype).This compares to a total of 5 influenza confirmed admissions in 2016 to 2017, the last influenza A(H3N2) dominated season and a total of 73 influenza confirmed admissions in 2015 to 2016, when influenza A(H1N1)pdm09 was dominating.

Microbiological surveillance

Respiratory DataMart, England

Influenza A and B positivity were monitored through the respiratory DataMart surveillance scheme in England for the season of 2017 to 2018, with the overall influenza positivity increasing above the MEM baseline threshold of 8.6% in week 49 2017. Influenza B and A(H3) were the dominant co-circulating viruses in the 2017 to 2018 season.

Overall influenza B positivity peaked at 16.7% in week 02 2018 with the highest age-specific positivity seen in the 5-14 year olds (peak positivity of 23.3% in week 05 2018).Influenza A(H3) positivity peaked at 9.9% in week 52 2017. This peak was earlier

and lower than that seen in the 2016 to 2017 season where the peak of 25.4% was seen in week 01 2017.The highest age-specific positivity of A(H3) was in the 65+ years with 2 peaks of 14.5% in week 51 2017 and 14.9% in week 13 2018. Influenza A(H1N1)pdm09 also circulated at low levels in 2017 to 2018 season which was slightly higher than the levels observed in the 2016/2017 season.

Figure 22. Weekly number of influenza A and B detections through Respiratory Datamart in England, with overall % positivity, 2017 to 2018

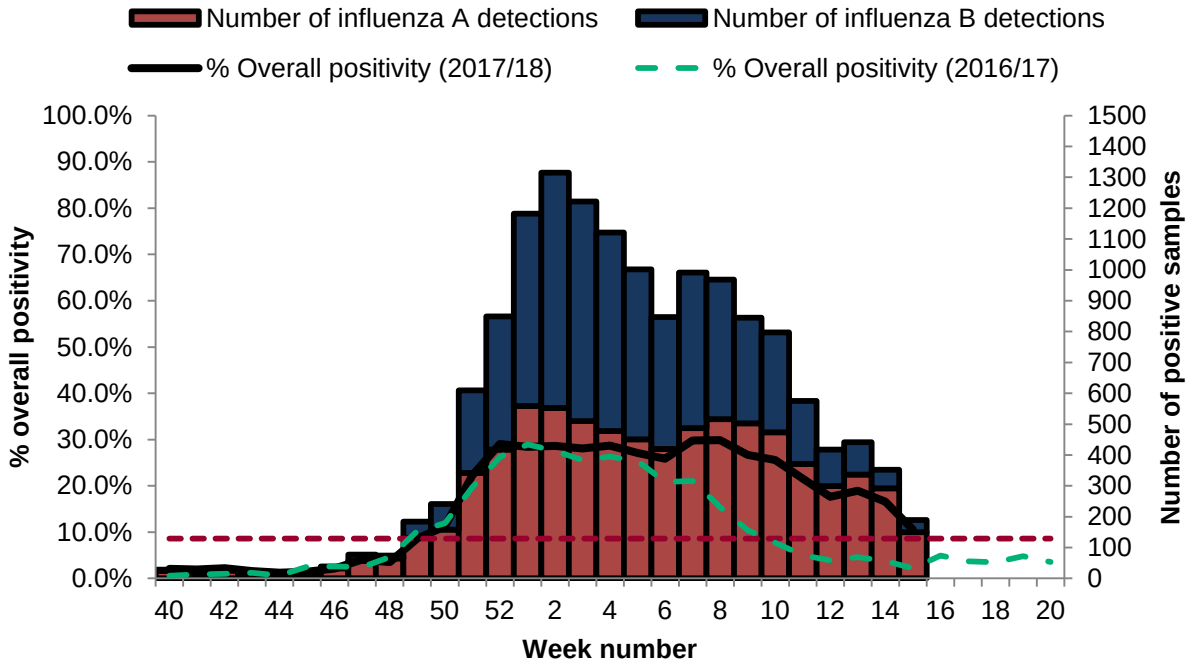
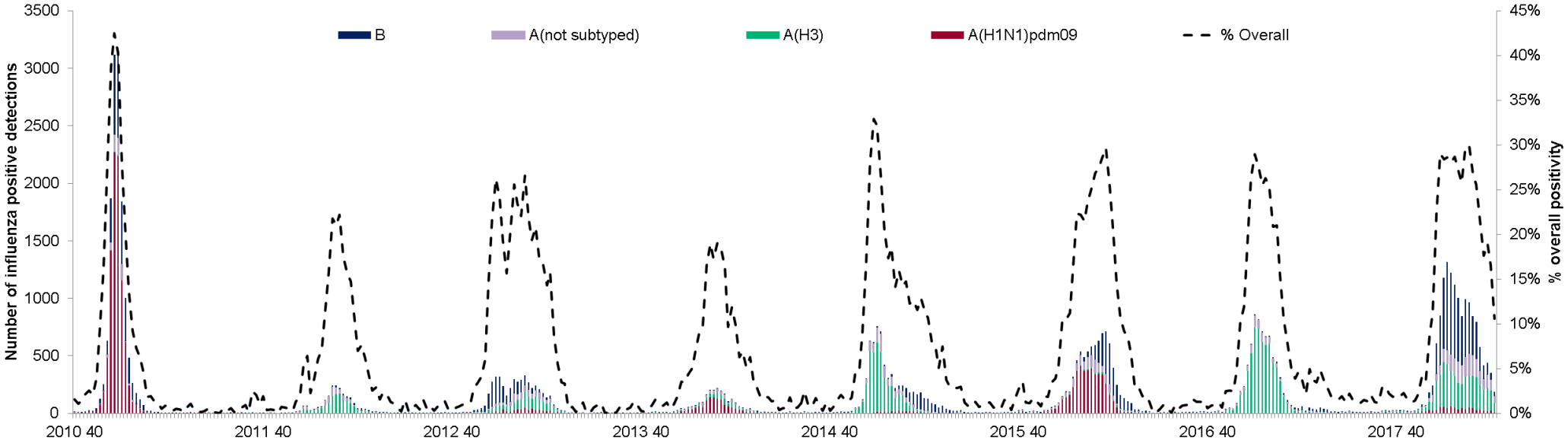


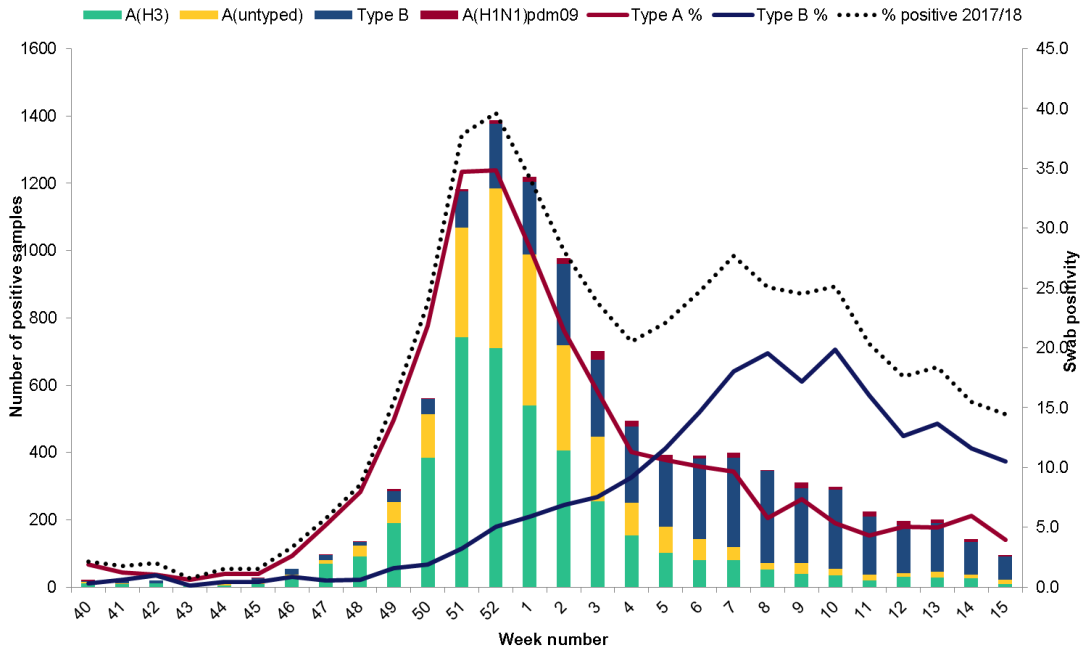
Figure 23. Weekly number of influenza detections by subtype through Respiratory Datamart in England, with overall % positivity, 2010 to 2018



ECOSS, Scotland

In Scotland, overall influenza positivity reported through non-sentinel sources (ECOSS) rose above the MEM baseline threshold of 5.7% in week 47 2017, and reached a peak of 39.6% in week 52 2017. Unlike England and Wales but similar to Northern Ireland, influenza A(H3) was the dominant circulating virus in Scotland, peaking in week 52 2017 and influenza B peaked later in week 10 2018 (Figure 24).

