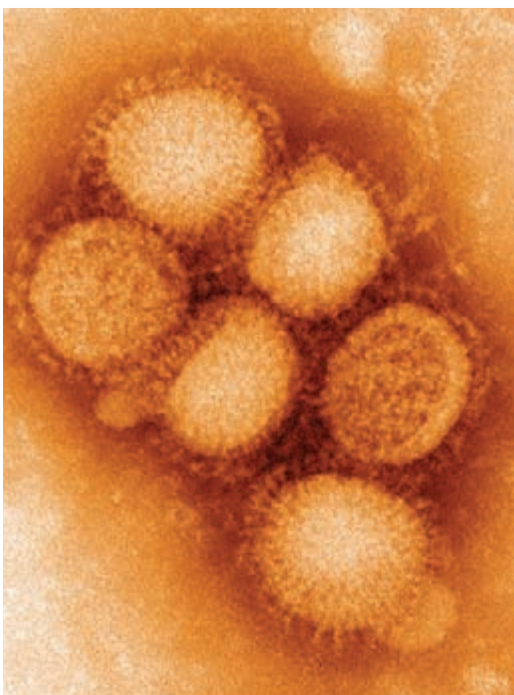
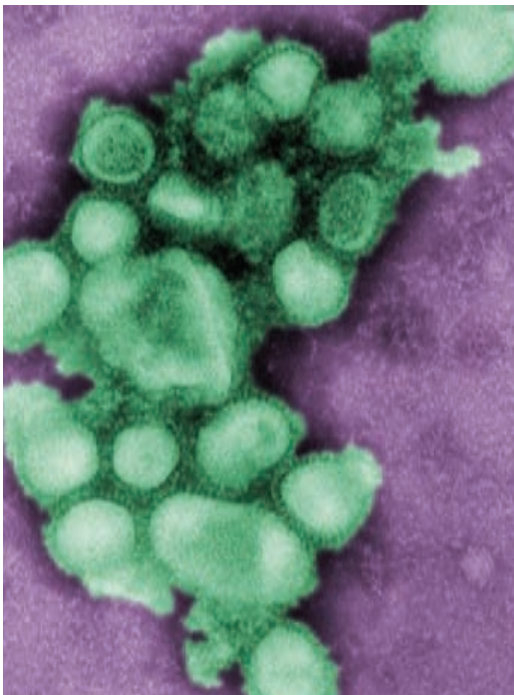
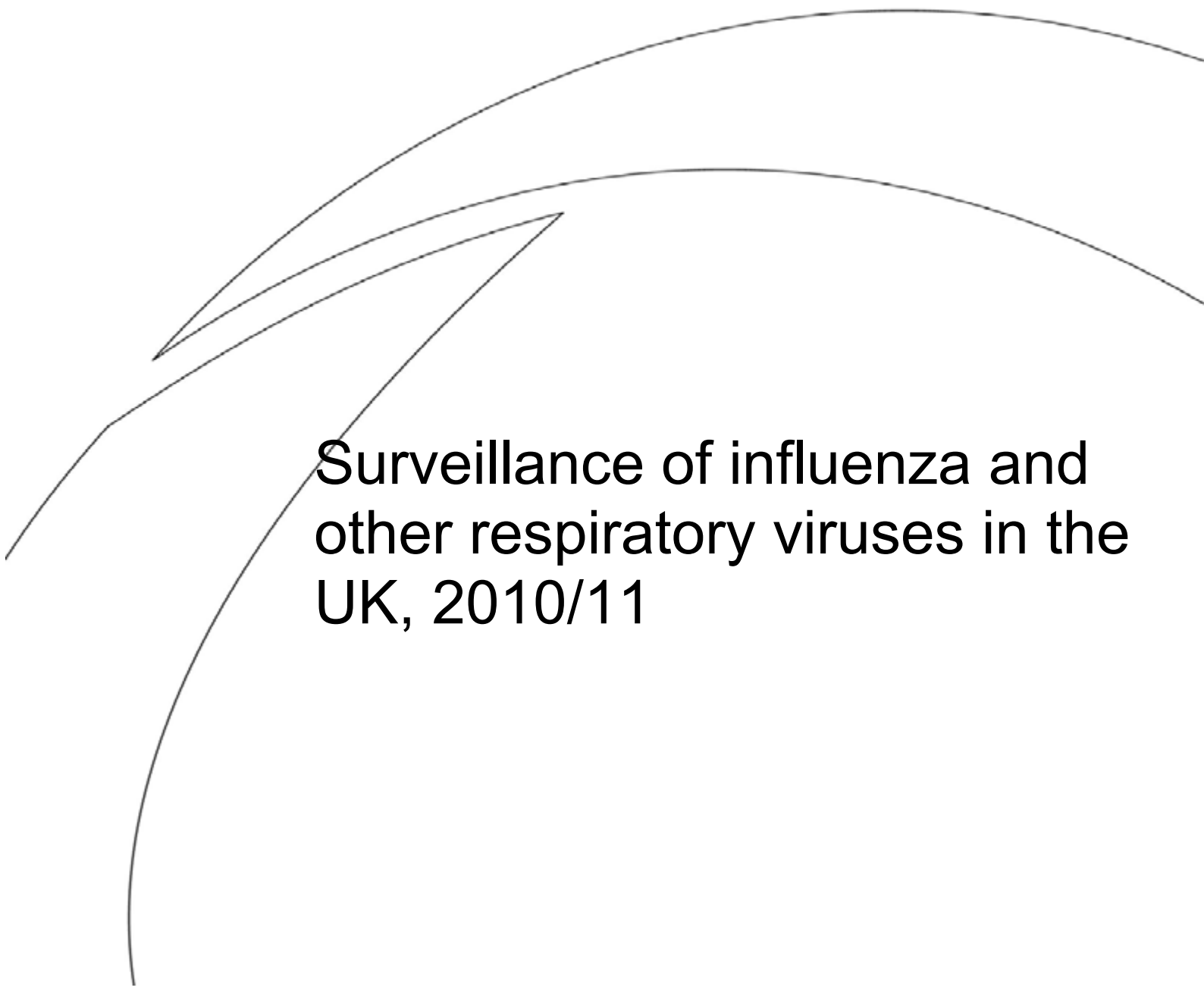


# Surveillance of influenza and other respiratory viruses in the UK

2010-2011 report





# Surveillance of influenza and other respiratory viruses in the UK, 2010/11

This report from the Health Protection Agency reflects understanding and evaluation of the current scientific evidence as presented in this document.

For information or queries relating to this document please contact the Respiratory Diseases Department: email [respcdsc@hpa.org.uk](mailto:respcdsc@hpa.org.uk)

Health Protection Agency  
151 Buckingham Palace Road  
London  
SW1W 9SZ

[www.hpa.org.uk](http://www.hpa.org.uk)  
© Health Protection Agency

May 2011

**This publication is also available in large print**

## Glossary

---

95% CI	95% confidence interval
ARI	Acute respiratory infection
CBI	Concurrent bacterial infections
CMO	Chief Medical Officer
DH	Department of Health
ECOSS	Scottish national laboratory reporting system
GP	General practitioner
GROS	General register office for Scotland
HCAI	Healthcare-associated infections
HI	Haemagglutination Inhibition
hMPV	Human metapneumovirus
HPA	Health Protection Agency
HPS	Health Protection Scotland
ICU	Intensive Care Units
ILI	Influenza-like-illness
JCVI	Joint Committee on Vaccination and Immunisation
NPFS	National Pandemic Flu Service
ONS	Office for National Statistics
OOH	Out of hours centres
PHA	Public Health Agency (Northern Ireland)
PIPeR	Pandemic Influenza Primary care Reporting
RCGP	Royal College of General Practitioners
RMN	Regional Microbiology Network
RR	Rate ratio
RSV	Respiratory syncytial virus
RT-PCR	Real time polymerase chain reaction
RVU	Respiratory Virus Unit (reference laboratory)
SARI	Severe acute respiratory infections
TIA	Transient ischemic attack
UK	United Kingdom
USISS	UK Severe Influenza Surveillance System
WHO	World Health Organization

---

# Contents

---

	Page
Glossary	2
Summary	5
Introduction	6
Sources of data	7
Consultation rates for ILI with GPs	7
Community syndromic surveillance	8
Microbiological surveillance	9
Mortality and morbidity monitoring	10
Vaccine uptake monitoring	11
Vaccine effectiveness	12
Routine and enhanced influenza surveillance system results	13
Clinical surveillance	13
Weekly UK GP clinical ILI surveillance schemes	13
RCGP	13
HPA/QSurveillance system	20
Other respiratory indicators	23
Community surveillance	25
Syndromic surveillance through call/out-of-hours centres	25
NHS Direct	25
Scotland NHS24	27
Northern Ireland OOH consultation rates	29
Flusurvey	29
Flu Watch	30
Outbreaks of acute respiratory disease	31
Microbiological surveillance	33
Virological surveillance data	33
DataMart	33
Sentinel virological schemes	35
RCGP/RMN	35
Sentinel virology in primary care in Scotland, Northern Ireland and Wales	37
Virus characterisation	38
Antiviral susceptibility	38
Antiviral resistance	38
HCAI antimicrobial resistance	39
Other respiratory viruses	40
Scottish national laboratory reporting system	41
Concurrent bacterial infections	41
Severity indicators results	43
Morbidity and mortality monitoring	43
Hospitalisation	43

UK Severe Influenza Surveillance System (USISS)	45
Hospitalisation in Scotland	46
Mortality	47
Number of reported confirmed fatal influenza cases and risk group	47
ONS weekly excess all-cause mortality	50
Weekly Scottish deaths	53
Vaccination	54
Vaccine uptake	54
Vaccine effectiveness/strain comparison	55
Recommendations for 2011/12 season	56
International situation	57
Discussion and conclusions	59
Acknowledgements	61
List of Tables	63
List of Figures	64
References	66

## Summary

---

During the first influenza season after the 2009/10 H1N1 influenza pandemic, the UK experienced intense influenza activity. Indices of activity in the community (such as NHS Direct and institutional outbreak surveillance) together with severe (hospitalised and fatal) influenza cases were reported in week 48. This occurred approximately two weeks before levels of consultations for influenza-like-illness (ILI) in sentinel GP schemes began to rise above traditional “baseline” levels. Also in week 48 an increase in the proportion of cold/flu calls to NHS Direct was also reported, after the early warning threshold was breached on 2 December 2010.

Overall, influenza activity in the UK in 2010/11 reached a level higher than that seen in the winter of the 2008/09 season and 2009/10 winter season of the pandemic, but lower than during the first wave of the pandemic in the summer of 2009. Clinical indices peaked between late December 2010 and early January 2011 in England, Wales, Scotland and Northern Ireland. Both influenza A/H1N1 (2009) and influenza B circulated at the same time. A prolonged tail to the season was noted (particularly in Scotland), as indicated by continued swab positivity for influenza B. Influenza was reported more often in young and middle-aged adults in the 2010/11 season than seen in the previous pandemic period in 2009/10. Outbreaks, mainly caused by influenza A/H1N1 (2009) and influenza B, were reported in schools, care homes, hospitals, prisons, a nursery and a military base. The occurrence of severe hospitalised cases resulted in increased intensive care unit bed occupancy, primarily in under 65 year olds. Severity indicators suggested a higher level of morbidity in terms of the daily number of cases of confirmed or suspected influenza in critical care compared to the 2009/10 pandemic. Mortality, in terms of excess deaths and individual fatal cases, was also higher in 2010/11 than the 2009/10 pandemic. Total excess deaths, however, were lower than seen in the 2008/09 season.

Influenza A/H1N1 (2009) was the predominant strain detected, with virological activity reflecting clinical activity. In addition, a significant proportion of virus detections due to influenza B were reported. In Europe, the predominant circulating strains varied between countries. Of the influenza A/H1N1 (2009) viruses tested in the UK, 3.1% were found to carry the mutation commonly associated with resistance to oseltamivir. While reports of concurrent bacterial infections (CBI) were not identified as a major feature of the 2009 pandemic, there were reports of CBI associated with influenza infection during the 2010/11 season, prompting an alert for clinicians issued by the Chief Medical Officer.

In England, the proportion of over 65 year olds who received the 2010/11 seasonal influenza vaccine reached 72.8% by the end of the season, a slight increase on the previous year. For people aged under 65 years in a clinical risk group, a slight decrease to 50.4% uptake was seen. Pregnant women were incorporated into the seasonal influenza vaccine programme in the UK for the first time in 2010/11, following the pandemic. Vaccine uptake in England was 36.6% among healthy pregnant women and 56.6% in pregnant women with an underlying clinical risk factor. Data from the final monthly collection of flu vaccine uptake by frontline healthcare workers show 34.7% were vaccinated by 28 February 2011.

## Introduction

---

In June 2009, with the emergence of pandemic H1N1 (2009), the World Health Organization (WHO) declared a global influenza pandemic, the first in over four decades (1). As a result, various existing routine influenza surveillance systems in the UK were enhanced or supplemented to gain a rapid understanding of this novel virus, to monitor its spread and impact, and to evaluate the uptake, impact and effectiveness of the various countermeasures that were implemented. Some of these systems have continued to monitor influenza activity during the post-pandemic period. Following an announcement by WHO of the end of the pandemic on 10 August 2010 (2), WHO recommended vigilance regarding future pandemic H1N1 (2009) virus activity. It was expected that the virus would behave as a seasonal virus and continue to circulate in the population. Its behaviour, however, could not be reliably predicted (3) although it was considered likely that the virus would continue to cause serious disease in a minority of those infected in younger age groups and people in high-risk groups (4).

The previous annual UK influenza report covered the pandemic period until 23 May 2010 (5). This report describes influenza activity in the UK in the 2010/11 winter season. Where available, data will be presented from the start of the pandemic in April 2009 to enable clear comparisons of the pandemic and post-pandemic periods.



## Sources of data

---

In the UK, surveillance of influenza and other respiratory viruses is undertaken by the Health Protection Agency (HPA), Health Protection Scotland (HPS), Public Health Agency (PHA) Northern Ireland and Public Health Wales. Data are collated from a variety of surveillance systems to provide timely information on when influenza circulation has started, which influenza strains are circulating, to ascertain which strains have epidemic potential, and to contribute towards the decision on influenza vaccine composition for the following season. Surveillance activities also produce up-to-date reports for health professionals, the media and public on trends in influenza activity, spread and burden of disease and the uptake and effectiveness of the main clinical countermeasures (in particular vaccination and antivirals) (6). Surveillance occurs throughout the year. While traditionally there is a focus on the winter season between October (week 40) and May (week 20), since the 2009/10 pandemic, surveillance has been maintained during the summer months, albeit with less frequent publications.

A number of different data sources are traditionally used to monitor influenza activity in the UK. In response to the 2009/10 pandemic, some systems were enhanced and new ones were created to strengthen surveillance. Therefore traditional seasonal influenza surveillance systems, along with several new influenza surveillance schemes, have remained in use in this first post-pandemic season.

### CONSULTATION RATES FOR ILI WITH GPs

A [series of directed sentinel schemes](#) operate across the UK. Data reported is the weekly consultations for influenza-like illness (ILI) and other acute respiratory illnesses. These schemes use the number of patients registered with the participating GP as the denominator. Clinical data is obtained from networks of GP surgeries in England and Wales via the Royal College of General Practitioners Weekly Return Service ([RCGP](#)). Equivalent schemes also run in [Scotland](#), [Wales](#) and [Northern Ireland](#). In addition, there is also the [HPA/QSurveillance](#) syndromic surveillance scheme, with automated extraction of information from GP information systems, which includes practices from England, Northern Ireland and Wales, although the majority are from England. To aid interpretation of the consultation rates and comparison with previous years, thresholds (baseline levels) have been defined to provide an approximate indication of expected levels when influenza is not circulating widely, when normal seasonal levels of influenza are circulating in the winter season and when above average or epidemic activity is occurring (Table 1). These thresholds reflect experience from several years of historical data.