Figure 24. Weekly ECOSS influenza positivity (number and percentage positive) by influenza subtype from week 40 2017 to week 15 2018, Scotland



Sentinel GP-based swabbing scheme

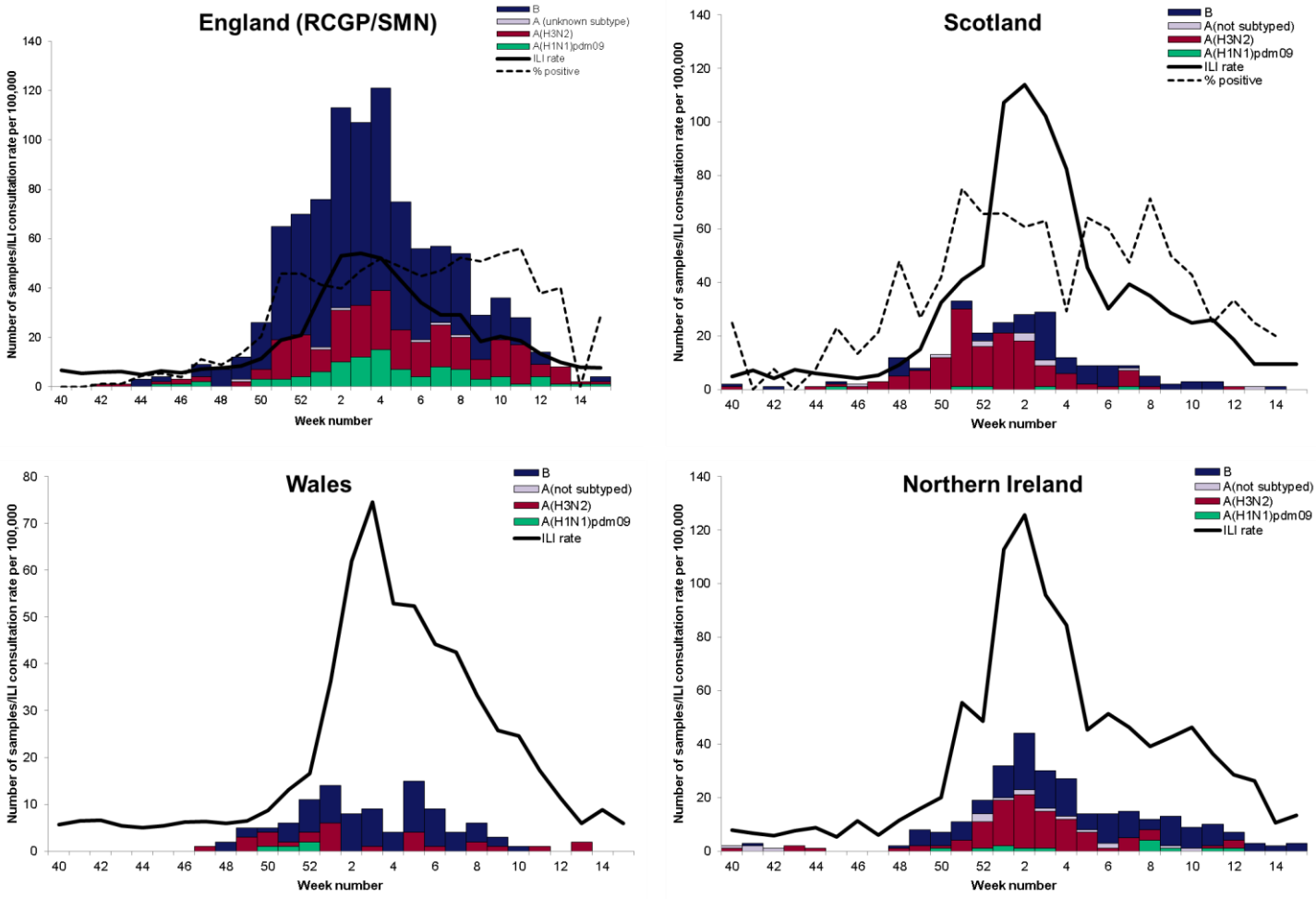
GP-based sentinel swabbing schemes in the UK were dominated by influenza A(H3N2) and B in line with observations in other surveillance schemes. England and Wales was dominated by the circulation of influenza B followed by influenza A(H3N2) whereas Scotland and Northern Ireland was dominated by influenza A(H3N2) followed by influenza B (Figure 25).

In England, influenza activity through the RCGP/SMN schemes increased from week 50 2017 and remained above 20.0% positivity until week 15 2018. Overall influenza positivity peaked at 56.0% in week 11 2018 (Figure 25).

Influenza activity monitored through the GP Sentinel Scheme in Scotland peaked at 75.0% positivity in week 51 2017 with predominance of influenza A(H3N2) in weeks 48 2017 to 02 2018 (peak positivity seen in week 51 2017); and influenza B predominance

in weeks 03 to 11 2018 (peak positivity seen in week 08 2018). The overall swab positivity for influenza increased and remained above the MEM baseline threshold of 16.7% between week 47 2017 and week 14 2018 (Figure 25).

Figure 25. Weekly number of influenza positive sentinel virology samples by influenza type,% positive and ILI rate, 2017 to 2018, UK



*NB: Positivity supressed for Wales and Northern Ireland due to small weekly sample numbers.

In Wales, similar to England, the peak number of influenza positive specimens were influenza B with the highest number seen in week 05 2018.

In Northern Ireland the peak was seen in week 02 2018 and was mainly due to influenza A(H3N2) and influenza B. Influenza B was predominant from week 04 2018 onwards (Figure 25).

Virus characterisation

PHE characterises the properties of influenza viruses through one or more tests, including genome sequencing [11] (genetic analysis) and haemagglutination inhibition [12] (HI) assays (antigenic analysis). These data are used to compare how similar the currently circulating influenza viruses are to the strains included in seasonal influenza vaccines, and to monitor for changes in circulating influenza viruses. The interpretation of genetic and antigenic data sources is complex due to a number of factors, for example, not all viruses can be cultivated in sufficient quantity for antigenic characterisation, so that viruses with sequence information may not be able to be antigenically characterised as well. Occasionally, this can lead to a biased view of the properties of circulating viruses, as the viruses which can be recovered and analysed antigenically, may not be fully representative of majority variants, and genetic characterisation data does not always predict the antigenic characterisation

Since week 40 2017, the PHE Respiratory Virus Unit (RVU) has characterised 1,704 influenza viruses detected (Table 2). Nine hundred and one influenza B viruses have been analysed; 896 were characterised as belonging to the B/Yamagata/16/88-lineage and 5 belonging to the B/Victoria/2/1987-lineage. All characterised B/Yamagata/16/88-lineage viruses to date are antigenically similar to B/Phuket/3073/2013, the influenza B/Yamagata-lineage component of the 2017/18 Northern Hemisphere quadrivalent vaccine. One of the B/Victoria/2/87-lineage viruses is antigenically similar to B/Brisbane/60/2008, the influenza B/Victoria-lineage component of 2017/18 Northern Hemisphere trivalent and quadrivalent vaccines.

Four influenza B viruses have been characterised where sequencing of the haemagglutinin (HA) gene shows that they belong within genetic clade 1A of the B/Victoria lineage, in a subgroup characterised by deletion of 2 amino acids in the HA. These double deletion subgroup viruses are antigenically distinct from the 2017/18 N.hemisphere B/Victoria lineage vaccine component, with similar viruses having been identified in a minority of influenza B/Victoria lineage viruses in the 2016/17 season in the US and Norway, and since detected in low but increasing proportions in other countries, including in Europe.

Genetic characterisation of 551 A(H3N2) influenza viruses detected since late summer, showed that the majority belong to genetic subclade 3C.2a, with 142 belonging to a cluster within this genetic subclade designated as 3C.2a1. Eighteen viruses belonging to the genetic subclade 3C.3a were detected. The Northern Hemisphere 2017/18 influenza A(H3N2) vaccine strain A/HongKong/4801/2014 belongs in genetic subclade 3C.2a.

Of 252 A(H1N1)pdm09 influenza viruses characterised, those that have been genetically characterised all belong in the genetic subgroup 6B.1, which was the

predominant genetic subgroup in the 2016/17 season and to date during the current season. Viruses antigenically analysed are similar to the A/Michigan/45/2015 Northern Hemisphere 2017/18 (H1N1)pdm09 vaccine strain.

Table 2. Viruses characterised by the PHE Reference Laboratory, from week 40 2017 to week 15 2018

Virus	No. viruses characterised			
	Genetic and antigenic	Genetic only	Antigenic only	Total
A(H1N1)pdm09	83	76	93	252
A(H3N2)	11	540	0	551
B/Yamagata-lineage	192	417	287	896
B/Victoria-lineage	4	1	0	5

Antiviral resistance

Neuraminidase inhibitor (NI) susceptibility (oseltamivir and zanamivir) is determined by phenotypic testing of virus isolates and genotypic testing of clinical samples positive for influenza A(H1N1)pdm09, A(H3N2), and influenza B viruses at the PHE RVU. 2 regional laboratories also perform screening for the H275Y amino acid substitution in influenza A(H1N1)pdm09 positive clinical samples. The data summarized below combine the results of both RVU and the 2 regional laboratories. The samples tested are routinely obtained for surveillance purposes, but diagnostic testing of patients not responding to NI treatment is also performed.

Since week 40 2017, 171 influenza A(H3N2) viruses have been tested for oseltamivir susceptibility, and 147 viruses were also tested for zanamivir susceptibility. Five A(H3N2) viruses were identified as resistant to one or both NIs; 3 viruses with the R292K amino acid substitution, which causes resistance to both oseltamivir and zanamivir have been detected, and 2 A(H3N2) viruses with a deletion from 244 to 248 of the neuraminidase (NA) protein causing resistance to oseltamivir but not to zanamivir were detected. One of these viruses also had an E119V amino acid substitution in addition to the deletion. Available information from 4 out of the 5 A(H3N2) NI resistant cases shows that they all had one or more underlying medical conditions, and 3 of the 4 cases had a history of prior exposure to oseltamivir.

Oseltamivir susceptibility has been determined for 213 influenza A(H1N1)pdm09 viruses, with 121 also tested for zanamivir susceptibility. Six viruses with the H275Y amino acid substitution were identified, causing oseltamivir resistance, but retaining zanamivir susceptibility. Available information shows that 3 out of the 6 oseltamivir resistant cases had one or more underlying medical conditions and 2 of them had a history of prior exposure to oseltamivir.

Of the 471 influenza B viruses tested for oseltamivir susceptibility 455 viruses were also tested for zanamivir susceptibility. All viruses were fully susceptible with one exception; one virus had the D198N amino acid substitution causing resistance to oseltamivir and

reduced susceptibility to zanamivir. This resistant case had a history of prior exposure to oseltamivir and some underlying medical conditions.

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[11] CDC genome sequencing. http://www.cdc.gov/flu/professionals/laboratory/genetic-characterization.htm
[12] CDC Antigenic information. http://www.cdc.gov/flu/professionals/laboratory/antigenic.htm

Vaccination

Seasonal influenza vaccine uptake in adults

Although, all countries of the UK use standardised specifications to extract uptake data from IT information systems in primary care, there some differences in extraction specifications therefore comparisons should be made cautiously.

In England, the uptake of seasonal influenza vaccine is monitored by PHE throughout the season based upon weekly and monthly extracts from GP information systems.

Cumulative uptake on influenza vaccinations administered up to 31 January 2018 was reported from 99.8% (7,155/7,170) of GP practices in England in 2017 to 2018. This showed a vaccine uptake of 72.6% in 65+ year-olds (compared to 70.5% in 2016 to 2017) and 48.9% for those aged 6 months to under 65 years of age with one or more underlying clinical risk factor (excluding pregnant women without other risk factors and carers), compared to 48.6% in 2016 to 2017 (Table 3). Uptake in pregnant women up to 31 January 2018 was 47.2%, compared to 44.9% in 2016 to 2017.The more detailed final uptake reports are now publically available[13].

In Scotland, the uptake of seasonal influenza vaccine is estimated by Health Protection Scotland (HPS) throughout the season, also based on automated 4-weekly extracts from 99% of all Scottish GP practices. As such, vaccine uptake reported here should be regarded as provisional.

Cumulative uptake in 2017 to 2018 to week 15 showed vaccine uptake of 73.7% in 65+ year olds (compared to 72.8% in 2016 to 2017). Uptake amongst those aged 6 months to under 65 year olds in one or more clinical at-risk groups (excluding pregnant women without other risk factors and carers) was 44.8% (compared to 44.9% in 2016 to 2017). Overall uptake in pregnant women (including those with and without other risk factors) up to week 15 2018 was 49.4%, compared to 50.3% in 2016 to 2017. The uptake in pregnant women (without other risk factors) was 48.1%, compared with 49.3% in 2016 to 2017. The uptake in pregnant women (with other risk factors) was 61.8%, compared with 58.0% in 2016 to 2017.

In Wales, the uptake of seasonal influenza vaccine is monitored on a weekly basis by Public Health Wales throughout the season based on automated weekly extracts of Read coded data using software installed in all General Practices in Wales.

[13] Vaccine Uptake – Influenza vaccine uptake reports. https://www.gov.uk/government/collections/vaccine-uptake#seasonal-flu-vaccine-uptake:-figures

Cumulative uptake data on influenza vaccinations administered were received from 100.0% of GP practices in Wales in 2017 to 2018. This showed a vaccine uptake of 68.8% in 65+ year olds (compared to 66.7% in 2016 to 2017) and 48.5% for those aged 6 months to under 65 years of age with one or more underlying clinical risk factor (excluding pregnant women without other risk factors, morbidly obese patients and carers), compared to 46.9% in 2016 to 2017.

Overall uptake in pregnant women was 72.7% compared to 75.9% in 2016 to 2017. In Wales, vaccine coverage in pregnant women is measured differently using a survey of pregnant women giving birth each year during January. Data are also automatically collected from general practices for women with pregnancy related Read-codes, these data report uptakes of 61.7% in pregnant women at risk and 46.0% in healthy pregnant women, however the validity of these data is unknown.

In Northern Ireland, the uptake of seasonal influenza vaccine is monitored by the Public Health Agency (PHA) of Northern Ireland. Cumulative uptake of influenza vaccination administered up to 31 March 2018 was reported from 98.8% of GP practices in NI in 2017 to 2018. In the population aged 65+ years uptake was 71.8% (compared to 71.9% in 2016 to 2017) and in the population of under 65 years at risk the uptake was 56.0% (compared to 57.1% in 2016 to 2017). Uptake in pregnant women up to 31 March 2018 was 56.7% compared to 58.6% in 2016 to 2017.

Uptake by frontline healthcare workers in England was 68.7% from 100% of organisations. This has increased from 63.2% in 2016 to 2017. In Scotland, provisional uptake figures in healthcare workers across all territorial health boards was 45.7%; this compares with 35.3% in 2016 to 2017. In Wales, uptake reached 56.9% compared to 49.1% in 2016 to 2017. In Northern Ireland, uptake in frontline healthcare workers was 33.4% compared to 29.0% in 2016 to 2017.

Table 3 summarises uptake in adults in the UK.

Table 3. Influenza vaccine uptake in 65+ year olds, 6 months to under 65 years at risk, pregnant women and healthcare workers, 2017 to 2018, UK

Target Group		England			Scotland			Northern Ireland			Wales		
		Number vaccinated	Denominator	%uptake	Number vaccinated	Denominator	%uptake	Number vaccinated	Denominator	%uptake	Number vaccinated	Denominator	%uptake
65+ years		7,426,917	10,235,533	**72.6**	751,689	1,020,490	**73.7%**	220,853	307,439	**71.8%**	451,346	655,902	**68.8%**
<65 years at risk		3,344,593	6,836,969	**48.9**	334,839	747,465	**44.8%**	151,677	270,971	**56.0%**	184,055	379,449	**48.5%**
Pregnant	No risk	267,865	585,936	**45.7**	19,578	40,664	**48.1%**	-	-	**-**	12,001	26,110	**46.0%**
	At risk*	36,010	58,005	**62.1**	2,561	4,143	**61.8%**	-	-	**-**	1,921	3,111	**61.7%**
	All	303,875	643,941	**47.2**	22,139	44,807	**49.4%**	11,132	19,637	**56.7%**	13,922	29,221	**47.6%**
Healthcare Workers		706,075	1,027,547	**68.7**	71,548	156,662	**45.7%**	16,167	48,371	**33.4%**	34,832	60,204	**57.9%**

Influenza vaccine (LAIV) programme for children

England

The Immform survey was used to monitor influenza vaccine uptake in 2, 3 and 4 year olds in primary care in England. The uptake for all GP-registered 2 year olds was 42.8% compared to 38.9% in 2016 to 2017; 44.2% compared to 41.5% in 3 year olds in 2016 to 2017 in England. This was reported from 99.6% of GP practices in England. This season all 4 year olds were vaccinated in school delivery programmes across England.

The seasonal influenza vaccine programme for children school year reception, 1,2, 3 and 4 (4 years rising to 9 years of age) was mainly delivered via a school-based programme, although one area delivered vaccinations through general practice. Vaccine uptake was monitored through manual returns by local teams for their responsible population.

An estimated 1,998,538 children in school years reception,1, 2, 3 and 4 (aged 4 rising to 9 years) in England received at least one dose of influenza vaccine during the period 1 September 2017 to 31 January 2018. With an estimated total target population of 3,360,997 the overall uptake was 59.5%. Total uptake in children in reception and school years 1, 2, 3 and 4 was 62.2%, 61.0%, 60.4%, 57.6% and 55.8%, respectively. Uptake by NHS region ranged from 47.8% to 70.7% with the lowest uptake reported in London and the highest uptake reported in Wessex (Table 4). A more detailed PHE report on influenza vaccine uptake in England in primary school age children is publically available[13].