Table 1 Thresholds per 100,000 for ILI consultation rates for different GP sentinel surveillance schemes, UK

Scheme (Country)	Baseline	Normal/seasonal	Above average/epidemic	Case definition
<b>RCGP (England)*</b>	30	30–200	>200	ILI
<b>Public Health Wales</b>	25	25–100	100–400	Influenza
<b>HPS (Scotland)**</b>	50	–	–	ILI/ARI
<b>PHA (Northern Ireland)</b>	70	70–500	>500	ILI/influenza
<b>HPA/QSurveillance (UK)***</b>	20	20–70	70–130	ILI

\* The thresholds for RCGP clinical data were lowered in 2004.

\*\* The threshold level for Scotland is now based on the Pandemic Influenza Primary care Reporting (PIPeR) system which currently represents 2% of the Scottish population. HPS are currently in the process of defining thresholds for normal and above average ILI/acute respiratory infection (ARI) activity based on this system and other GP clinical surveillance systems.

\*\*\* The HPA/QSurveillance system is based upon the QSurveillance database, which receives data from over 3,400 practices covering 43% of England's population, 11% of the population in Wales, 17% in Northern Ireland and 0% in Scotland. There is also an exceptional level, which is greater than 130 per 100,000.

## COMMUNITY SYNDROMIC SURVEILLANCE

Various community surveillance systems are in place to monitor influenza activity in the general UK population to include those who would not necessarily go to their GP but report symptoms which could indicate influenza.

[NHS Direct](#) is a 24/7 nurse-led telephone health advice and information service in England and Wales. The NHS Direct/HPA surveillance scheme analyses data from this service. Key respiratory indicators are the proportion of callers reporting cold/flu and fever by age group. In Scotland a similar system (NHS-24) operates where information is routinely collected on calls made to NHS-24 where the caller mentions amongst the reasons for calling that they may have a cold/flu. In Northern Ireland there is no equivalent of NHS Direct/NHS-24. In Northern Ireland, data is collected from primary care out-of-hours centres (OOH) on total consultations and those for influenza/ILI, stratified by age.

[Flusurvey](#) is a European Union-funded project run by the London School of Hygiene and Tropical Medicine, which provides internet-based surveillance of influenza in the general UK population. It was first launched in July 2009 in the middle of the pandemic.

[Flu Watch](#) is a Medical Research Council/Wellcome funded community-based cohort surveillance system in England run by University College London. It was first launched in the 2006/07 influenza season.

Acute respiratory outbreaks in institutional settings are reported using a standard pro forma as they occur to the HPA Colindale.

## MICROBIOLOGICAL SURVEILLANCE

The HPA Respiratory Virus Unit (RVU), Colindale, undertakes antigenic and genetic characterisation of influenza isolates submitted for testing by HPA and NHS laboratories in England and other laboratories in the UK. Antigenic characterisation is performed by haemagglutination inhibition (HI) assay using post-infection ferret antisera to A/California/07/2009 (H1N1 (2009) vaccine strain), A/Perth/16/2009 (H3N2 vaccine strain) and the B-Victoria lineage. The latter is similar to the current vaccine strain B/Brisbane/60/2008. An isolate with a 4-fold or less change in reactivity to the reference strain is classified as being like the reference strain.

DataMart is a laboratory surveillance tool to monitor influenza and other respiratory viruses based on a network of 16 HPA and NHS laboratories in England. Respiratory swabs from primary and secondary care are tested for a variety of viruses using real time polymerase chain reaction (RT-PCR) assays. Viruses tested for include influenza, rhinovirus, parainfluenza, adenovirus, human metapneumovirus (hMPV) and respiratory syncytial virus (RSV). As denominator data are available, it is possible to examine trends in the proportion of samples positive for each virus on a weekly basis.

Additionally, the reference laboratory in RVU and several HPA regional laboratories monitor the occurrence of antiviral resistance in influenza isolates using a molecular marker for resistance to the antiviral drug oseltamivir (H275Y). RVU subsequently undertakes full phenotypic susceptibility testing on a sample of specimens. Resistance to the antiviral drug zanamivir is also tested for phenotypically in the reference laboratory.

The Healthcare associated infections (HCAI) team at the HPA Colindale analyse lower respiratory tract bacterial isolate (*Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*) susceptibilities to key empiric therapy antibiotic choices.

In Scotland, similar information on laboratory reports is submitted through the national laboratory reporting system (ECOSS) for the same pathogens tested by multiplex PCR on a weekly basis.

In addition, the National Laboratory Reporting Scheme, LabBase, comprises approximately 230 NHS, HPA and independent sector microbiology laboratories throughout England and Wales. This scheme reports positive results for human samples (from community and hospital settings) testing positive for pathogens. Trends in respiratory viruses including RSV, rhinovirus, parainfluenza, adenovirus, and hMPV are examined.

A subset of approximately 85 general practices in the RCGP Weekly Returns Service submits respiratory samples for virological testing from patients presenting in primary care with an ILI. Respiratory specimens, along with key demographic and epidemiological information about the patient and their illness (e.g. use of antivirals and vaccination history), are gathered and submitted to HPA Colindale. A complementary sentinel primary care scheme of virological sampling is carried out by the HPA, whereby respiratory specimens from patients presenting to a network of GPs with an acute respiratory infection are submitted to the local HPA regional laboratory together with epidemiological information from the patient. Similar directed sentinel swabbing schemes through primary care operate in Scotland (with 50 sentinel GP

practices), Wales (with 19 GP practices) and Northern Ireland (with 32 GP practices). Specimens are tested by PCR for influenza and other respiratory virus infections. Data from these schemes are used to calculate the proportion of ILI cases who consult in primary care and who are positive for influenza each week.

## **MORTALITY AND MORBIDITY MONITORING**

The daily number (“stock”) of patients with confirmed or suspected influenza in critical care beds was collated in England during both the 2009/10 pandemic and 2010/11 winter period by the Department of Health (DH) as part of the Winterwatch programme. Where population rates are presented, the population figures are from the Office for National Statistics (ONS) mid-2009 estimates, which are available by age group and region.

The UK Severe Influenza Surveillance System (USISS) pilot scheme for 2010/11 was created following the success of the HPA/DH) web-based hospital surveillance system established during the 2009 pandemic in England. The pilot was undertaken to determine the feasibility of establishing a routine surveillance system for hospitalised influenza cases. Starting in December 2010, a sentinel network of 23 acute NHS trusts in England were recruited. Trusts reported confirmed influenza cases to USISS prospectively and retrospectively since week 40 2010 (ending 10 October 2010). One trust also agreed to collect data on Severe Acute Respiratory Infections (SARI). Trusts reported weekly aggregate numbers of hospitalised cases to USISS until week 10 2011 (ending 13 March 2011). For confirmed cases, this included influenza type, age group and level of care. For SARI cases, this included the total number of SARI cases admitted to the trust by age group, and the proportion of those tested for influenza.

The HPA receives and follows up reports of deaths in England – where influenza is suspected to have contributed. Reports come from various sources including clinicians, laboratory reports and death certificates. A confirmed case is defined as an individual dying with a laboratory confirmed influenza infection, where influenza contributed to the death. Although the fatal cases reported and confirmed to be associated with influenza infection do not constitute all cases that occur, they do provide a representative picture of the types of patients and underlying factors associated with severe disease. The equivalent organisations in [Scotland](#), [Wales](#) and [Northern Ireland](#) have established systems to gather and report information on influenza-related deaths. These systems, including the case definition, differ between countries.

Reports of individuals who developed severe acute respiratory illness due to confirmed influenza who required intensive care management were received by HPS from each NHS Board in Scotland during this flu season. Similarly, reports of deaths due to confirmed influenza illness were received by HPS. A brief summary of these reports (age breakdown, risk factors of note, type of influenza illness etc) were published as part of the routine Influenza Update Report throughout the season.

[ONS](#) collates and reports to the HPA estimated total all-cause death registrations on a weekly basis. This information is used to calculate weekly excess all-cause all-age death registrations in England and Wales and to compare any observed excess for this season to previous seasons. A statistical model is used based on the Serfling method (7) to establish a baseline of the expected weekly number of registered deaths. If the observed number is above the upper limit of a 90% confidence interval around this expected number for at least one week, an excess is said to have occurred. The General Register Office for Scotland (GROS) provides information on the number of deaths from all-causes registered on a daily basis to HPS. A similar analysis to that described above for the ONS death registrations is undertaken by HPS.

[EuroMOMO](#) (Mortality Monitoring in Europe) is a project coordinated by the Statens Serum Institut, Denmark, and co-funded by the European Commission. It provides European countries with a common approach to analyse their mortality data and compare them to other countries (8). The algorithm provides expected and observed weekly number of deaths corrected for reporting delay and standardised for the total population by age group and region. The overall objective is to develop a routine public health mortality monitoring system aimed at detecting and measuring, on a real time basis, the excess number of deaths related to influenza and other potential acute public health threats across European countries. This system has been run as a pilot by the HPA over the 2010/11 winter season and provides an indication of whether the estimated number of death registrations is more than would be expected for the time of the year.

## **VACCINE UPTAKE MONITORING**

The Joint Committee on Vaccination and Immunisation (JCVI) recommended that all those aged 65 years and over, and those aged between 6 months and less than 65 years and falling into a clinical at-risk group, be offered the seasonal 2010/11 trivalent influenza vaccine (9). Clinical at-risk groups include individuals with one or more of the following underlying medical conditions: chronic respiratory disease, chronic heart disease, chronic renal disease, chronic liver disease, chronic neurological disease, diabetes or immunosuppression. For the first time, pregnant women (at any stage of pregnancy) were also included in the recommendation, following observations during the pandemic of their elevated risk of severe disease. Health care workers in direct contact with patients were also recommended vaccination.

Uptake of the vaccine in the different eligible groups was monitored in England by the HPA through the DH web-portal, Immform. Data on eligible target populations and the number of patients/healthcare workers vaccinated were automatically extracted or manually outputted from GP and acute NHS trust information systems and uploaded into Immform.

In Scotland, Wales and Northern Ireland similar data were collected using automated and manual methods.

## **VACCINE EFFECTIVENESS**

Estimates of vaccine effectiveness were made using data from GP sentinel virological schemes in England, Scotland and Wales. A swab negative case-control study of individuals with influenza-like-illness in primary care was undertaken. Those testing PCR positive for influenza regardless of type or subtype were cases and those testing negative were controls. Vaccine effectiveness was estimated as  $1 - \text{odds ratio}$ , adjusted for available confounders.

# **Routine and enhanced influenza surveillance system results**

---

The first post-pandemic season since the H1N1 (2009) pandemic began with reports of severe cases of influenza due to H1N1 (2009). This included hospitalisations, increased intensive care bed occupancy and deaths in week 48 2010 (ending 5 December 2010). This occurred together with increases in community indicators of influenza activity (both respiratory disease outbreaks and signals from NHS Direct). This community activity and reports of severe cases occurred prior to any increase in GP consultation rates. GP consultation rates finally increased above baseline levels in week 49 (ending 12 December 2010).

## **CLINICAL SURVEILLANCE**

### **WEEKLY UK GP CLINICAL ILI SURVEILLANCE SCHEMES**

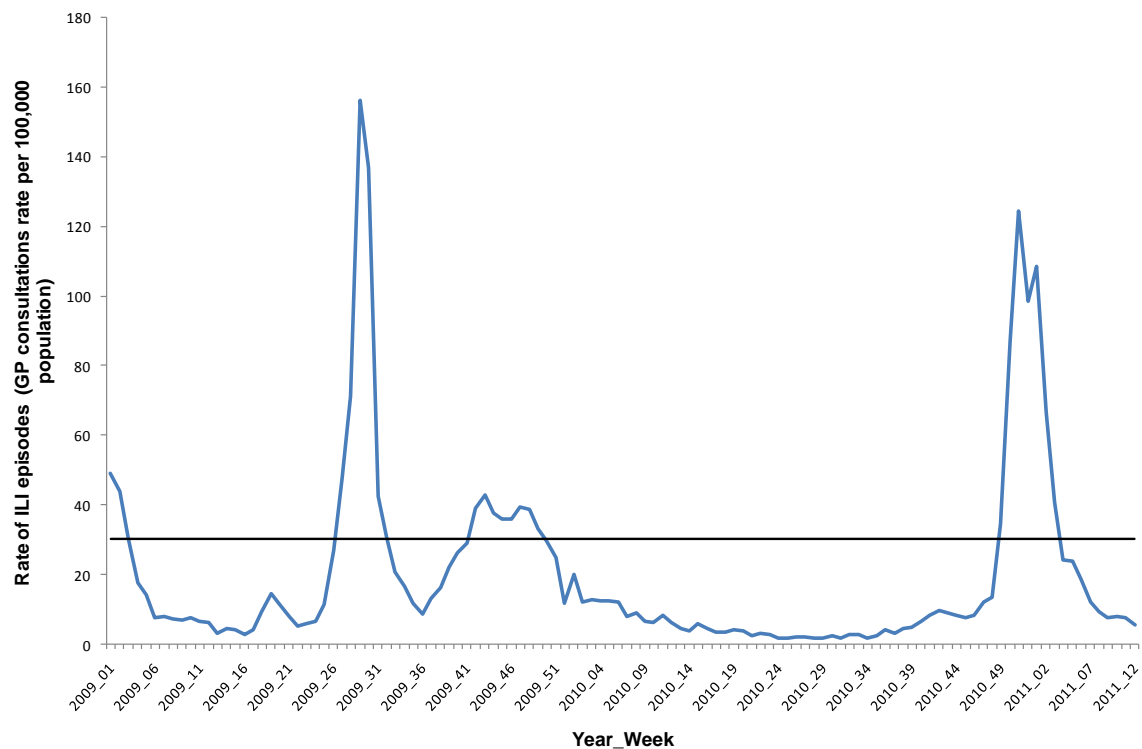
During 2010/11, the increase in influenza activity as determined through GP consultation rates was preceded by reports of severe hospitalised and fatal cases, together with several outbreaks in closed settings.

### **RCGP**

During the 2010/11 season, the RCGP weekly all-age ILI rate in England and Wales exceeded the baseline level of 30 new episodes per 100,000 persons in week 49 (ending 12 December 2010) to reach 31.6 per 100,000 (Figure 1). Activity peaked in week 51 (ending 26 December 2010) at 120.2 per 100,000, with a second peak of 101.8 per 100,000 after the Christmas/New Year vacation in week 1 (ending 9 January 2011). Levels then remained above baseline until week 4 (ending 30 January 2011) when they decreased from 38.8 to 23.3 per 100,000. The peak this season was higher than that observed in the 2009/10 winter (41.4 per 100,000 in week 43 ending 25 October 2009), but lower than that seen during the peak in the pandemic summer wave in 2009 (156.3 per 100,000 in week 29 ending 19 July 2009). It is important to note that the peak in primary care consultations in the winter season of 2009/10 was affected by the telephone and web-based pandemic response system, the National Pandemic Flu Service (NPFS), which operated in England between 23 July 2009 and 11 February 2010.

RCGP ILI rates are also reported by region in England: north, south and central. All-age ILI rates increased above baseline in Central and South England in week 49 (ending 12 December 2010) and increased the following week in Northern England. The highest peak was in Southern England with an ILI rate of 131.0 per 100,000 in week 51 (ending 26 December 2010). Central England reached a peak of 120.5 per 100,000 in week 51 2011 (ending 26 December 2010) and Northern England peaked later and lower at 103.2 per 100,000 in week 1 2011 (ending 9 January 2011).

Figure 1 Overall weekly RCGP ILI rate in England and Wales January 2009 – March 2011\*

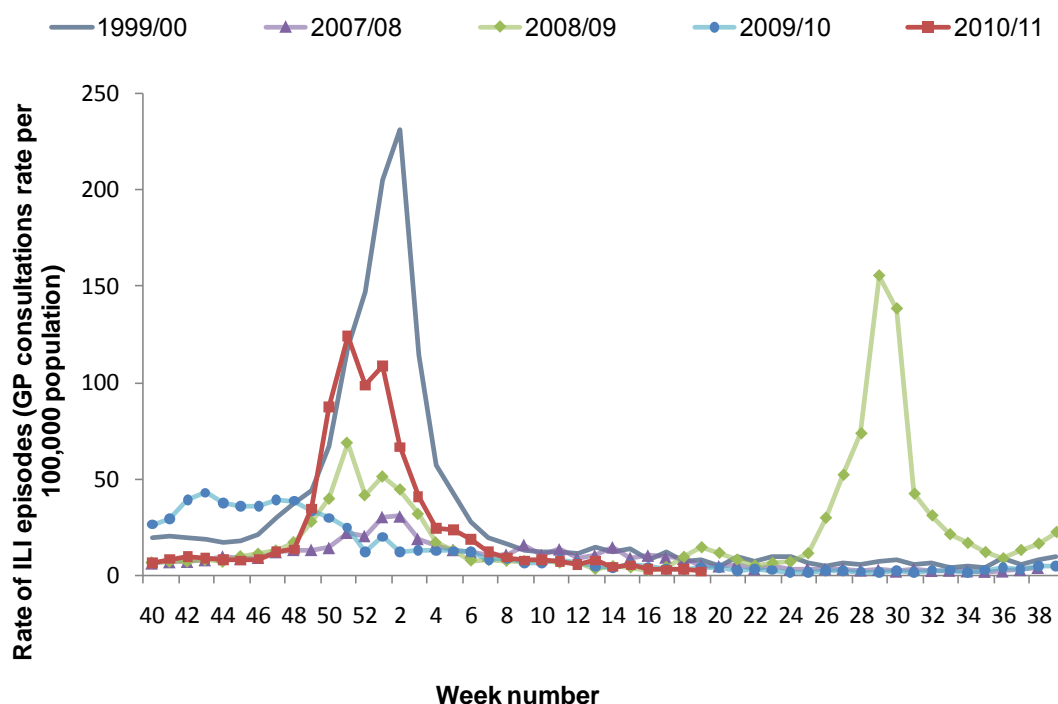


\*The horizontal black line indicates the RCGP baseline threshold of 30 per 100,000 set by RCGP

Relative to previous winters, the 2010/11 winter rates were the highest observed since the 1999/00 season (233.0 per 100,000 in week ending 16 January 2000) (Figure 2). The peak this winter occurred almost two months later than the peak observed in the 2009/10 winter season during the pandemic, but at a similar time to pre-pandemic seasons (Figures 1 and 2).



Figure 2 RCGP weekly ILI rate per 100,000 in England and Wales from various seasons since 1999/00



The sentinel GP schemes of the Devolved Administrations showed a similar picture in terms of timing of clinical activity reported from primary care (Figure 3). The absolute rates reported from each of the UK countries are influenced by the local surveillance systems and cannot be used to compare relative impact between the countries of the UK.

In Scotland, similar levels of activity were seen during the 2009/10 and 2010/11 winters, with a peak of 89.3 per 100,000 in week 45 2009 (ending 8 November 2009) and a peak of 77.3 per 100,000 in week 51 2010 (ending 26 December 2010) (Figure 4).

Figure 3 UK weekly ILI GP consultation rates by country April 2009 – March 2011

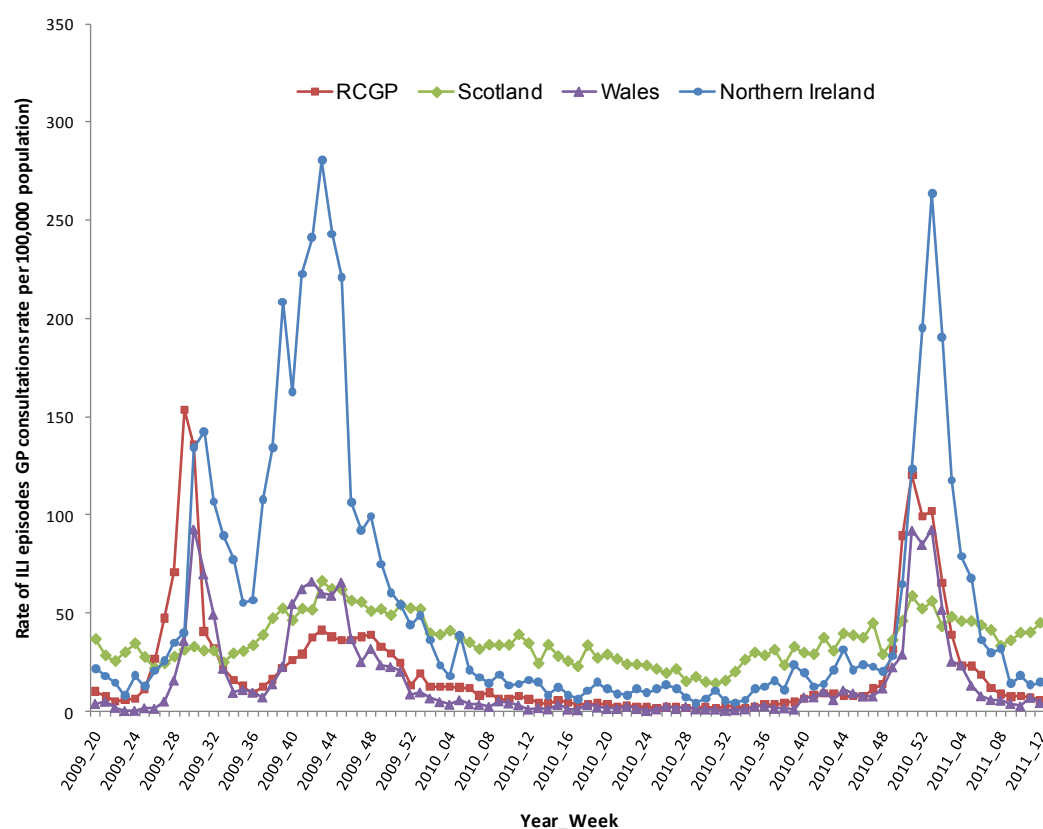
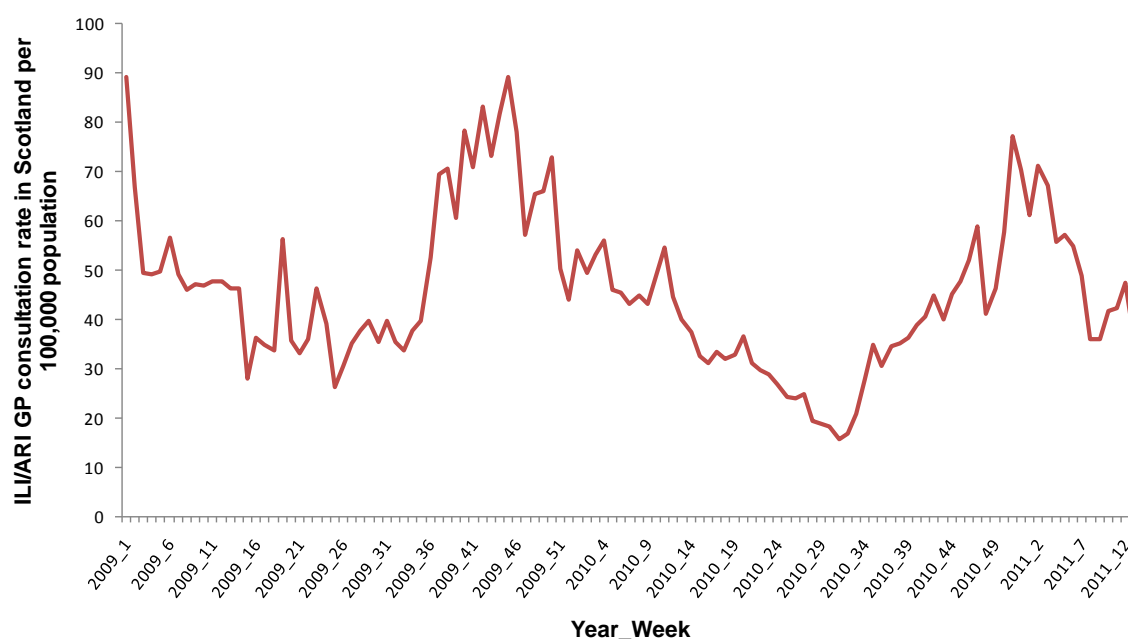


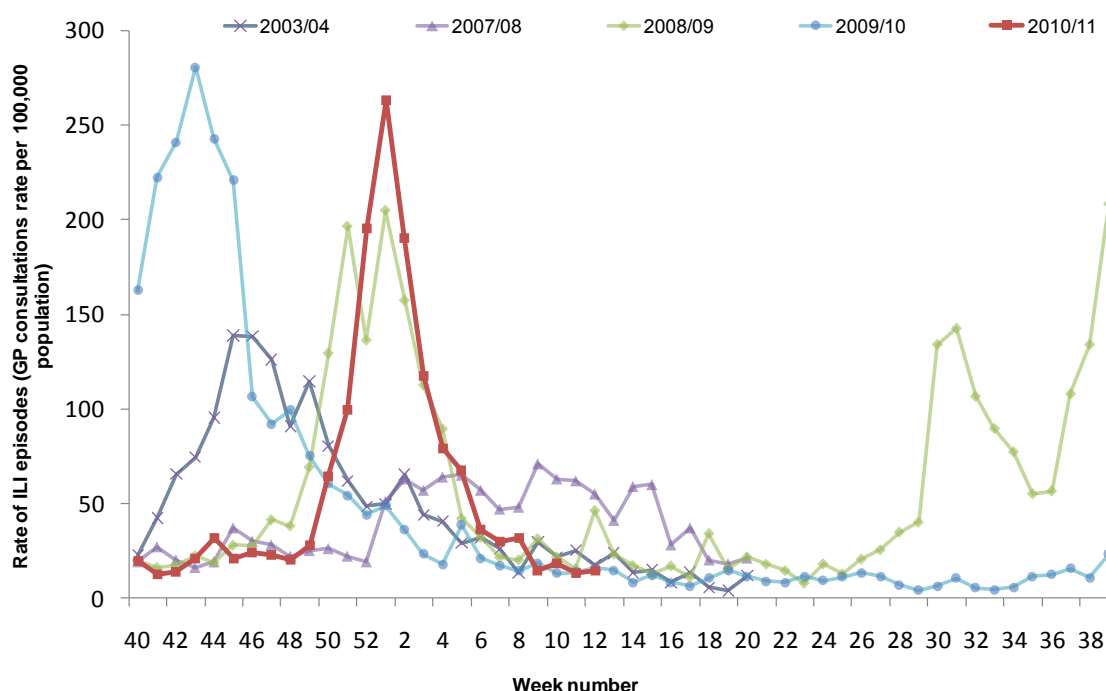
Figure 4 Weekly overall ILI/ARI rate in Scotland via PIPeR January 2009 – March 2011



Northern Ireland experienced a similar peak level of activity in 2010/11 (peak of 263.5 per 100,000 in week 1 ending 9 January 2011) compared to 2009/10 (peak of 280.6

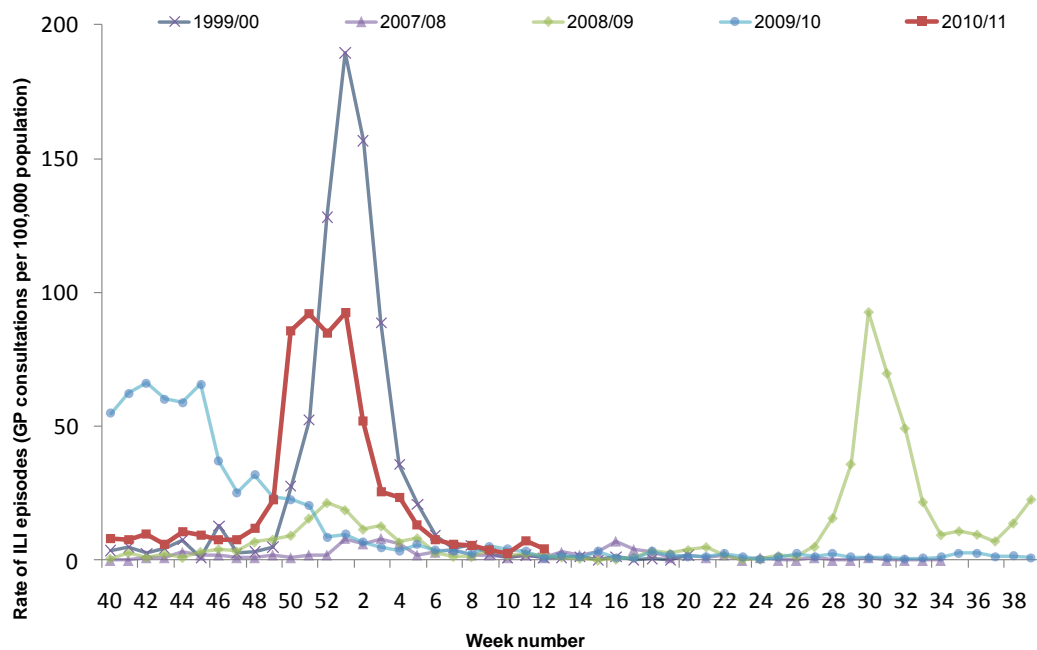
per 100,000 in week 44 ending 1 November 2009) (Figure 5), but activity occurred later in the 2010/11 season.

Figure 5 Overall weekly GP ILI consultation rate in Northern Ireland from various seasons since 2003/04



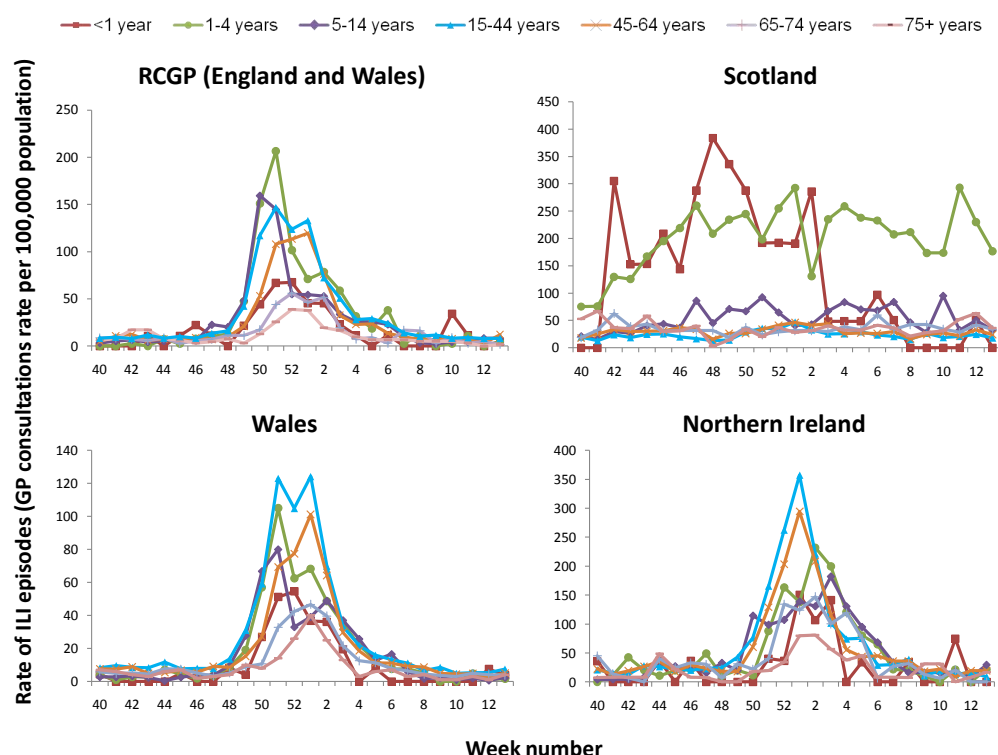
Wales experienced a higher, but later, peak in clinical influenza activity in the 2010/11 winter compared with the previous year, with 92.6 per 100,000 in week 1 (ending 9 January 2011) compared with 66.2 per 100,000 in week 42 (ending 18 October 2009). It was a similar magnitude to the peak observed during the height of the pandemic (92.8 per 100,000 in week 31 ending 2 August 2009) (Figure 6).