Table 4. Estimated number and proportion of children of school years reception, 1, 2, 3 and 4 age who were vaccinated with influenza vaccine by local NHS England team from 1 September 2017 to 31 January 2018

Local NHS England team	No. of children eligible for vaccination	No. of children vaccinated with at least 1 dose of influenza vaccine	Vaccine uptake (%)
North	**926,318**	**572,104**	**61.8**
Cumbria & North East	160,570	99,455	61.9
Lancashire	89,300	52,669	59.0
Greater Manchester	188,459	113,136	60.0
Yorkshire & Humber	343,260	214,619	62.5
Cheshire & Merseyside	144,729	92,225	63.7
Midlands & East	**1,047,683**	**629,432**	**60.1**
North Midlands	214,504	133,634	62.3
Central Midlands	298,343	172,032	57.7
West Midlands	276,058	157,027	56.9
East	258,778	166,739	64.4
London	**534,755**	**255,418**	**47.8**
London	534,755	255,418	47.8
South	**852,241**	**541,584**	**63.5**
South Central	224,631	150,323	69.9
South West	185,936	109,739	59.0
Wessex	155,074	109,679	70.7
South East	286,600	171,843	60.0
Total	**3,360,997**	**1,998,538**	**59.5**

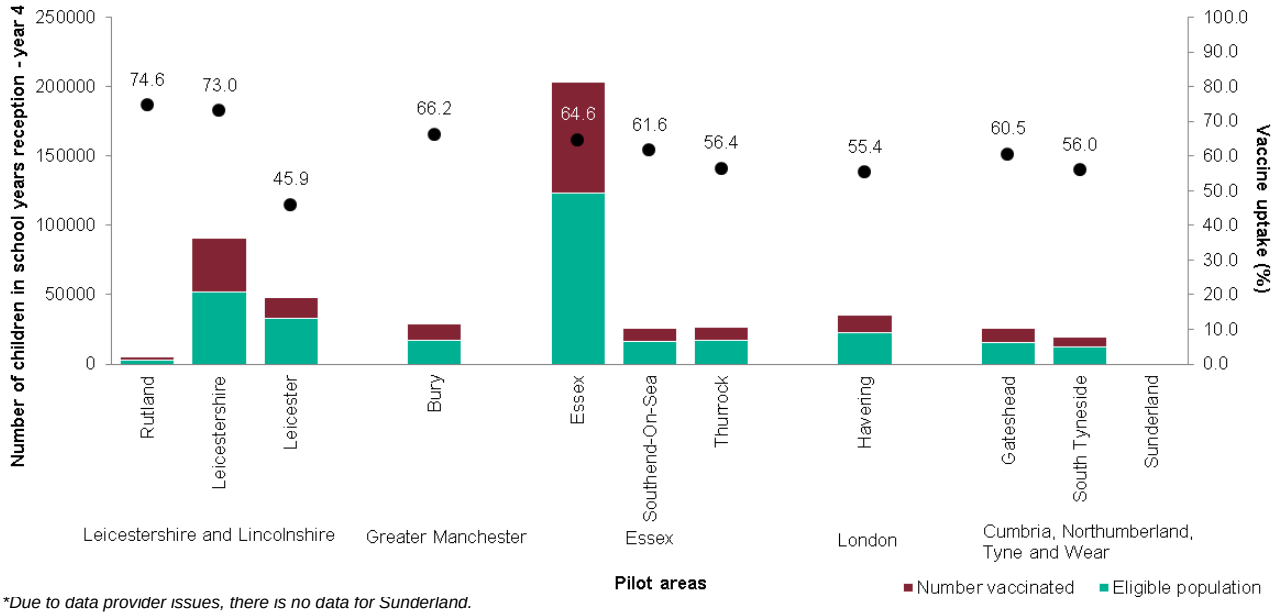
* Data for Bassetlaw, an LA district of Nottinghamshire UA, was collected independently. Bassetlaw uptake figures are reported under Yorkshire and Humber NHS England team.

Overall uptake for children in school years reception, 1, 2, 3 and 4 age by LA ranged from 26.0% to 79.3%. Uptake by year group by LA ranged from 30.5% to 82.3% for children in reception, 29.6% to 80.0% for children in school year 1, from 24.2% to 81.6% for children in school year 2, from 22.6% to 81.6 for children in school year 3 and from 22.1% to 79.4% for children in school year 4.

The 2017 to 2018 season also saw the continuation of the primary school-age vaccination programme in 5 pilot areas that have been piloting the programme since 2013 to 2014. Influenza vaccine was offered to all primary school age children aged 4-11 years (school years reception to 6) through a school based delivery model. Reception children were added to this cohort due to changes in the programme this season.

An estimated 195,185 primary school children aged 4-11 years in 5 pilot areas received at least one dose of influenza vaccine during the period 1 September 2017 to 31 January 2018 (Figure 26). With an estimated total target population of 312,697, this results in an overall uptake of 62.4% (ranging by pilot site from 45.9% to 74.6%).

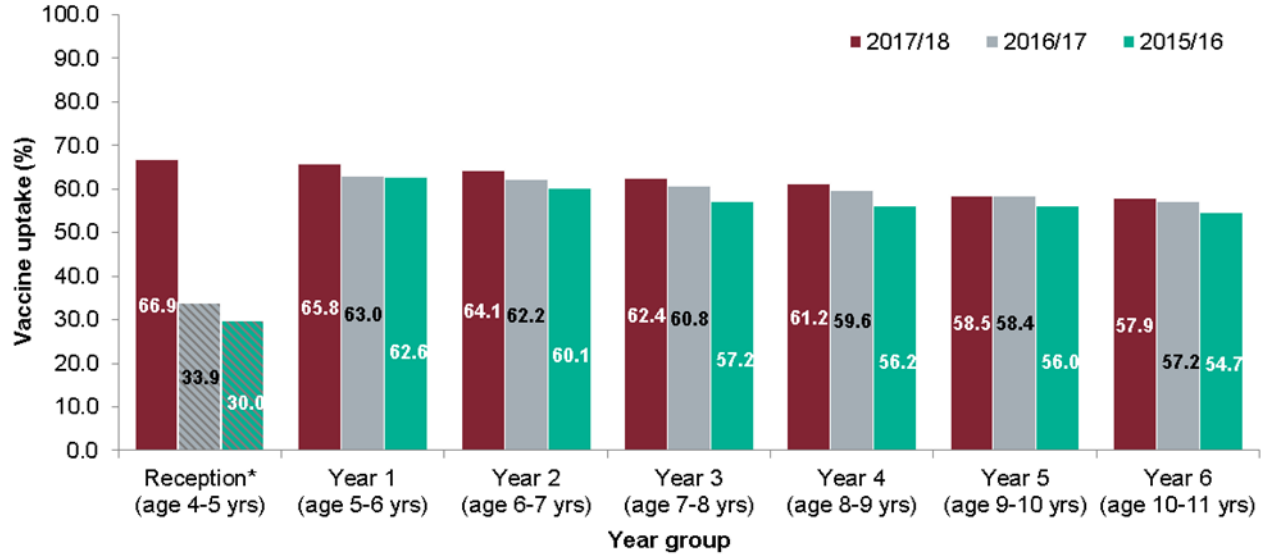
Figure 26. Estimated proportion of primary school age children (aged 4-11 years) who were vaccinated with influenza vaccine by pilot area, England, 1 September 2017 to 31 January 2018



**Due to data provider issues, there is no data for Sunderland.*

Vaccine uptake for the period 1 September 2017 to 31 January 2018 in pilot areas by year group ranged from 66.9% in reception (aged 4 years) to 54.0% in school year 6 (aged 10 years), with an overall pattern of decreasing uptake with increasing age (Figure 27). A 1.4% increase in vaccine uptake was observed since 2016 to 2017.

Figure 27. Estimated proportion of primary school age children (aged 4-11 years) who were vaccinated with influenza vaccine by year group in pilot areas, England, 2015 to 2018



*Children in ages 4-5 years old were vaccinated in GP practices during the 2016/17 and 2015/16 seasons.