Figure 6 Overall weekly GP ILI consultation rate in Wales from various seasons since 1999/00



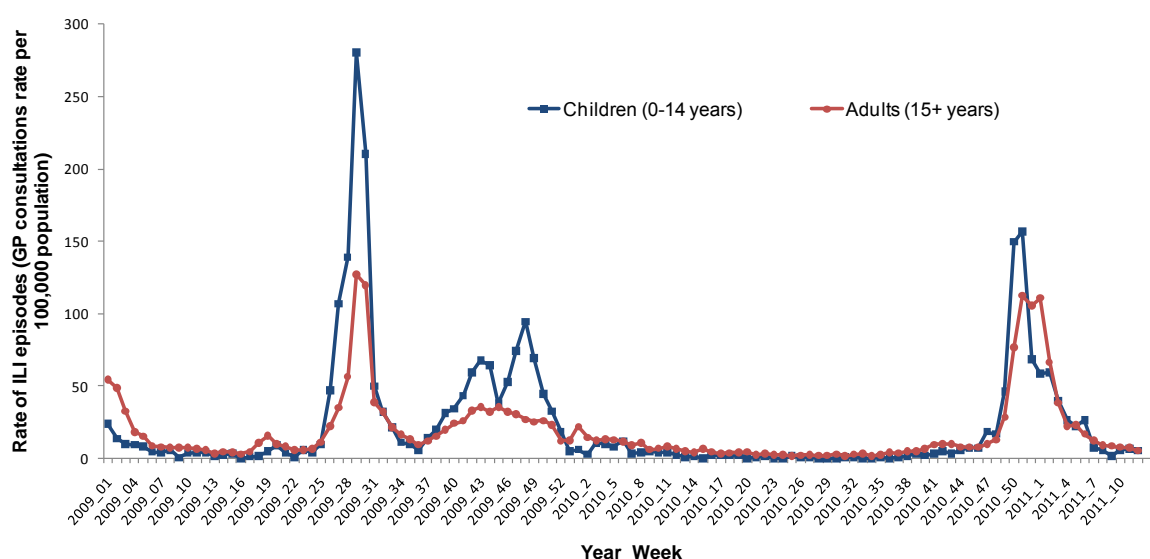
In the RCGP scheme, the highest age-specific GP consultation peak was in the 1–4 year group with a rate of 206.6 per 100,000 in week 51 (ending 26 December 2010). The lowest age-specific peak rate was in 75+ years, with 38.8 per 100,000 in week 52 (ending 2 January 2011) (Figure 7).

Figure 7 Weekly ILI GP consultation rates by age group within the UK October 2010 – March 2011



When comparing children (0–14 years old) with adults (15 years or older), it was evident that children remained more affected than adults with a higher ILI age-specific rate in 2010/11 as during the pandemic (Figure 8), however the proportion of adults affected did increase in 2010/11 compared to the 2009/10 season.

Figure 8 RCGP weekly ILI GP consultation rates in adults and children in England and Wales January 2009 – March 2011



Different age-specific results were evident in the Devolved Administrations (Figure 7).

In Scotland, the under one year olds had the highest ILI consultation rates overall (peak of 383.8 per 100,000 in week 48, ending 5 December 2010) followed by the 1–4 year olds (peak of 292.5 per 100,000 population in week 1 ending 9 January 2011). The lowest peak was in the 45–64 year group, 46.1 per 100,000 in week 1 2011 (ending 9 January 2011).

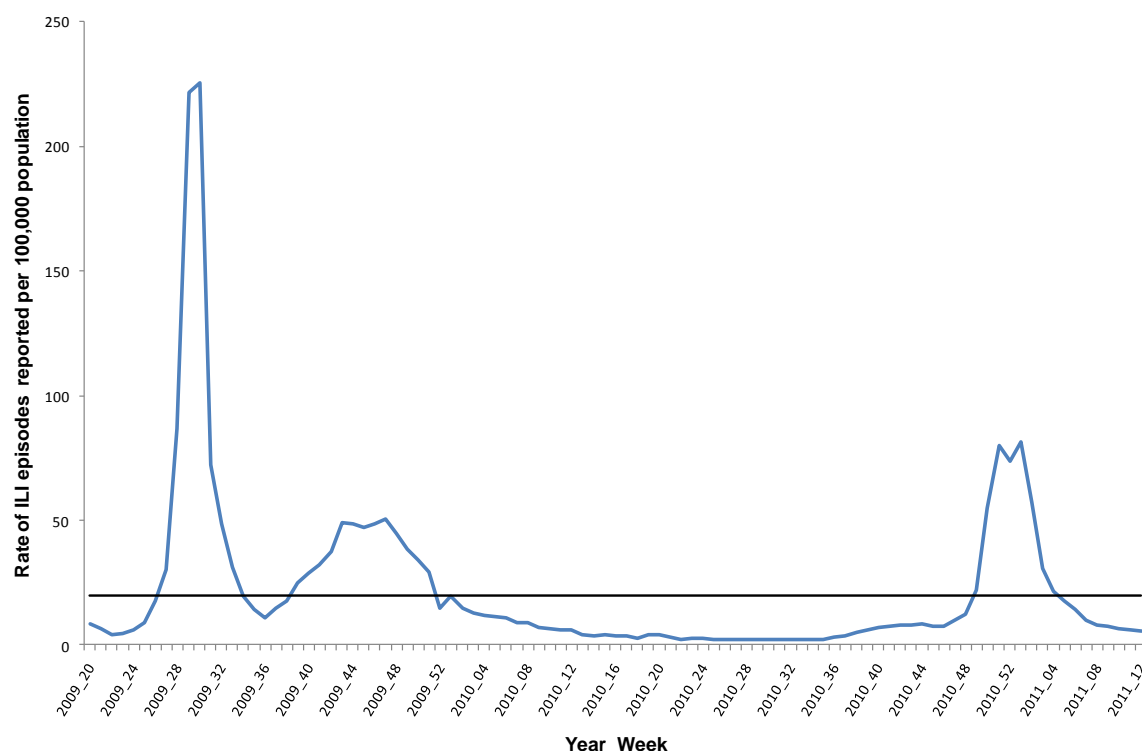
In Wales, the highest peak was in the 15–44 year group at 124.2 per 100,000 in week 1 2011 (ending 9 January 2011). The lowest peak was in the 75+ years group, with 40 per 100,000 also in week 1 2011.

In Northern Ireland, the 15–44 year group also had the highest rate, with 356.9 per 100,000 in week 1 (ending 7 January 2011), while the lowest rate for maximum peak by age group was in the 75+ years group, with 81.1 per 100,000 in week 2 (ending 14 January 2011).

## **HPA/QSurveillance scheme**

In the HPA/QSurveillance GP syndromic surveillance scheme, the weekly ILI rate for England, Wales and Northern Ireland showed a similar pattern to the RCGP ILI rate (Figure 9). A peak of 80.2 per 100,000 was observed in week 51 (ending 26 December 2010), with a second peak (resulting from the Christmas holidays as in the RCGP scheme) of 81.4 per 100,000 in week 1 (ending 9 January 2011). The highest peak in 2010/11 was higher than that observed during the 2009/10 winter season (50.5 per 100,000 in week 47 ending 22 November 2009) but lower than that seen during the summer of 2009 (226.0 per 100,000 in week 30 ending 26 July 2009). The peak during the winter of 2010/11 occurred approximately one month later than the 2009/10 winter peak.

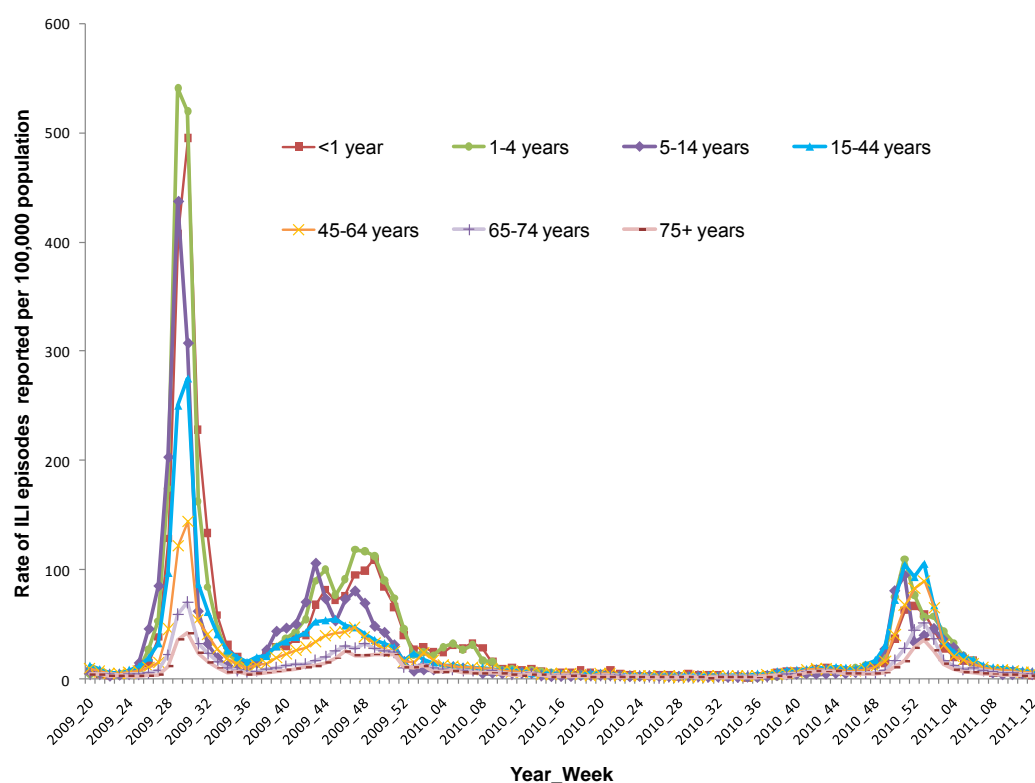
Figure 9 HPA/QSurveillance overall weekly ILI consultation rate in England, Wales and Northern Ireland April 2009 – March 2011\*



\*The horizontal black line indicates the HPA/QSurveillance ILI baseline threshold of 20 per 100,000.

The 1–4 year age group had the highest ILI rate in winter 2010/11 (as seen during the pandemic), with a peak of 109.4 per 100,000 in week 51 2010 (ending 26 December 2010) (Figure 10). However, adults under 65 years were more affected in 2010/11, with a peak of 104.9 per 100,000 in 15–44 year olds per 100,000 and 89.2 per 100,000 in 45–64 year olds in week 1 2011 (ending 9 January 2011) compared to peak adult rates in the 2009/10 winter season of 54.5 per 100,000 in 15–44 year olds in week 45 2009 (ending 8 November 2009) and 46.5 per 100,000 in 45–64 year olds in week 47 2009 (ending 22 November 2009). In both seasons, the lowest rate was seen in the 75+ years group, with a peak rate of 35.7 per 100,000 in week 1 2011 (ending 9 January 2011) and 24.9 per 100,000 in week 46 2009 (ending 15 November 2009).

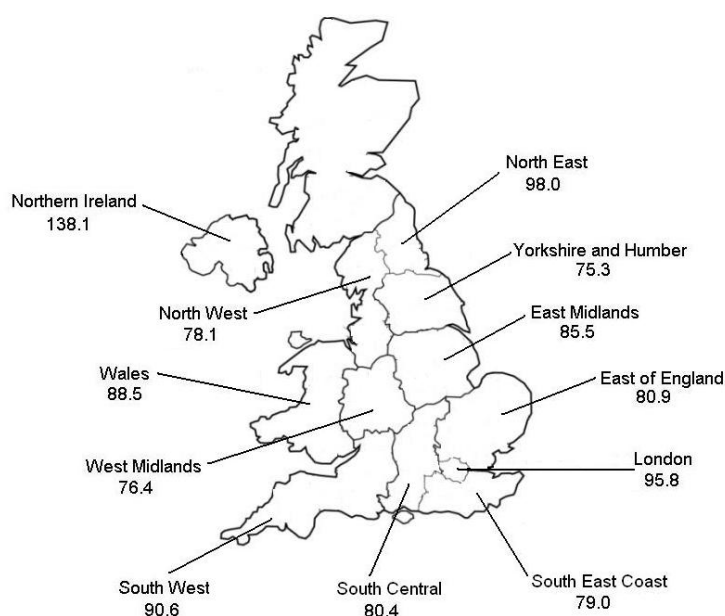
Figure 10 HPA/QSurveillance weekly ILI consultation rate by age group in England, Wales and Northern Ireland April 2009 – March 2011



During the 2010/11 season, the highest regional ILI rate was observed in Northern Ireland. This was notably higher relative to other regions at 138.1 per 100,000 in week 1 (ending 9 January 2011). The rest of the UK regions were at similar levels to each other with the highest rate seen in the North East at 98.0 per 100,000 and the lowest in Yorkshire and Humber at 75.3 per 100,000 both in week 1 2011 (Figure 11). London was the first region to reach its peak in week 51 (ending 26 December 2010).



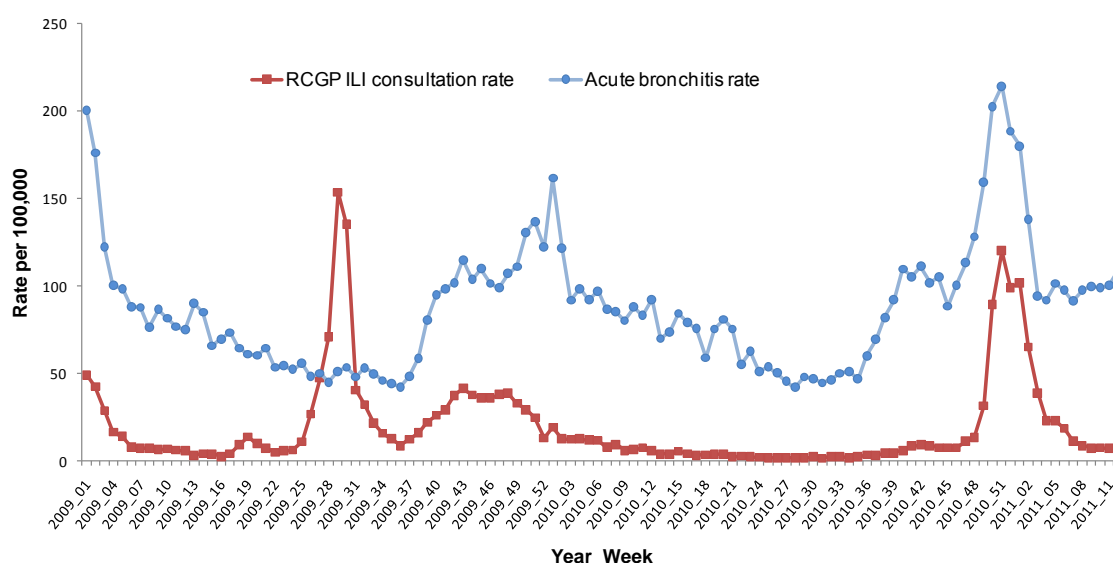
Figure 11 HPA/QSurveillance peak weekly ILI rate per 100,000 by region in England, Wales and Northern Ireland October 2010 – March 2011



## OTHER RESPIRATORY INDICATORS

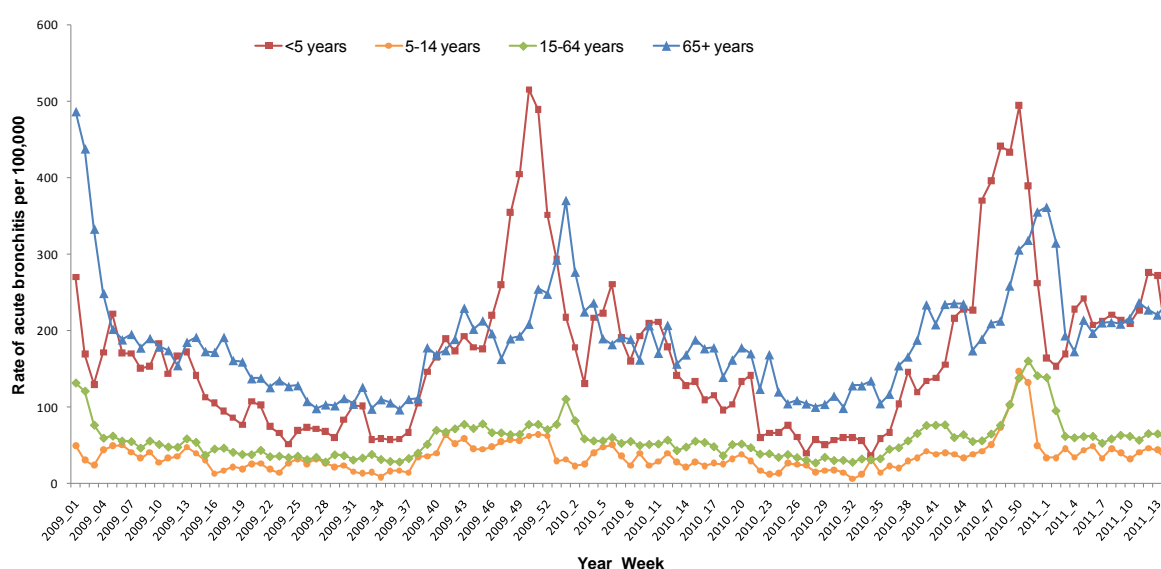
The all-age rate of acute bronchitis in the RCGP primary care surveillance scheme reached a peak of 214.4 per 100,000 in week 51 (ending 26 December 2010), the same week as when the RCGP GP ILI consultation rate peaked (Figure 12). This is higher than the peak observed for the 2009/10 season of 161.8 per 100,000 in week 1 2010 (ending 10 January 2010).