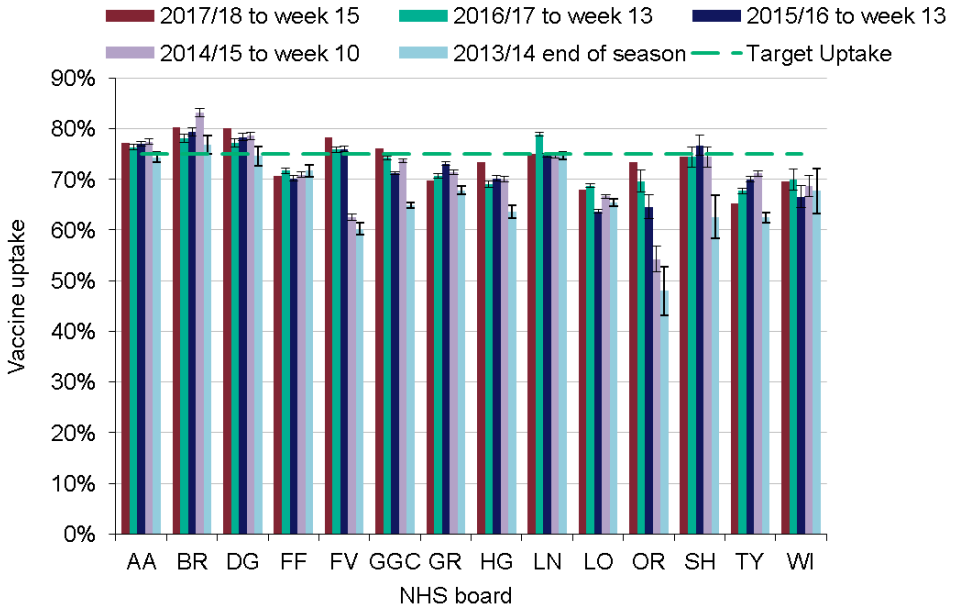
Scotland

The estimated uptake in preschool children (2 to under 5 year olds, not yet in school) vaccinated in the GP setting was 56.9% in 2017 to 2018 (compared to 59.0% in 2016 to 2017).

In 2017 to 2018, the offer of influenza vaccine was made to all primary school aged children in Scotland with an estimated 301,160 children aged 4-11 years who received at least one dose of influenza vaccine. With an estimated total target population for the school based programme of 412,721, this resulted in an uptake of 73.0% at the end of the season. This is similar to the vaccine uptake achieved during the primary school programme in 2016 to 2017 (299,450 children vaccinated out of a target population of 410,337, resulting in an 73.0% uptake). These uptake figures are based on aggregate school level data collated in season and are likely to be an underestimate, as the estimated uptake from some NHS boards does not include data from additional children vaccinated in general practice.

Reported uptake of the primary school programme varied by NHS board (Figure 28).

Figure 28. Mean influenza vaccine uptake (%) by NHS board, with confidence intervals [CI] for the primary schools in 2017 to 2018 to week 15 2018, compared to the previous 4 seasons



* *For the majority of NHS health board, the uptake includes data obtained from general practices on the number of children vaccinated in schools.
**NHS Health boards include: Ayrshire & Arran (AA), Borders (BR), Dumfries & Galloway (DG), Fife (FF), Forth Valley (FV), Greater Glasgow & Clyde (GGC), Grampian (GR), Highland (HG), Lanarkshire (LN), Lothian (LO), Orkney (OR), Shetland (SH), Tayside (TY), Western Isles (WI).

Wales

In Wales, national uptake of influenza vaccine in children increased in 2017 to 2018. The childhood influenza programme in Wales expanded this season to include children in school year 4 (8 year olds).

Immunisations for 2 and 3 year olds were delivered through general practices in Wales, apart from one health board where the majority of 3 year olds were immunised through nursery school immunisations sessions (uptake in these nursery school sessions was 62.8%).

Uptake of influenza vaccine for children aged 2 years was 51.7% (compared to 45.4% in 2016 to 2017), for 3 year olds it was 48.8% (compared to 45.1% in 2016 to 2017). For the whole group of children aged 2 and 3 years, uptake was 50.2% (compared to 45.3% in 2016 to 2017).

Children aged 4, 5, 6, 7 and 8 years, received their vaccinations in school immunisation sessions and uptake was 68.5%, 69.2%, 69.6%, 67.2% and 66.7% in each of these groups respectively. For the group as a whole, uptake was 68.3% (compared to 66.9% in 2016 to 2017).

Northern Ireland

In 2017 to 2018, the childhood influenza vaccination programme continued to include all pre-school children aged 2 to 4 years old and all primary school aged children. The former group were offered vaccination through primary care, with the latter group offered vaccination through school health teams. The vaccination uptake rate in 2017 to 2018 for pre-school children aged 2 to 4 years old was 50.6% (compared to 52.6% in 2016 to 2017). The vaccination uptake rate for children in primary school (aged approximately 4 to 11 years old) was 76.5% (compared to 78.3% in 2016 to 2017).

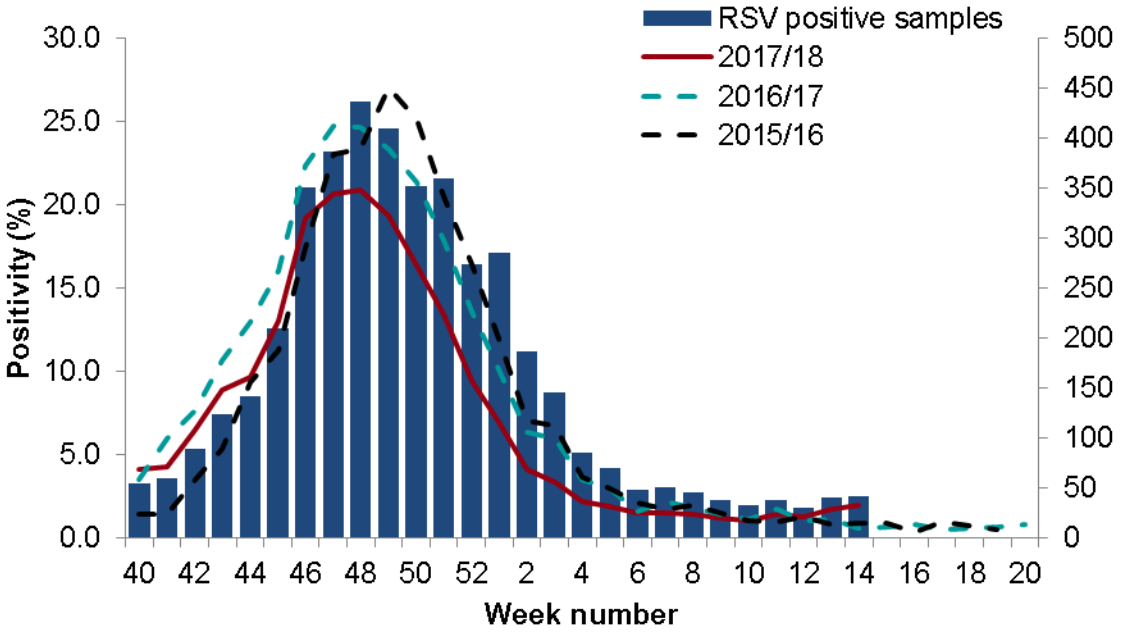
Other respiratory viruses

Respiratory syncytial virus (RSV) reported through DataMart Surveillance system peaked in week 48 2017 at 20.9% positivity, with circulation above 10.0% between week 45 2017 and 51 2017 (Figure 29). This peak was observed around the same time as the peaks seen in the last 2 seasons, 24.7% in 2016 to 2017 peaking in week 47 2016 and 27.0% in 2015 to 2016 peaking in week 49 2015.

The highest positivity was seen in children aged less than 5 year of age, with a peak of 47.6% in week 46 2017, similar to the peak in 2016 to 2017.

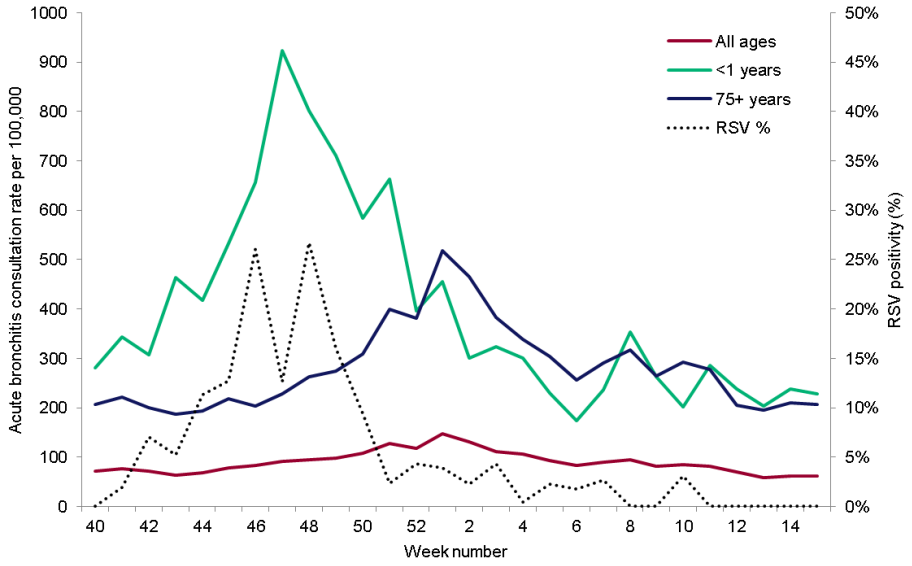
The lowest age-specific peak positivity was noted in the 15-44 year olds, with a peak of 10.4% in week 49 2017.

Figure 29. RSV number of positive samples and positivity (%) by week in Respiratory Datamart, 2015 to 2018, England



The overall RCGP GP acute bronchitis rate peaked at 146.6 per 100,000 in week 01 2018. The rate in under one year olds peaked slightly earlier than previous seasons in week 47 2016 at 924.0 per 100,000, whereas the rate for 75+ year olds peaked in the same week as the overall rate (week 01 2018) at 518.3 per 100,000 (Figure 30).

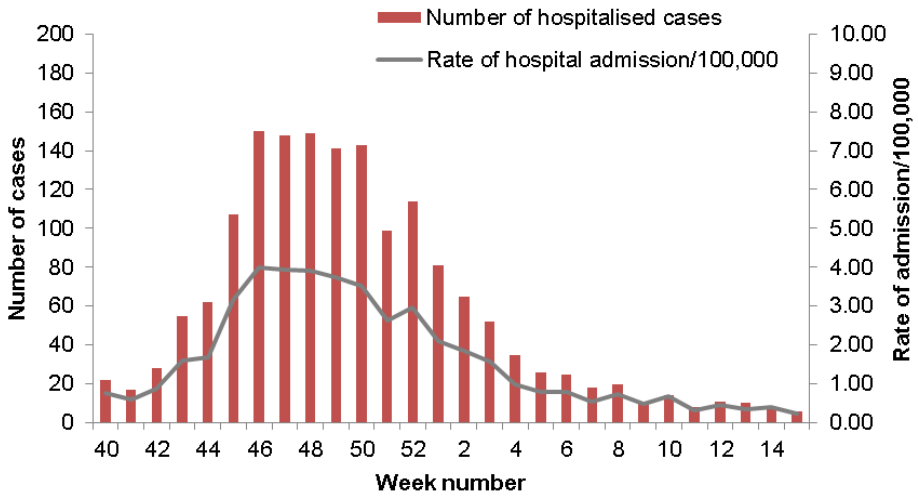
Figure 30. Weekly acute bronchitis consultation rates overall, in under one year olds and 75+ year olds with RSV posivity (%) through the RCGP scheme, 2017 to 2018, England



As part of a WHO initiative to pilot RSV surveillance[14], England has been monitoring and collating data on confirmed hospitalised RSV cases through the USISS sentinel scheme in 2017 to 2018.

Between week 40 2017 and week 15 2018, a total of 1,773 confirmed RSV cases (1,623 hospitalised and 150 admitted to ICU/HDU) have been reported from 9 participating trusts. The peak was similar to that observed through Datamart in week 48 2018 (Figure 31). The highest number of confirmed RSV cases were noted in the <1 year olds.

Figure 31. Weekly hospitalised RSV case rate per 100,00 trust catchment population, England, week 40 2017 to week 15 2018

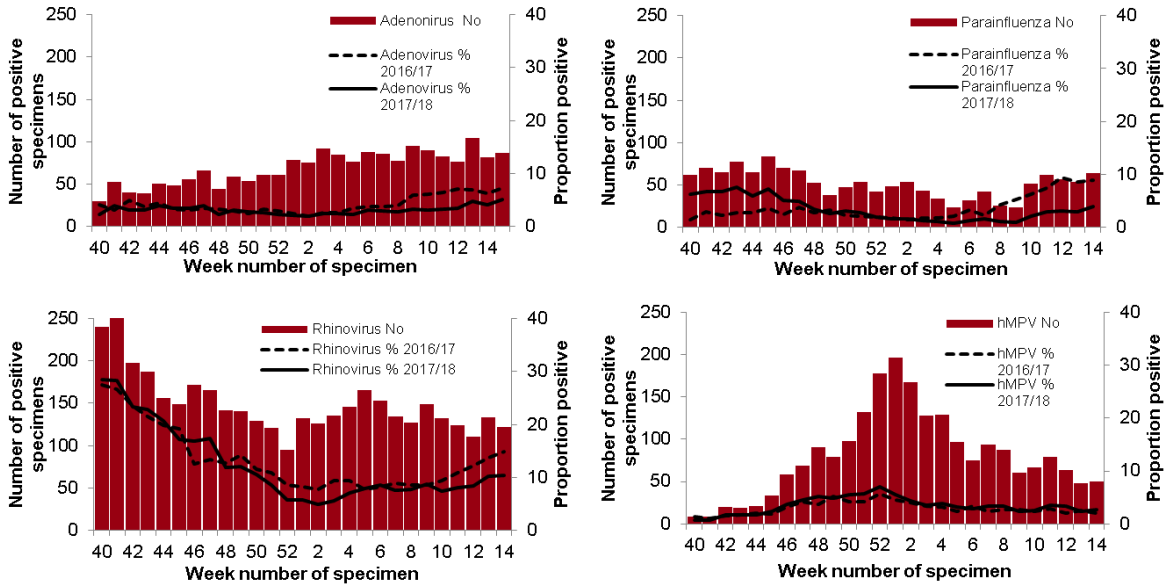


Of the other respiratory viruses monitored through the respiratory DataMart system, the highest activity was seen with rhinovirus at the beginning of the season but activity was low during the winter months when influenza was circulating.

Parainfluenza activity started to increase from week 06 2018 and similarly to rhinovirus was low during the months when influenza was circulating, with activity increasing towards the end of the influenza season from week 10 2018, which has been noted in the previous season. Human metopneumovirus (hMPV) showed increased levels between week 46 2017 to week 08 2018 and has been decreasing since. Low levels of adenovirus were observed throughout the season and no clear seasonality was seen (Figure 32).

[14] WHO RSV surveillance. http://www.who.int/influenza/rsv/en/

Figure 32. Weekly number of positive samples and proportion positive for other respiratory viruses, 2016-2018



In Scotland, the pattern of non-influenza respiratory pathogens detected through non-sentinel sources (ECOSS) for 2017 to 2018 season (up to week 15 2018), was similar to that seen in the 2016 to 2017. Rhinovirus was the most commonly detected non-influenza pathogen (3,550 detections, 31.8% positive samples) followed by RSV (3,101 detections, 27.8% positive samples), adenovirus (1,807 detections, 16.2% positive samples) and coronavirus (1,008 detections, 9.0% positive samples). The other non-influenza pathogens (parainfluenza, hMPV and *Mycoplasma pneumoniae*) were detected in a lower proportion of positive samples (4.9%, 8.1% and 2.3%, respectively).

In Wales, all hospital and non-sentinel GP samples are routinely tested for: influenza, RSV, Adenovirus, Mycoplasma pneumoniae, rhinovirus, parainfluenza and human metapneumovirus. The 2 most commonly non-influenza respiratory pathogens detected in the 10,293 samples tested were rhinovirus (12.4%, n= 1281) and RSV (8.1%, n=832). Other detected causes of respiratory infection included: human metapneumovirus (5.7% n= 584), adenovirus (3.2%, n=333), parainfluenza (3.0%, n=311), enterovirus (1.9%, n=198) and Mycoplasma pneumoniae (0.5%, n=53).

Excess all-cause mortality surveillance

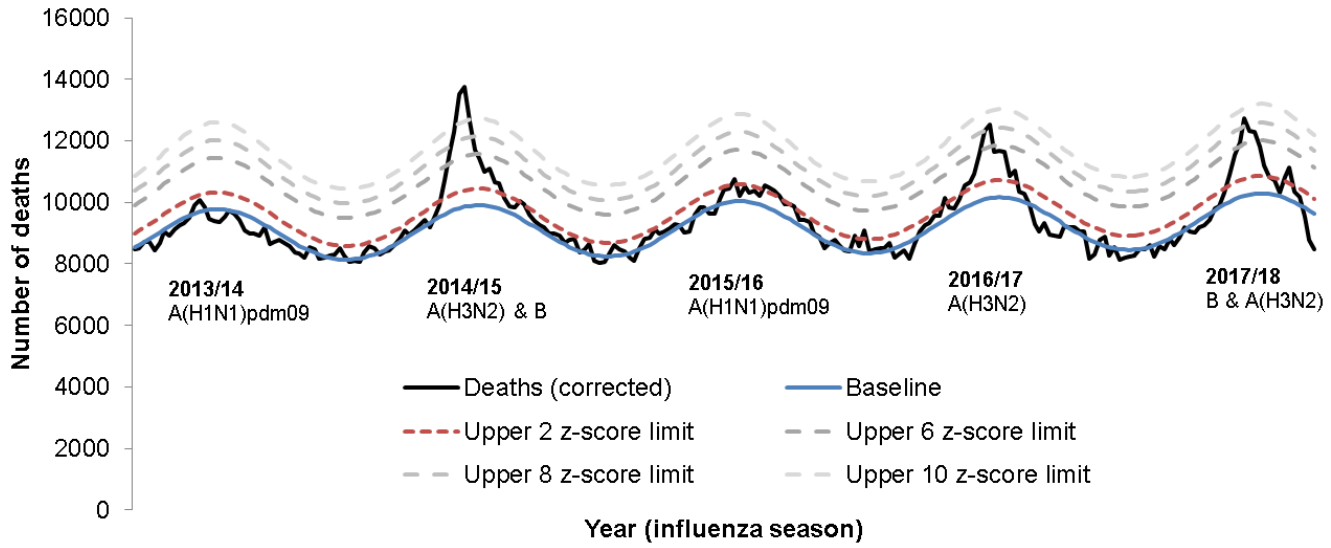
Excess mortality is defined as a significant number of deaths reported over that expected for a given point in the year based on historical patterns, allowing for weekly variation in the number of deaths.