Figure 12 RCGP weekly Acute Bronchitis consultation rate in England and Wales April 2009 – March 2011



By age, the highest rate in the 2010/11 season was observed in the under five year olds, where a peak was reached of 494.5 per 100,000 in week 50 2010 (ending 19 December 2010) (Figure 13). This is slightly less than the peak reached the previous year of 515.6 per 100,000 in week 50 2009 (ending 13 December 2009). The lowest peak rate remained in the 5–14 year group which peaked at 146.4 per 100,000 in week 50 2010 (ending 19 December 2010).

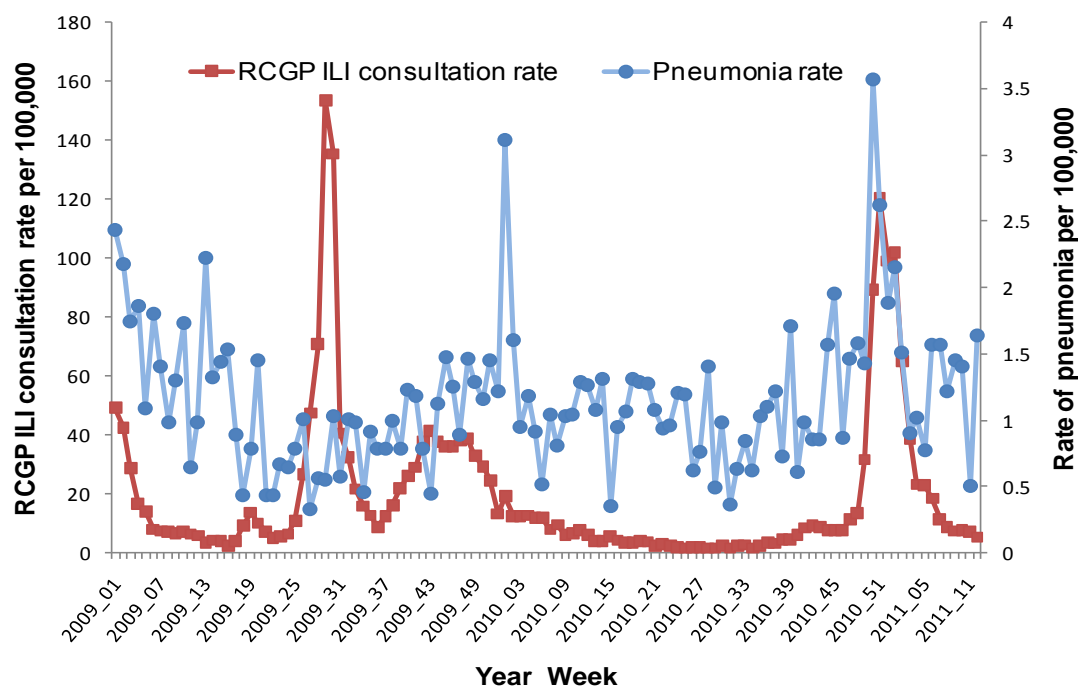
Figure 13 RCGP weekly Acute Bronchitis consultation rate by age group in England and Wales October 2009 – March 2011



In the RCGP surveillance scheme, the rate of pneumonia peaked at 3.57 per 100,000 in week 50 2010 (ending 19 December 2010), the week before the RCGP ILI GP consultation rate peaked (Figure 14). By comparison, the rate in the QSurveillance scheme peaked at 2.30 per 100,000 in week 1 2011 (ending 9 January 2011). The

75+ year olds had notably higher rates relative to other age groups with a peak of 7.82 per 100,000 in week 2 2011 (ending 16 January 2011). The over 75 year olds also had a notably higher rate in the RCGP scheme, with a peak of 19.11 per 100,000 in week 50 2010 (ending 19 December 2010).

Figure 14 RCGP overall weekly pneumonia consultation rate in England and Wales October 2010 – March 2011



## COMMUNITY SURVEILLANCE

Community surveillance measures increased at a similar time to reports of the first hospitalised and fatal influenza cases. At the beginning of week 48 (week ending 5 December 2010), the proportion of cold/flu calls to NHS Direct increased above baseline. Already 11 respiratory disease outbreaks had been detected in week 47 (ending 28 November 2010).

## SYNDROMIC SURVEILLANCE THROUGH CALL/OUT-OF-HOURS CENTRES

### NHS Direct

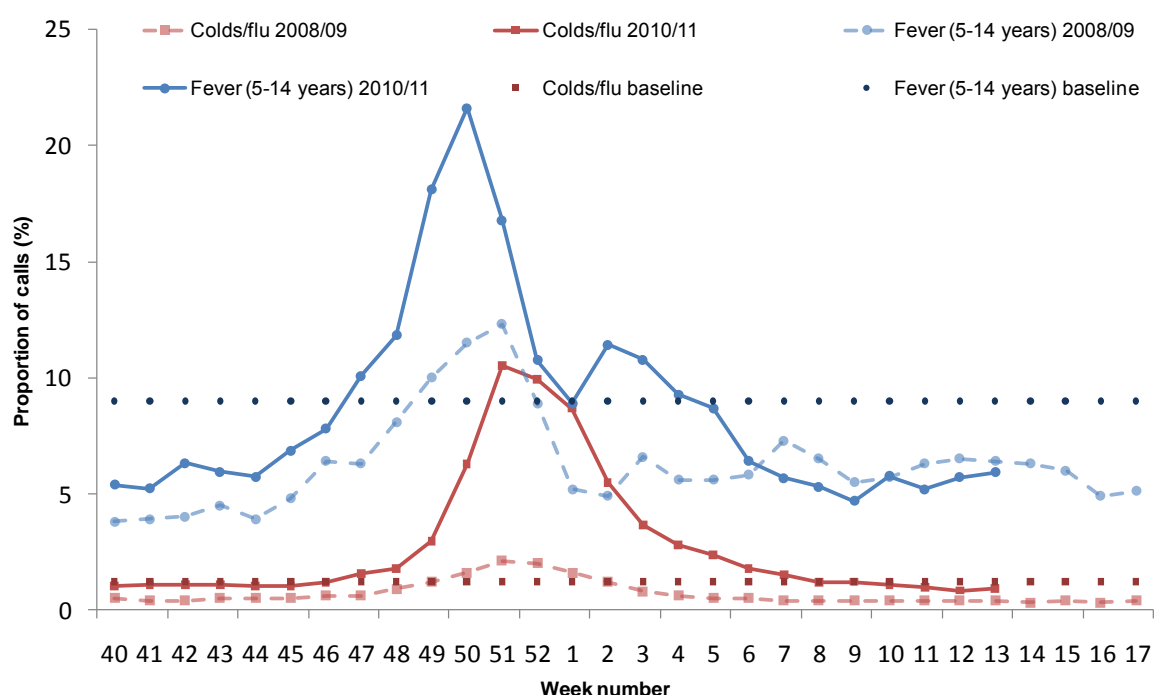
NPFS replaced NHS Direct as the data source for community ILI syndromic surveillance during the pandemic between July 2009 and February 2010. NHS Direct then resumed handling of cold/flu calls from the community in England and Wales (NPFS did not operate in Wales).

The daily proportion of cold/flu calls first increased above the influenza early warning threshold of 1.2% on 29 November 2010 (Figure 15). Following three consecutive days when the level of activity exceeded the early warning threshold, the early

warning alert was communicated on the 2 December 2010, approximately two weeks prior to ILI consultation rates exceeding traditional “baseline” levels in the GP sentinel schemes. The weekly proportion of cold/flu calls rose to a peak of 10.5% in week 51 (ending 26 December 2010) in line with the peak RCGP ILI rate and then decreased in week 7 (ending 20 February 2011), reducing below the influenza threshold. The 15–44 year age group formed the largest proportion of cold/flu calls with a peak of 15.3% in week 51 (Figure 16). Levels were higher during the 2010/11 season than in 2008/09 when a peak of 2.1% in week 51 2008 (week ending 21 December 2008) was reached.

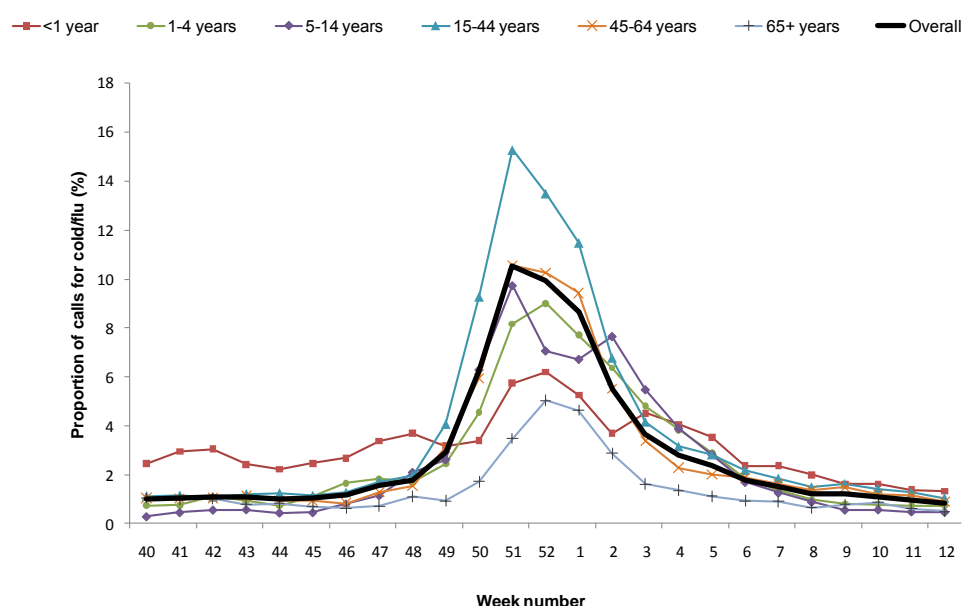
The proportion of fever calls in children aged 5–14 had a higher peak in the 2010/11 season than in the pre-pandemic era, with 21.6% in week 50 2010 (ending 19 December 2010) compared to 12.3% in week 51 in 2008 (week ending 21 December 2008). No comparative data is available from the pandemic.

Figure 15 NHS Direct weekly proportion of calls for cold/flu and fever in children in England and Wales in 2010/11 and 2008/09 seasons\*



\*Due to the 2009 pandemic, daily NHS Direct data was not available for syndromic surveillance analysis from week 18/2009 until week 40/2010 due to system changes made to NHS Direct sites that prevented the monitoring of call symptoms. For this reason, 2008/09 season (up to week 18) data is presented here.

Figure 16 NHS Direct weekly proportion of calls for cold/flu by age group in England and Wales October 2010 – March 2011



## Scotland NHS-24

The weekly proportion of all calls in Scotland to NHS-24 which mention cold/flu for the period 1 April 2009 until 31 March 2011 is shown in Figure 17. There were two periods in which the proportion of cold/flu calls rose during this season. The first peak was seen at the end of September/early October when the flu immunisation campaign began. Following that NHS-24 cold/flu activity fell and was stable until it began to rise again in early December. As seen in England and Wales, the 15–44 year age group formed the largest proportion of cold/flu calls with a peak of 5.9% in week 52 (Figure 18).

Figure 17 NHS-24 weekly proportion of calls for cold/flu and fever in children in Scotland in 2010/11 and 2008/09 seasons

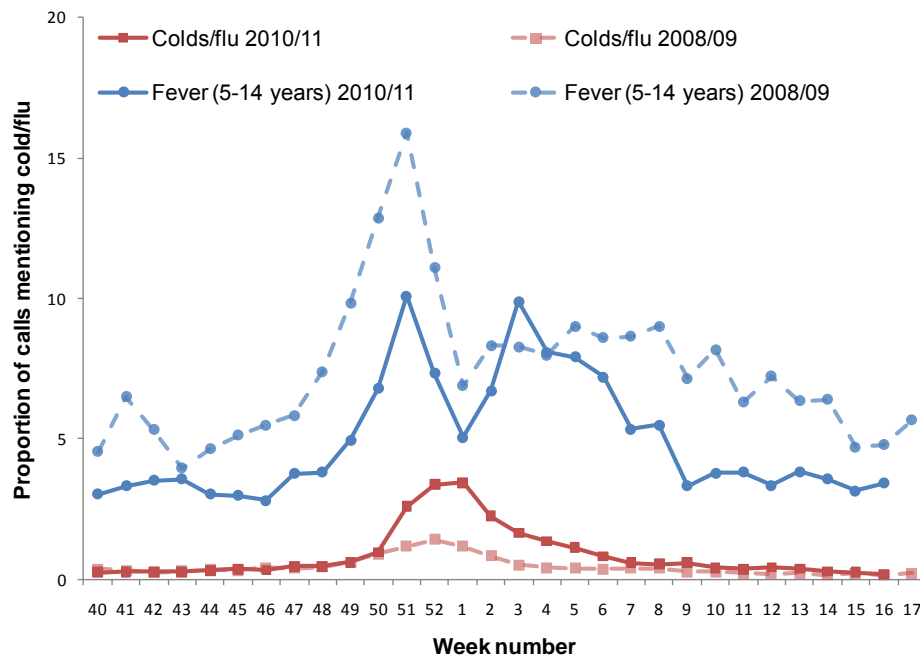
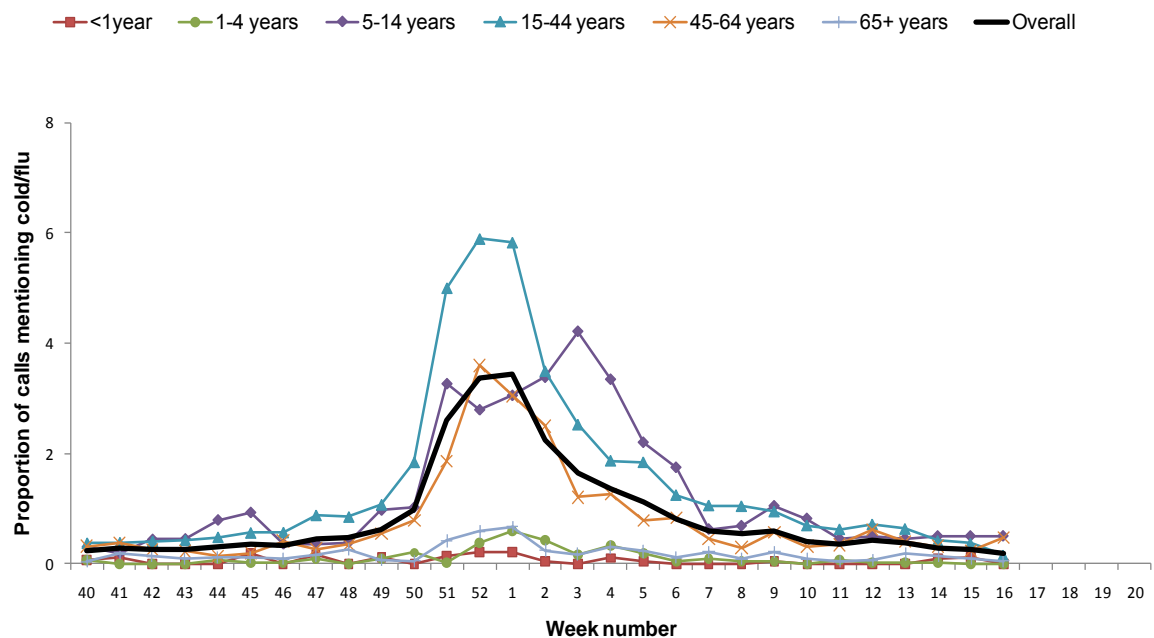


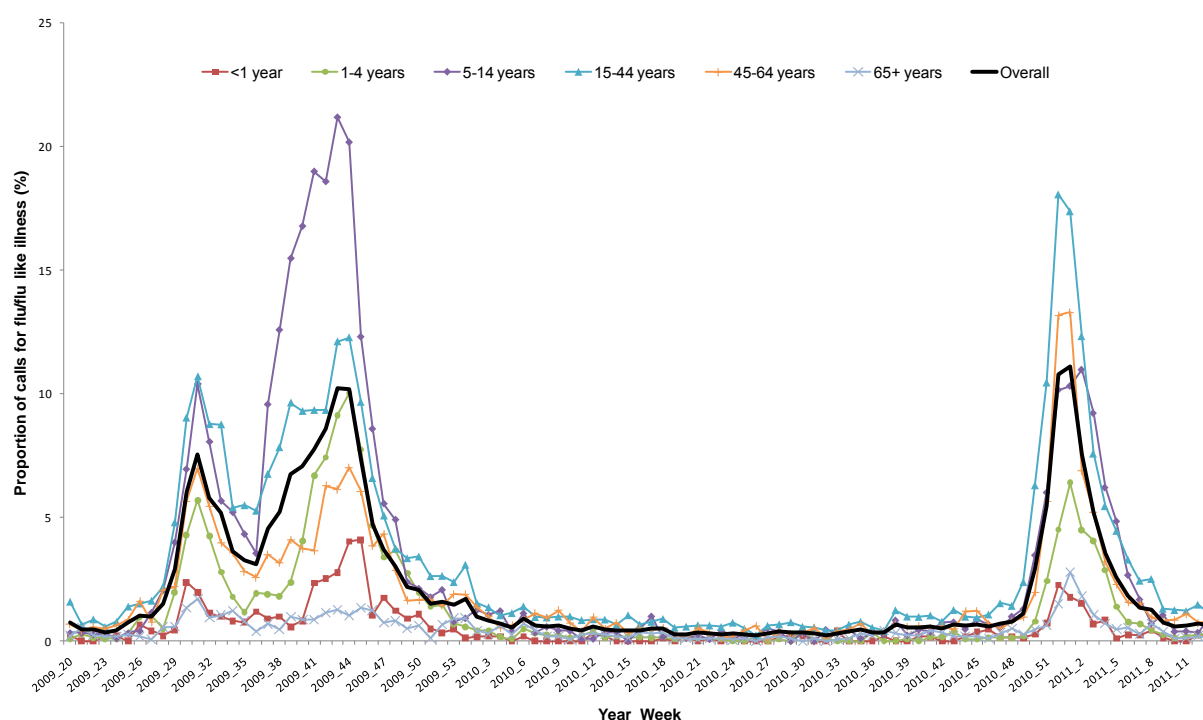
Figure 18 NHS-24 weekly proportion of calls for cold/flu by age group in Scotland October 2010 – March 2011



## Northern Ireland OOH consultation rates

In Northern Ireland, the overall proportion of calls for flu or flu-like illness in the out of hours service reached a peak of 11.1% in week 1 2011 (ending 9 January 2011) (Figure 19). This is slightly higher than the peak of 10.2% in week 43 2009 (ending 25 October 2009) seen the previous autumn. As seen in England and Wales, the 15–44 year group had the highest proportion of consultations, with a peak of 18.1% in week 52 2010 (ending 2 January 2011). This is compared to the previous autumn during the pandemic when the 5–14 year group had the largest proportion of consultations in the previous autumn during the pandemic, with a peak of 21.2% reached in week 43 2009 (ending 25 October 2009).

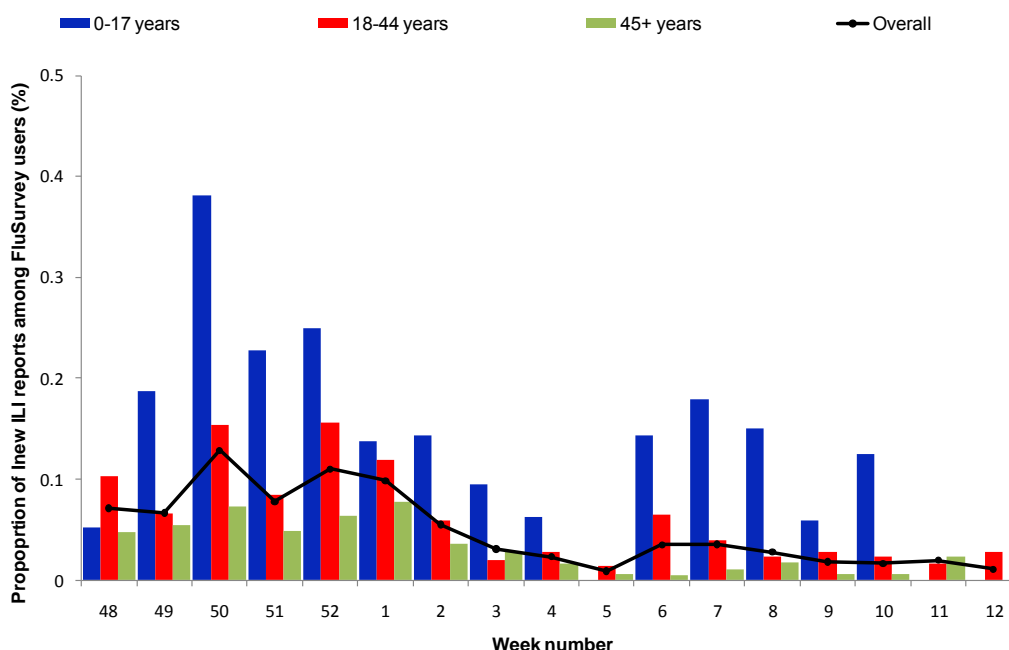
Figure 19 OOH weekly proportion of calls for flu/flu-like-illness by age group in Northern Ireland April 2009 – March 2011



## FLUSURVEY

During the 2010/11 season, the all-age proportion of online Flusurvey participants reporting ILI reached a peak of 12.8% in week 50 (ending 19 December 2010) (Figure 20). The highest proportion was consistently seen in the under 18 year olds relative to the other two age groups, with a peak of 38.1% of users reporting symptoms of ILI in week 50 (ending 19 December 2010).

Figure 20 Flusurvey weekly incidence of influenza in participants in the UK December 2010 – March 2011



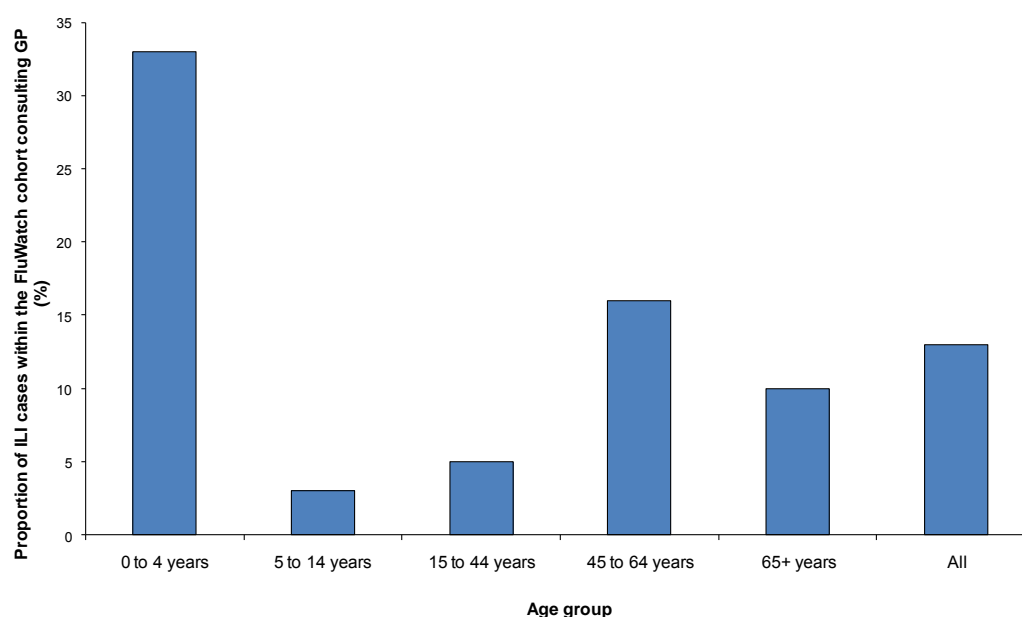
## FLU WATCH

The community-based Flu Watch cohort reported a peak ILI rate of 1,948 per 100,000 person weeks in week 51 (ending 26 December 2010). This was higher than the peak of 1,063 per 100,000 person weeks seen in week 42 of 2009 (ending 18 October 2009) but less than the peak of 3,532 per 100,000 person weeks observed in week 50 2008 (ending 14 December 2008). The age group most affected in 2010/11 were the under five year olds with a peak of 13,636 per 100,000 person weeks in week 44 2010 (ending 7 November 2010).

Overall, only 13% (95% confidence interval (95% CI) 7–19%) of ILI cases in the cohort reported visiting their GP during the winter season (Figure 21). This varied by age group with 33% (95% CI 14–52%) of 0–4 year olds visiting but only 3% (95% CI 0–8%) of 5–14 year olds.



Figure 21 Cumulative proportion of ILI cases within the Flu Watch cohort visiting the GP by age-group in England in 2010/11\*



\*Total Number of participants = 121

## OUTBREAKS OF ACUTE RESPIRATORY DISEASE

A total of 170 respiratory disease outbreaks in closed settings were reported during the 2010/11 season in England; 130 from schools, 15 from care homes, five from hospitals, one from a military base, one from a nursery and 18 from prisons. By region, the East Midlands was the most affected with 28 outbreaks reported, followed by Yorkshire and Humber with 24, the North West with 22 and London with 21 (Figure 22).

The first two outbreaks were reported in week 41 2010 (ending 17 October 2010) in the South West and Yorkshire and Humber. Week 49 2010 (ending 11 December 2010) was the peak week with 57 outbreaks recorded (Figure 23). The last outbreak was reported in week 6 2011 (ending 13 February 2011) in the South East.

Figure 22 Outbreaks of acute respiratory disease reported in England in 2010/11 season

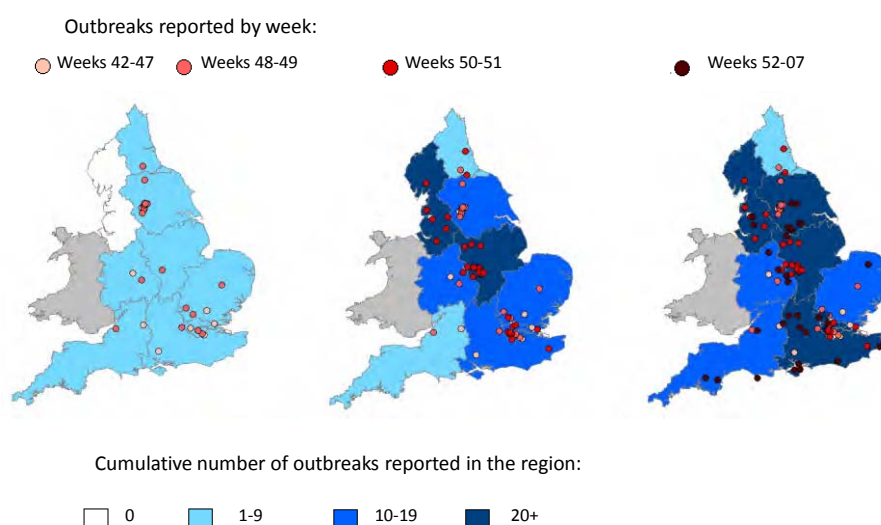
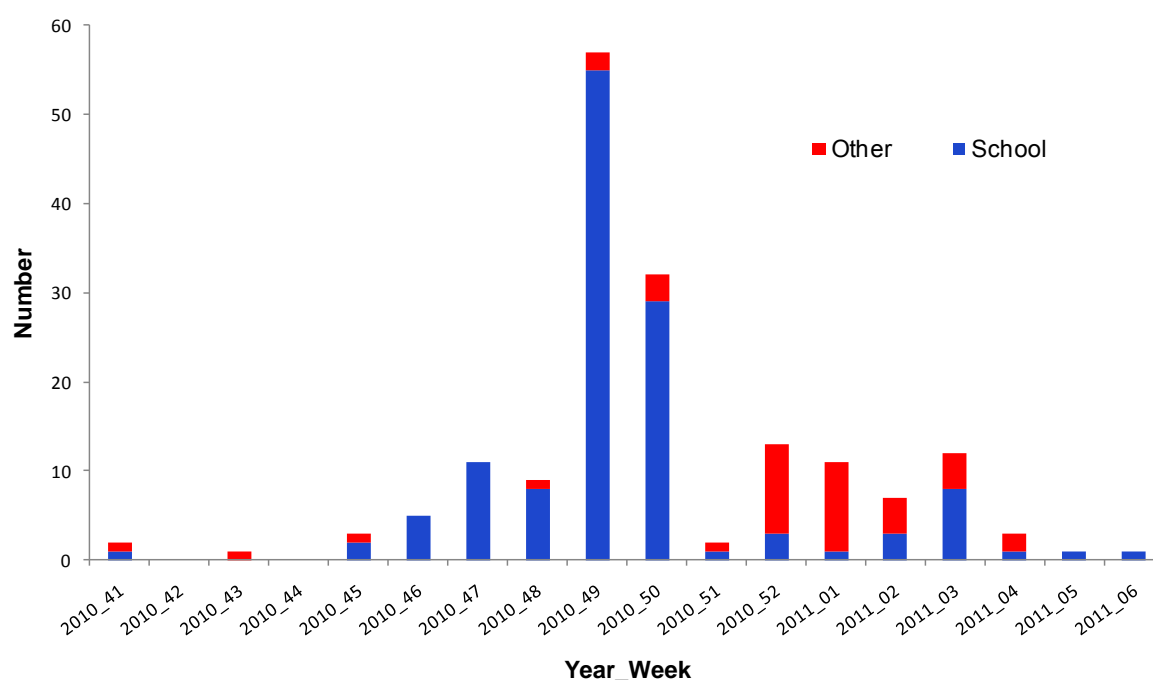


Figure 23 Number of reported outbreaks of acute respiratory disease by setting in England by week in 2010/11 season



Out of 75 outbreaks with reported results of virological testing, influenza A/H1N1 (2009) was detected in 31 (41.3%), influenza B in 19 (25.3%) and other influenza A types in seven (9.3%). A combination of influenza A/H1N1 (2009) and influenza B was found in seven (9.3%). Other viruses detected were rhinovirus, RSV, parainfluenza type 1 and enterovirus. Five deaths were virologically confirmed in three separate outbreaks with influenza A/H1N1 (2009), influenza B and rhinovirus detected.