The UK uses the European monitoring of excess mortality (EuroMOMO) algorithm to estimate weekly all-cause excess mortality[15]. This algorithm allows for direct comparison between excess mortality estimates in the countries of the UK.

The number of deaths is corrected by reporting delay and excess determined by week of death, avoiding the impact of bank holidays.

During 2017 to 2018, up to week 15 2018, significant excess mortality was seen in England predominantly in all ages and in 65+ year olds between week 50 2017 and week 11 2018 for 10 weeks (Figure 33). In other age groups, significant excess was seen in 15-64 year olds (Table 5).

Figure 33. Weekly observed and expected number of all-age all-cause deaths, with the dominant circulating strain type(s) , England, 2013 to 2018



[15] EuroMOMO. http://www.euromomo.eu/

Across the devolved administrations of the UK, modelled estimates using the EuroMOMO model showed significant excess in all ages and 65+ year olds in all countries and some excess in the younger age groups in England and Scotland were observed (Table 5).

Table 5. Weeks with excess mortality observed in 2017 to 2018 (up to week 15) in the UK

Age group (years)	Weeks with excess in 2017 to 2018			
	England	Wales	Scotland	Northern Ireland
All ages	50-05,09-10	52,06-07,10	41,49-04,06,09	49,51-05,07
<5	-	42	-	-
5-14	50	-	-	-
15-64	51-04	-	49,52-02,06,15	-
65+	50-07,09-11	52-04,06-07,09-11	49-04,09	49,51-05,07

Paediatric mortality

Fatal case reports from local health protection teams and the Office for National Statistics (ONS) were received for influenza-related deaths in children in England.

Provisional data shows that during the 2017 to 2018 winter influenza season between 1 October 2017 and up to 10 May 2018, 16 influenza-related fatal cases were reported in children aged between 0 to 17 years. There were 8 female and 8 male cases. 10 of the 16 cases had influenza A infection (including 4 influenza A(H1N1)pdm09) and the remaining 6 cases had influenza B infection recorded as part of their cause of death.

Information available shows that underlying medical conditions were reported from 7 of the 16 cases. Influenza vaccination history was available from 6 of the 16 cases and none of the 6 cases had received the 2017/18 influenza vaccine.

Influenza-attributable deaths

The FluMOMO model is an extension of the EuroMOMO algorithm which aims to estimate the excess number of deaths associated with influenza activity, adjusting for extreme temperature[16]. Similar to the EuroMOMO model, it is a standardised model which can be applied across countries and has been used previously in England to estimate such deaths[17].

Figure 34 represents the weekly number of all-age deaths and attribution to influenza and extreme temperature. It is evident from this that the majority of the excess deaths observed through the EuroMOMO algorithm (Figure 33 & Table 5) in 2017/18 are associated with influenza infection, with the cold snap observed between week 09 and 11 associated with some of the excess mortality during this period in England.

[16] FluMOMO. http://www.euromomo.eu/methods/flumomo.html
[17] Pebody RG, Green HK, Warburton F, Sinnathamby M, Ellis J, Mølbak K, Nielsen J, de Lusignan S, Andrews N (2018). Significant spike in excess mortality in England in winter 2014/15 – influenza the likely culprit. Epidemiology and Infection 1–8. https://doi.org/10.1017/S0950268818001152

Figure 34. Weekly number of all-age deaths and attribution to influenza (red line) and extreme temperature (green line), England, 2013 to 2018 (up to week 15)

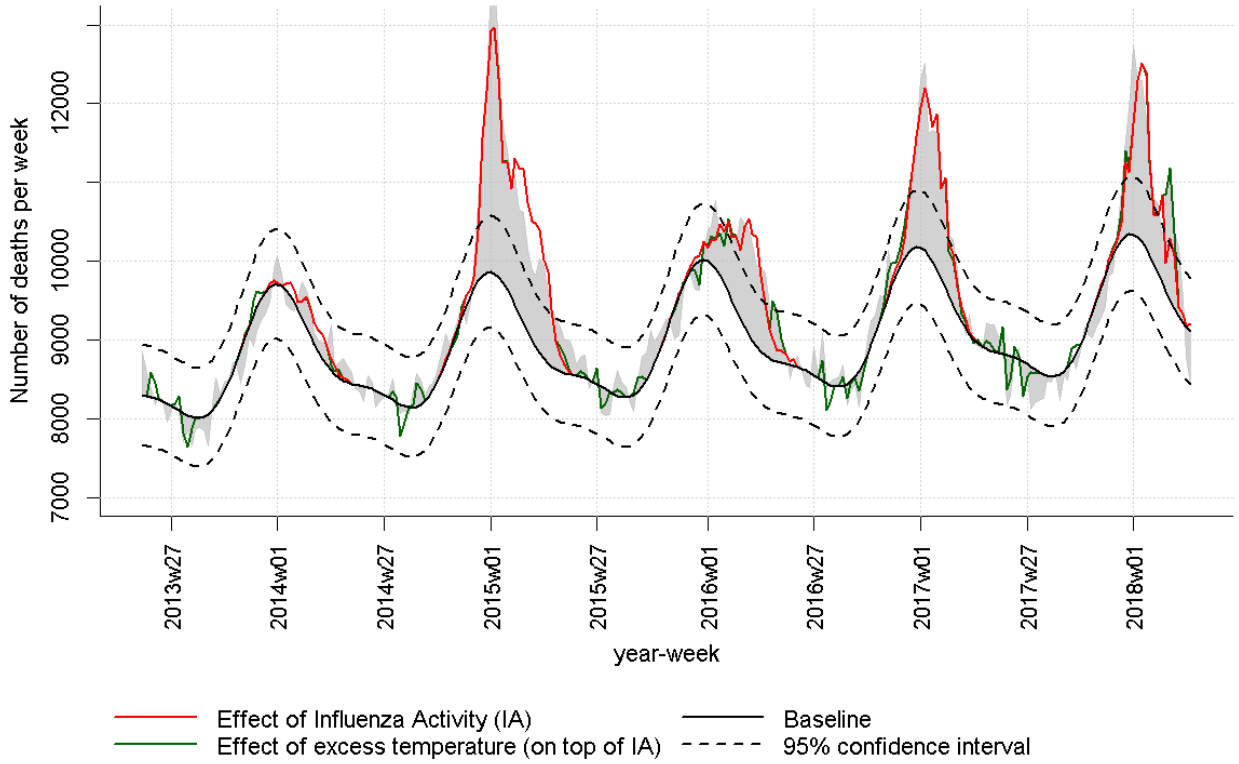


Table 6. Number of deaths associated with influenza observed through the FluMOMO algorithm with confidence intervals, England, 2013 to 2014 season to 2017 to 2018 (up to week 15)

	All ages	0-4 years	5-14 years	15-64 years	65+ years
2013/14	3,107 (2,706 to 3,526)	55 (41 to 70)	11 (5 to 18)	438 (366 to 515)	400 (224 to 607)
2014/15	34,300 (33,362 to 35,247)	128 (110 to 147)	14 (14 to 14)	2,013 (1,888 to 2,139)	27,014 (26,184 to 27,853)
2015/16	14,357 (13,588 to 15,141)	112 (92 to 133)	10 (4 to 19)	2,221 (2,073 to 2,372)	9,618 (8,993 to 10,256)
2016/17	17,592 (16,825 to 18,370)	64 (50 to 80)	15 (8 to 23)	1,069 (966 to 1,176)	13,486 (12,820 to 14,164)
2017/18*	15,969 (15,125 to 16,828)	6 (6 to 6)	1 (1 to 1)	1,112 (1,112 to 1,112)	15,004 (14,215 to 15,807)

*data up to week 15 2018

Emerging respiratory viruses

Human MERS-CoV infections

Since WHO first reported cases of Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV) in September 2012, a total of 2,189 laboratory confirmed cases have been reported globally up to 26 April 2018 in 27 countries. This includes at least 782 fatal cases (case fatality ratio of 36%). Most cases have either occurred in the Middle East or have direct links to a primary case infected in the Middle East. A feature of MERS-CoV, is its ability to cause large outbreaks within healthcare settings. Local secondary transmission following importation has been reported from the UK, France, Tunisia and the Republic of Korea.