In Scotland, relatively few influenza outbreaks were reported in the 2010/11 season. They included one in a prison and others in nursing homes.

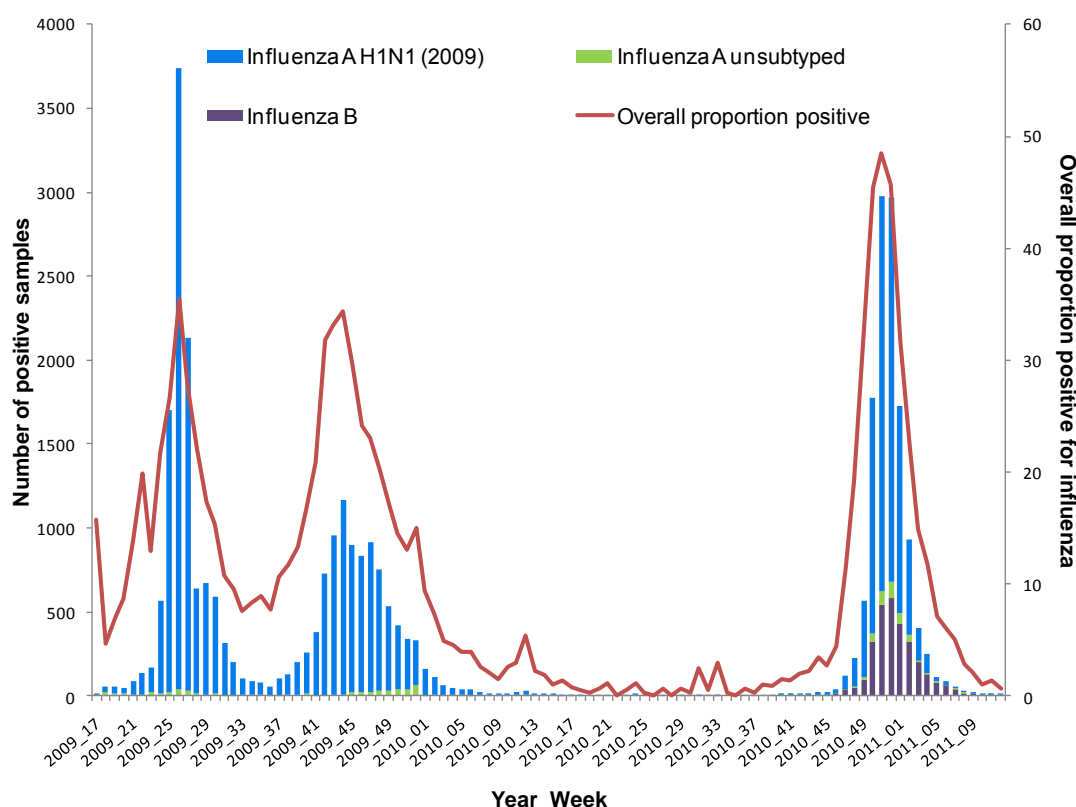
## MICROBIOLOGICAL SURVEILLANCE

### VIROLOGICAL SURVEILLANCE DATA

#### DataMart

The proportion of respiratory samples reported positive in the DataMart surveillance scheme reached a peak in the 2010/11 season – higher than either of the two waves of influenza activity during the pandemic (Figure 24). A peak of positivity of 48.5% was reached in week 51 2010 (ending 26 December 2010), the same week as peak RCGP ILI consultation activity. This compared to a peak of 35.4% in week 26 2009 (ending 28 June 2009) and a peak of 34.3% in week 44 2009 (ending 1 November 2009).

Figure 24 DataMart weekly number of positive influenza samples by influenza type with overall proportion positive in England April 2009 – March 2011

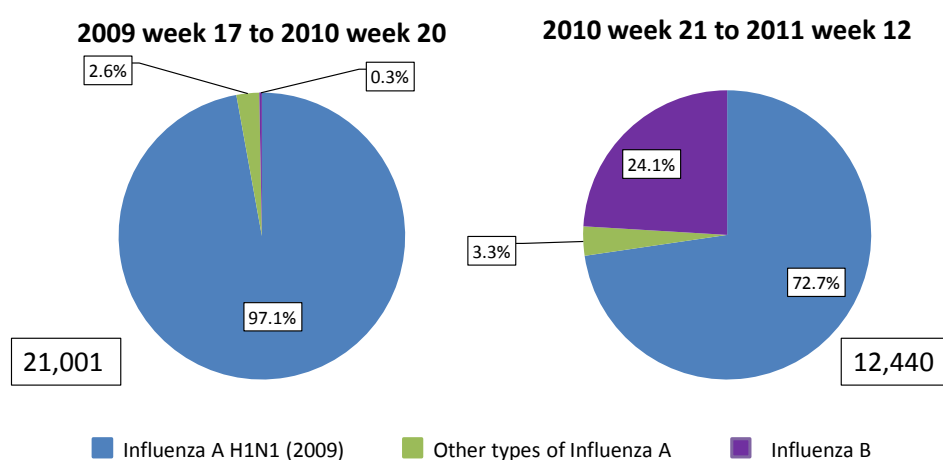


The majority of positive samples detected in both seasons were influenza A/H1N1 (2009). A peak of 2,353 influenza A/H1N1 (2009) samples was detected in week 51 2010 (ending 26 December 2010). This is compared to a peak of 3,707 H1N1 (2009)

positive samples in the first wave of the pandemic in week 26 2009 (ending 28 June 2009) and of 1,161 positive samples in the second wave in week 44 2009 (ending 1 November 2009).

Overall, influenza A/H1N1 (2009) and influenza B were the predominant circulating viruses in 2010/11 with few, sporadic A/H3N2 viruses detected. The H1N1 (2009) strain continues to replace the previous seasonal H1N1 strain. By comparison to the pandemic season, a larger proportion of influenza type B viruses was seen, 24.1% vs. 0.3% (Figure 25).

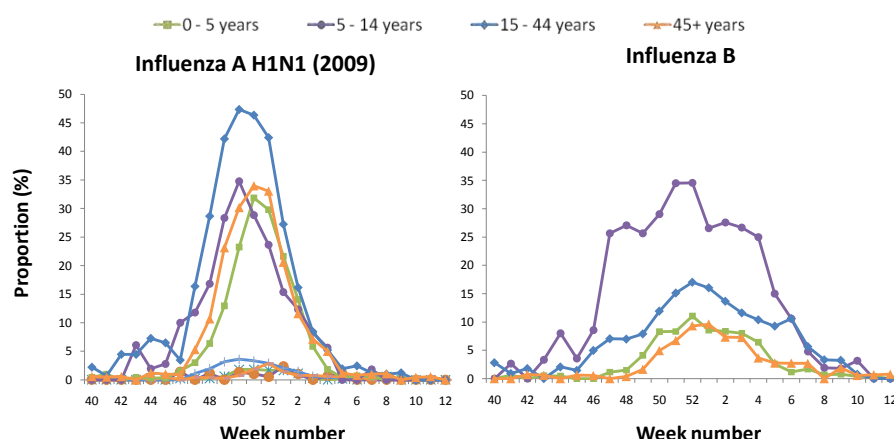
9/10



The highest positivity level of influenza A/H1N1 (2009) in 2010/11 was found in the 15–44 year group (peak of 47.4% in week 50 ending 19 December 2010), whereas the peak was in the 5–14 year group in 2009/10 (peak of 60.8% in week 42 (ending 18 October 2009).

Influenza B was found at higher positivity levels in the 5–14 year group relative to the other age groups with a peak of 34.5% in weeks 51 and 52 (weeks ending 26 December 2010 and 2 January 2011 respectively) (Figure 26).

Figure 26 Age distribution of proportion of positive DataMart specimens by influenza

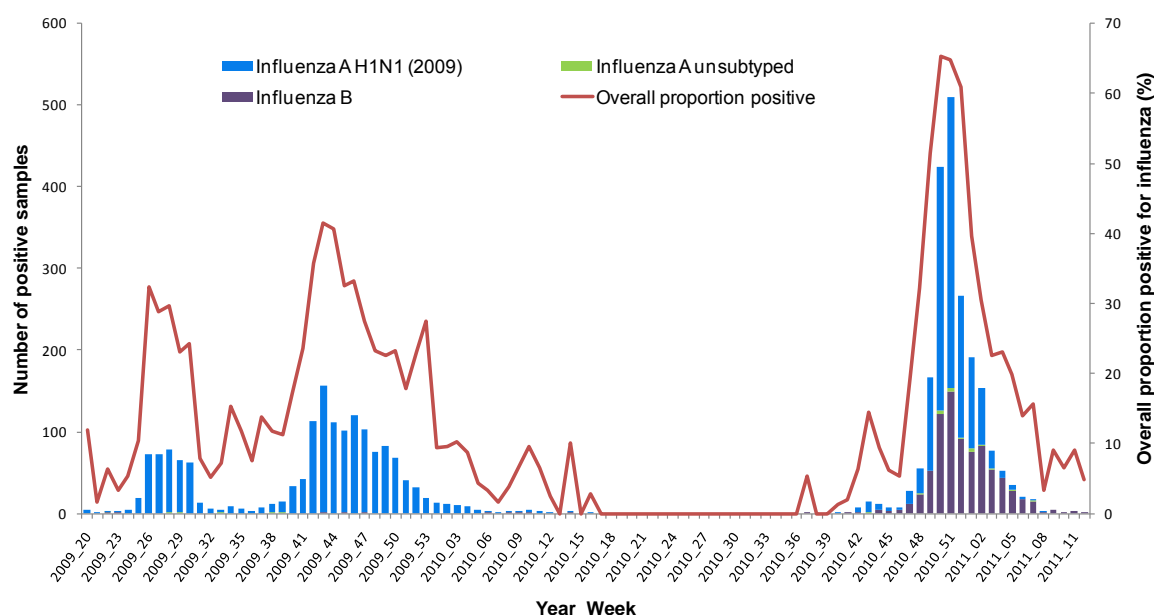


## Sentinel virological schemes

### RCGP/RMN

The positivity rate in the two English GP sentinel schemes (RCGP/HPA and HPA/Regional Microbiology Network (RMN) schemes) started to rise in week 48 and peaked at 65.3% in week 50 (ending 19 December 2010) (Figure 27). This is higher than the peak positivity observed during the pandemic (41.4% in week 43 2009 (ending 25 October 2009)). In contrast to winter 2009/10 when very few specimens tested positive for influenza subtypes other than influenza A/H1N1 (2009), influenza B constituted a significant proportion of positive samples in the 2010/11 season in the sentinel GP surveillance schemes. During the peak in week 51, 510 (66.4%) out of 768 samples were positive of which 356 (46.4%) were influenza A/H1N1 (2009), five were influenza A/unsubtyped and 149 (19.4%) were influenza B. By week 2 (ending 16 January 2011), influenza B had become the predominant virus type and remained so through to week 12 (ending 27 March 2011): out of 154 (30.5%) positive samples from 504 tested over this period, 83 (16.5%) were influenza B, one was influenza A/unsubtyped and 70 (13.9%) were influenza A/H1N1 (2009).

Figure 27 RCGP/RMN weekly number of positive samples in England and Wales by influenza type with overall proportion positive April 2009 – March 2011\*



\*Total number of specimens = 13,139

Total number of positive specimens = 3,691

The 15–24 year group had the highest proportion of positive samples with a peak of 77.6% reached in week 52 (ending 2 January 2011) (Table 2). All age groups at their peak had a proportion positive greater than 55% except for the 65+ year group, which had a lower proportion of 41.2% positive in week 51 (ending 26 December 2010). Overall, the 5–14 year group had the highest proportion positive this season (53.1%) with the lowest proportion in the over 65 year olds (10.3%) (Table 2).

Table 2 Overall and peak week proportion of positive RCGP/RMN influenza samples by age-group in England and Wales October 2010 – March 2011

		Overall	Peak week	
All ages	%	37.5	64.9	wk 50
	(n/N)	(2,075/5,538)	(426/656)	
under 5 year olds	%	38.6	67.4	wk 50
	(n/N)	(216/560)	(33/49)	
5-14 years	%	53.1	75.9	wk 50
	(n/N)	(375/706)	(88/116)	
15-24 years	%	45.3	77.6	wk 52
	(n/N)	(428/944)	(59/76)	
25-44 years	%	40.0	68.8	wk 50
	(n/N)	(695/1,738)	(148/215)	
45-64 years	%	31.6	58.5	wk 52
	(n/N)	(370/1,171)	(69/118)	
over 65 year olds	%	10.3	41.2	wk 51
	(n/N)	(39/379)	(7/17)	

# Sentinel virology in primary care in Scotland, Northern Ireland and Wales

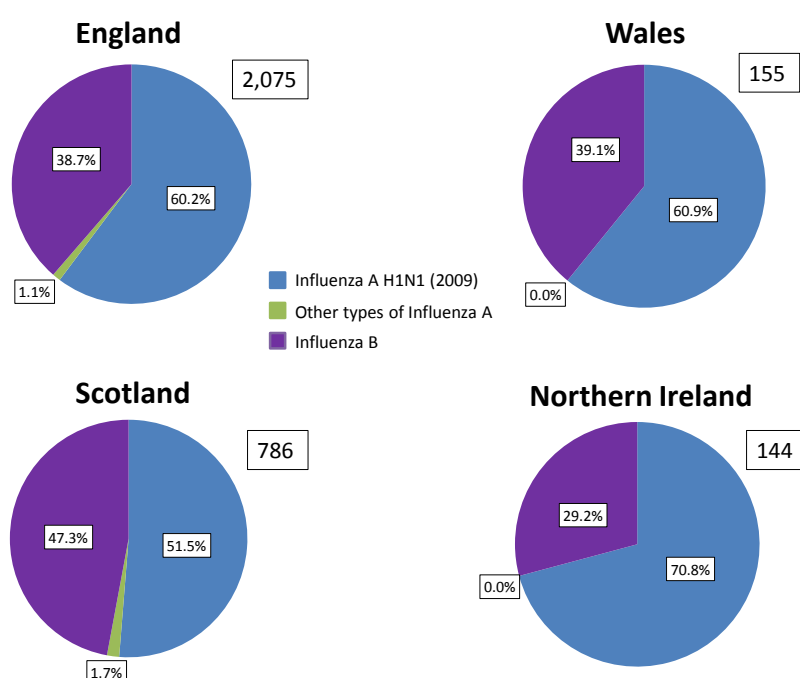
Similar positivity rates were seen in all the sentinel schemes of the Devolved Administrations (Table 3). In Scotland, a peak of 70.4% (131/186) was reached in week 52 (ending 2 January 2011), although the peak number of specimens were received from patients in week 2 of 2011 (246 specimens). In Northern Ireland a peak of 81.0% (17/21) was reached in week 52 and the highest peak in Wales was 78.1% (25/32) in week 51 (ending 26 December 2010).

Table 3 Overall and peak week proportion of samples positive for influenza from GP sentinel schemes in the UK October 2010 – March 2011

	England % (n/N)	Scotland % (n/N)	Northern Ireland % (n/N)	Wales % (n/N)
<b>Overall</b>	37.5 (2,075/5,538)	40.2 (783/1,950)	41.0 (144/351)	53.7 (116/216)
<b>Peak week</b>	64.9 (week 50) (426/656)	70.4 (week 52) (131/186)	81.0 (week 52) (17/21)	78.1 (week 51) (25/32)

Influenza B viruses were detected in all four countries of the UK (Figure 28). The highest proportion of influenza B (47.3%) was in Scotland.