MERS-CoV infection was originally confirmed in 4 cases with 2 imported cases to the UK detected in September 2012 and January 2013, respectively. The 2 secondary cases with non-sustained transmission in the UK were linked to the second imported UK case in January 2013. PHE continues to monitor potential cases in travellers returning from the Middle East with severe respiratory disease, with individuals tested for MERS-CoV if they meet the suspect case definition. No positive cases have been reported in the UK since February 2013. Since the start of the MERS-CoV global outbreak up to 26 April 2018, 1191 suspected cases amongst returning travellers have been identified in the UK and tested negative for MERS-CoV. However, in April and May 2014, 2 laboratory confirmed cases transited through London Heathrow Airport on separate flights to the USA. Contact tracing of flight contacts did not identify any further cases.

PHE remains vigilant, closely monitoring developments in countries where new cases emerge and continues to liaise with international colleagues to assess whether recommendations need to change in relation to MERS-CoV. The risk of infection to UK residents in the UK remains very low, although the risk of infection to UK residents in the affected areas is slightly higher, but is still considered to be low. There does remain a risk of imported cases from affected countries; however, this risk remains low[19]. For further PHE information on management and guidance of possible cases, please see information online[20].

Human influenza A(H7N9) infections

The first 3 human infections with avian influenza A(H7N9) was reported in China through WHO in April 2013 [21]. Up to 26 April 2018, 1,567 cases have been reported, including at least 534 deaths giving an overall case fatality ratio of 38.3%.

To date, 433 cases of avian influenza A(H7N9) have been reported during the 6th Wave (01 October 2017 onwards) in China. This represents a significant decrease in the number of cases compared to previous waves. There is no evidence to suggest that this decrease in cases is triggered by a change in the virus characteristics. The decrease in cases is most likely due to a mandatory bivalent H5/H7 vaccination campaign in poultry in China. PHE will continue to monitor the situation closely.

For further updates, please see the WHO website [22] and for PHE advice on clinical management, please see information available online [23].

[19] https://www.gov.uk/government/publications/mers-cov-risk-assessment
[20] https://www.gov.uk/government/collections/middle-east-respiratory-syndrome-coronavirus-mers-cov-clinical-management-and-guidance
[21] http://www.who.int/csr/don/2013_04_01/en/

Human influenza A(H5N1) and influenza A(H5N6) infections

Since 2003, 860 cases of avian influenza A(H5N1) have been reported including 454 deaths, giving an overall case fatality rate of 53%. Cases have been reported from 16 countries. From 01 January 2017 to 26 April 2018, 4 cases have been reported, 3 from Egypt and one from Indonesia. As of 26 April 2018, a total of 19 human influenza A(H5N6) cases have been reported since February 2014.

Most human cases were exposed to H5 and H7 viruses through contact with infected poultry or contaminated environments, including live poultry markets. Since the viruses continue to be detected in animals and environments, further human cases can be expected. Even though small clusters of H5N1 and H7N9 virus infections have been reported previously including those involving healthcare workers, current epidemiological and virological evidence suggests that viruses have not acquired the ability to undergo sustained transmission among humans, thus the likelihood is low.

Should infected individuals from affected areas travel internationally, their infection may be detected in another country during travel or after arrival. If this were to occur, further community level spread is considered unlikely as evidence suggests these viruses have not acquired the ability to transmit easily among humans [24].

[22] http://www.who.int/influenza/human_animal_interface/influenza_h7n9/en/
[23] https://www.gov.uk/government/collections/avian-influenza-guidance-data-and-analysis
[24] http://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interface_02_03_2018.pdf?ua=1

Conclusions

Moderate levels of influenza activity were seen in the community in the UK in 2017 to 2018, with influenza B and influenza A(H3N2) being the predominant viruses circulating throughout the season, together with some influenza A(H1N1)pdm09 circulation. The health impact was predominantly seen in older adults, with increased numbers of care homes outbreaks and excess mortality seen particularly in the 65+ year olds. The activity in general practice varied across the UK (moderate peak activity in England, Scotland and Northern Ireland but high in Wales). All countries experienced, a high number of peak admissions of influenza to both hospital and ICU/HDU with rates higher than those observed in the past 6 seasons since the scheme has been operating.

Influenza vaccine uptake in 2017 to 2018 varied across the UK with uptake generally higher or similar to the last season in all targeted groups. In England, the uptake rates were higher than the previous season in the 65+ year olds, pregnant women and healthcare workers and remained similar to last season for <65 year olds at risk. In Scotland, the uptake in the 65+ year olds, healthcare workers and pregnant woman with other risk factors was higher than previous season and the other target groups had similar or slightly lower uptakes. In Wales, uptake in these targeted groups were slightly higher than the previous season with the exception of pregnant women. In Northern Ireland, uptake in the target groups were slightly lower than the previous season with the exception of the uptake in healthcare workers which was higher.

Roll out continues of the childhood LAIV programme across the UK which was first implemented in 2013 to 2014 and, is now in its fifth season in 2017 to 2018, targeting 2 to 3 year olds in primary care and all children of school year reception, 1, 2, 3 and 4 age across the UK. Uptake levels were generally higher for the new programme compared to the previous seasons. Further work and observations from this and future seasons will be critical to evaluate this programme and to inform its optimal rollout to children.

Activity from other typical circulating respiratory viruses, including RSV, rhinovirus, adenovirus, parainfluenza and hMPV, was overall similar to that seen in the previous few seasons. Surveillance continues within the UK for novel respiratory viruses, including the 2 which emerged in 2012 to 2013: MERS-CoV and influenza A(H7N9), both of which have high reported case fatality ratios, and where there is risk of importation to the UK.

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Appendix A

Appendix A: USISS mandatory - rate of laboratory confirmed influenza ICU/HDU admissions per 100,000 trust catchment population, by NHS England Local Teams, 2013 to 2018

NHS England Local Team	2013/14 season				2014/15 season				2015/16 season				2016/17 season				2017/18 season			
	Trust catchment population	No. influenza cases	No. Trusts	Rate per 100,000	Trust catchment population	No. influenza cases	No. Trusts	Rate per 100,000	Trust catchment population	No. influenza cases	No. Trusts	Rate per 100,000	Trust catchment population	No. influenza cases	No. Trusts	Rate per 100,000	Trust catchment population	No. influenza cases	No. Trusts	Rate per 100,000
London	8,708,213	279	21	3.20	8,470,502	456	20	5.38	8,470,502	693	20	8.18	8,470,502	255	20	3.01	8,188,389	629	19	7.68
Midlands & East (Central Midlands)	3,567,158	60	9	1.68	3,567,158	22	9	0.62	3,567,158	121	9	3.39	3,567,158	63	9	1.77	3,567,158	316	9	8.86
Midlands & East (East)	4,142,430	42	13	1.01	4,142,430	74	13	1.79	3,546,341	115	12	3.24	4,142,430	53	13	1.28	4,142,430	185	13	4.47
Midlands & East (North Midlands)	3,083,386	32	8	1.04	3,083,386	65	8	2.11	3,083,386	194	8	6.29	3,083,386	49	8	1.59	3,083,386	185	8	6.00
Midlands & East (West Midlands)	4,270,637	56	13	1.31	4,270,637	117	13	2.74	4,270,637	158	13	3.70	4,270,637	81	13	1.90	4,270,637	274	13	6.42
North (Cheshire & Merseyside)	2,487,103	31	13	1.25	2,268,688	52	12	2.29	2,268,688	130	12	5.73	2,268,688	38	12	1.67	2,268,688	147	12	6.48
North (Cumbria & North East)	3,369,070	43	10	1.28	3,369,070	110	10	3.26	3,369,070	133	10	3.95	3,369,070	91	10	2.70	3,369,070	241	10	7.15
North (Greater Manchester)	2,902,404	40	7	1.38	2,945,195	51	8	1.73	2,945,195	124	8	4.21	2,945,195	57	8	1.94	2,945,195	225	8	7.64
North (Lancashire)	1,153,032	-	3	0.00	1,153,032	-	3	0.35	1,153,032	31	3	2.69	1,153,032	9	3	0.78	1,153,032	53	3	4.60
North (Yorkshire & Humber)	5,440,956	62	14	1.14	5,440,956	93	14	1.71	5,440,956	203	14	3.73	5,440,956	117	14	2.15	5,440,956	315	14	5.79
South (South Central)	2,838,431	28	6	0.99	2,838,431	68	6	2.40	3,158,108	104	7	3.29	3,158,108	57	7	1.80	3,158,108	135	7	4.27
South (South East)	4,704,284	41	12	0.87	4,704,284	69	12	1.47	4,704,284	98	12	2.08	4,704,284	49	12	1.04	4,704,284	227	12	4.83
South (South West)	3,200,500	26	10	0.81	3,200,500	52	10	1.62	3,200,500	83	10	2.59	3,200,500	41	10	1.28	3,200,500	152	10	4.75
South (Wessex)	2,420,118	20	7	0.83	1,828,256	37	6	2.02	1,828,256	62	6	3.39	1,828,256	31	6	1.70	1,828,256	91	6	4.98

*number of cases <5 suppressed denoted as '-'