Figure 28 Proportion of samples positive for influenza by type from GP sentinel schemes in the UK during 2010/11 season



## **Virus characterisation**

The HPA RVU has isolated and antigenically characterised 264 influenza A/H1N1 (2009) viruses, eight influenza A/H3N2 viruses and 474 influenza B viruses from community and hospital samples from week 40 (ending 10 October 2010) to week 12 (ending 27 March 2011). Antigenic analysis of influenza A/H1N1 (2009) viruses characterised to date from hospitalised and community cases found they are similar to the A/California/07/2009 vaccine strain. Of the other influenza viruses characterised: all eight influenza A/H3N2 viruses are similar to the A/Perth/16/2009 H3N2 vaccine strain and the majority (over 93%) of influenza B viruses belong to the B-Victoria lineage, similar to the current vaccine strain B/Brisbane/60/2008. By week 12 (ending 27 March 2011), fewer than 7% of the characterised influenza B viruses had been found to be antigenically distinct and from the B-Yamagata lineage. They are closely related antigenically to each other with good reactivity to reference sera and are similar to other influenza B viruses from this lineage that have been sporadically identified in 2009 and 2010. Viruses from the Yamagata lineage were first detected in week 50 of the 2010/11 season (ending 19 December 2010) and made up 5.5% (3/55) of the influenza B viruses. When higher numbers were tested, this gradually increased to less than 7% in week 7 2011 (ending 20 February 2011) and remained at this level through to week 12.

In Scotland, 107 viruses were characterised, 61 influenza A/H1N1 (2009), four influenza A/H3N2 and 41 influenza B viruses.

## **ANTIVIRAL SUSCEPTIBILITY**

### **Antiviral resistance**

From week 40 2010 (ending 10 October 2010) to week 14 2011 (ending 10 April 2011), a total of 1,781 influenza A/H1N1 (2009) viruses were analysed at RVU and at those HPA regional laboratories performing antiviral testing for the marker commonly associated with resistance to oseltamivir in influenza H1N1 viruses (H275Y) (Table 4). The viruses tested came from a cross section of patients from all regions of the UK, from all age groups and from both community and hospital sources. Out of these positive cases, a total of 56 (3.1%) were found to carry the H275Y mutation; 42 in England, one in Northern Ireland, 11 in Scotland and two in Wales. The relatively high proportion of resistant cases in samples submitted from the Devolved Administrations reflects the differences in laboratory practice between countries. In England a large number of samples are subjected to pyrosequencing, the results of which allow streaming for further analysis for resistance. Only a small selection of samples are however referenced to HPA RVU by the devolved administrations for resistance testing on the basis of limited molecular testing undertaken locally. Affected patients had an age range of 0 to 76 years with a median of 37 years and a male to female sex ratio of 0.96 during 2010/11. During the pandemic from May 2009 to April 2010, a resistant proportion of 0.8% (45/5587) was calculated. All of these cases were hospitalised (Table 5).



Table 4 Number of influenza specimens resistant to the antivirals oseltamivir and zanamivir in UK during 2010/11 season

		<b>Oseltamivir</b>		<b>Zanamivir</b>
		Genotype	Phenotype	Phenotype
		Resistant/Total tested	Resistant/Total tested	Resistant/Total tested
<b>England</b>	H1N1 (2009)	42/1,708	2/135	0/135
	H3N2	0/0	2/3	0/3
	Flu B	0/0	0/281	0/281
<b>Wales</b>	H1N1 (2009)	2/9	0/0	0/0
	H3N2	0/0	0/0	0/0
	Flu B	0/0	0/0	0/0
<b>Northern Ireland</b>	H1N1 (2009)	1/11	0/1	0/1
	H3N2	0/0	0/0	0/0
	Flu B	0/0	0/1	0/1
<b>Scotland</b>	H1N1 (2009)	11/53	0/0	0/0
	H3N2	0/0	0/0	0/0
	Flu B	0/0	0/1	0/1
<b>Total</b>	H1N1 (2009)	56/1,781	2/136	0/136
	H3N2	0/0	0/3	0/3
	Flu B	0/0	0/283	0/283

Table 5 Number of H1N1 specimens resistant to the antiviral oseltamivir in the UK May 2009 - April 2010

Source	Total tested	Number H275Y genotyped	Number phenotyped	Number resistant	% (number resistant/total tested)
<b>Community</b>	1098	882	216	0	0.0
<b>Hospital</b>	4489	3855	634	45	1.0
<b>Total</b>	5587	4737	850	45	0.8

One hundred and thirty-six of the 1,781 influenza A/H1N1 (2009) specimens were fully tested for susceptibility (Table 4). Two of these were found to be phenotypically resistant to oseltamivir (included in the 56 reported above), while out of 136 tested, all retained sensitivity to zanamivir. Three influenza A/H3N2 viruses and 283 influenza B viruses were fully tested for susceptibility and found to be sensitive to oseltamivir and zanamivir.

## HCAI antimicrobial resistance

Out of all lower respiratory tract isolates of *S. aureus*, *S. pneumoniae* and *H. influenzae* reported as tested from laboratories in England, 80% or more were

susceptible to the antibiotics tetracycline and co-amoxiclav. There have been no significant changes in susceptibility in recent years.

## OTHER RESPIRATORY VIRUSES

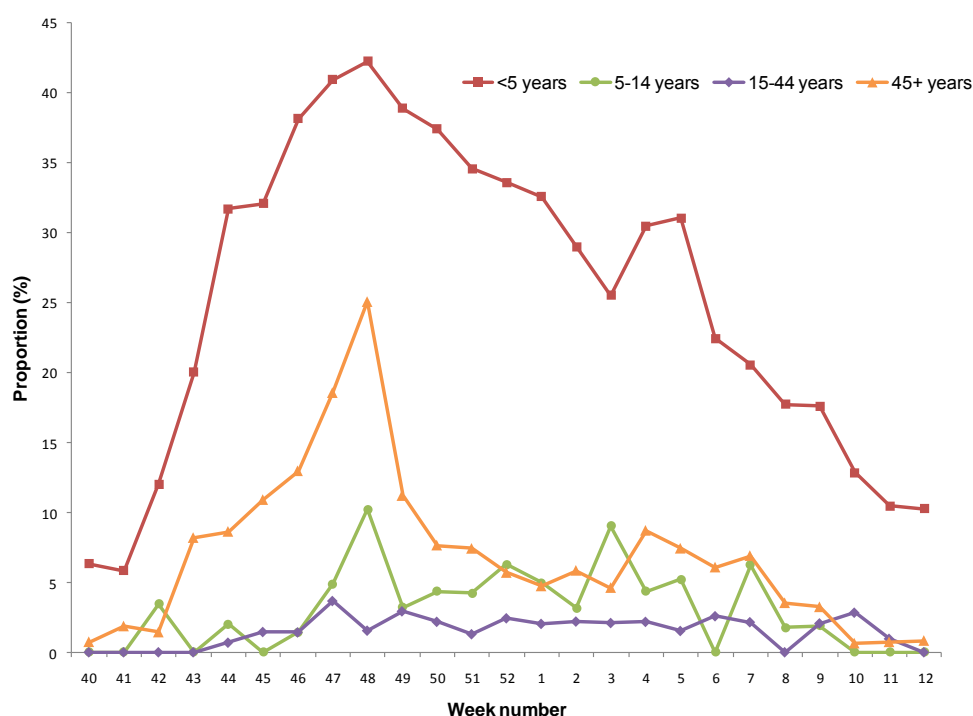
The most frequently reported respiratory virus other than influenza in the LabBase system was RSV. RSV reached a peak in 2010/11 of 913 laboratory reports in week 51 2010 (ending 26 December 2010). This is slightly less than the peak that occurred during the 2009/10 season (1,031), which also occurred in week 51 2009 (ending 20 December 2009). The frequency of rhinovirus was equivalent to pre-pandemic levels. Counts of parainfluenza, adenovirus and hMPV remained below 100 laboratory reports each week during the 2010/11 season.

The DataMart surveillance system reports positivity for each of these respiratory viruses. The peak positivity in rhinovirus infections was 35.9% in week 40 2010 (ending 10 October 2010). After a dip over Christmas, positivity levels increased again.

Detections of RSV peaked in week 48 2010 (ending 5 December 2010) at 23.6% positivity and have declined since. The highest positivity was seen in children aged less than five years, with a peak of 42.3% in week 48 2010 (Figure 29).

Adenovirus, hMPV and parainfluenza detections remained low, although a notable continuing increase was seen in the period following week 51 2010 (ending 26 December 2010), followed by a decrease since week 14 2011 (ending 10 April 2011).

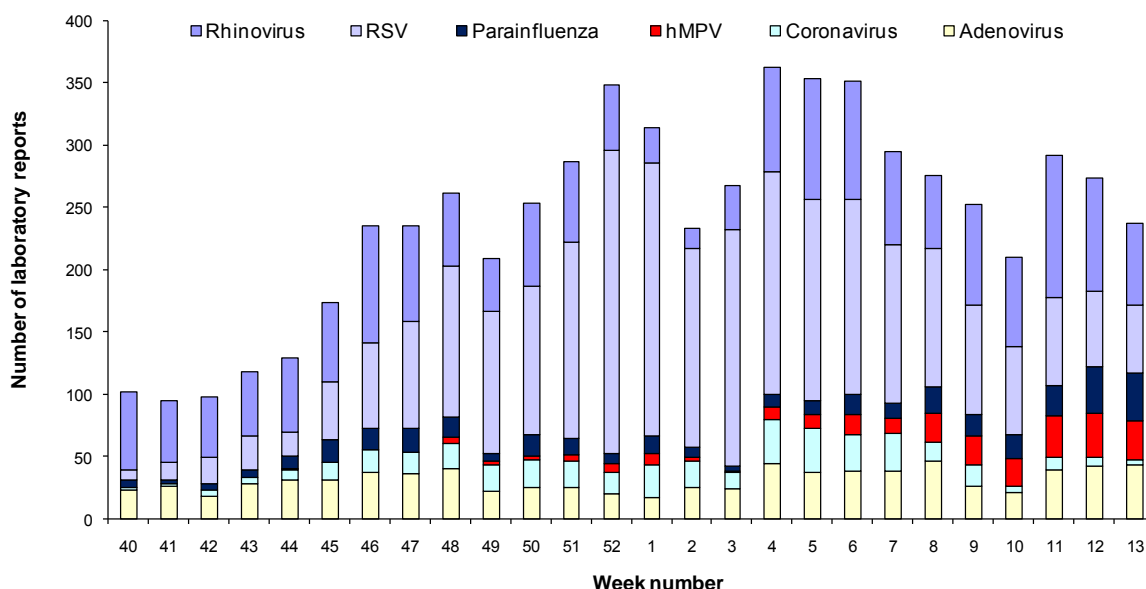
Figure 29 Weekly proportion of DataMart positive RSV samples by age-group in England October 2010 – March 2011



## Scottish National Laboratory Reporting System

The most common non-flu pathogens circulating this season were RSV, rhinovirus and adenovirus (Figure 30). Levels seen this year were similar to last year.

Figure 30 Number of laboratory confirmed reports of viral respiratory pathogens (excluding influenza) submitted through non-sentinel sources (ECOSS) in Scotland week 40 2010 to week 13 2011



Note: Week 12 and 13 data are provisional and may be subject to change

## CONCURRENT BACTERIAL INFECTIONS

While CBI were not identified as a major feature of the 2009 pandemic, during the 2010/11 season there were reports of CBI associated with influenza cases (10). Initial awareness originated from anecdotal reports of invasive secondary bacterial infections complicating cases of seasonal influenza together with increases in *Streptococcus pyogenes* and *S. pneumoniae* reports. Linkage of influenza and bacterial laboratory data identified that 3.4% (144/4,232) of bacterial infection cases (*S. pyogenes*, *S. pneumoniae*, *S. aureus*, *H. influenzae* and *Neisseria meningitidis*) were co-infected with influenza; 76% with influenza A, 26% with influenza B and 2% with both influenza A and B (10).

Analysis of routine surveillance data identified increases for a number of invasive bacterial pathogens, in particular *S. pyogenes* and invasive pneumococcal disease above seasonally expected levels in England (10). Between the 1 November 2010 and 14 January 2011 in England, when compared to historical data spanning the same period, increases in invasive *S. pyogenes* disease cases were seen in all age groups and the majority of regions. Increases in invasive *S. pneumoniae* infections were seen exclusively in 15–44 year olds. A similar trend was not observed for other invasive bacterial pathogens (*S. aureus*, *H. influenzae* and *N. meningitidis*) where overall case numbers remained in line with previous seasons. These observed

increases coincided with increased influenza activity in December 2010, particularly in under 15 year olds and 15–44 year olds.

Based on this preliminary analysis, an alert was issued to clinicians by the Chief Medical Officer (CMO) in January 2011 (11).

An increase in invasive bacterial infections compared to previous years was not seen in Scotland in the winter of 2010/11.

# Severity indicators results

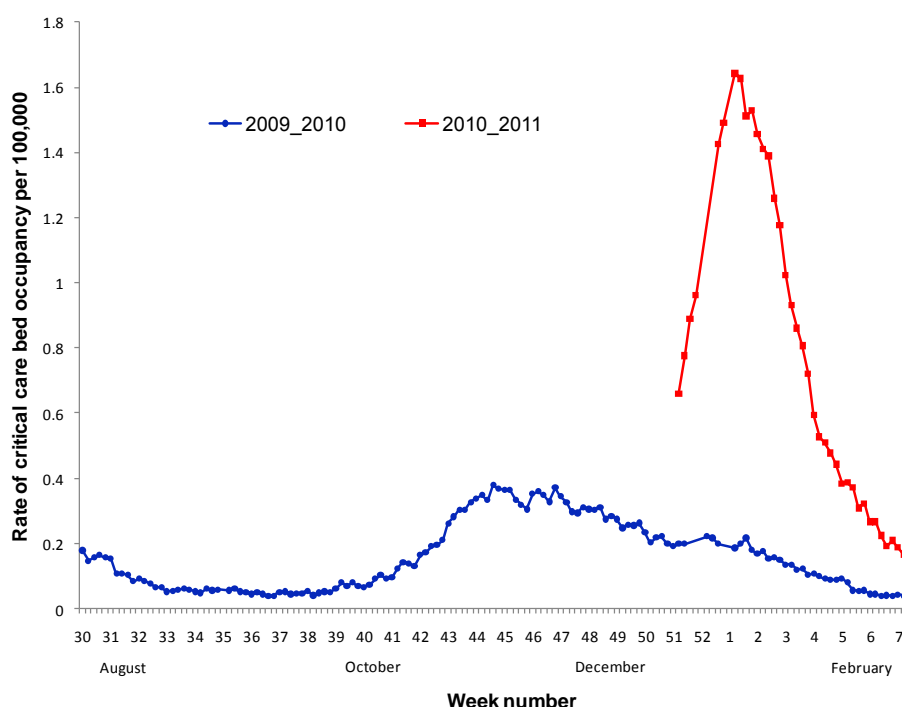
In 2010/11, hospitalised confirmed influenza cases were first reported in week 48 (ending 5 December 2010) primarily in under 65 year olds. This occurred unusually before a notable increase in GP consultation rates and resulted in increased critical care bed occupancy.

## MORBIDITY AND MORTALITY MONITORING

### HOSPITALISATION

There was a rapid increase in daily number of cases with confirmed or suspected influenza occupying critical care beds in 2010/11. The peak occurred on 4 January 2011 which was later than the peak in 2009/10 (5 November 2009). In addition, it was larger, with 851 cases in critical care on 4 January 2011 compared to 196 cases at the peak in 2009 (Figure 31).

Figure 31 Daily number of critical care beds occupied with suspected or confirmed influenza cases in England through the Winterwatch scheme during 2009/10 and 2010/11



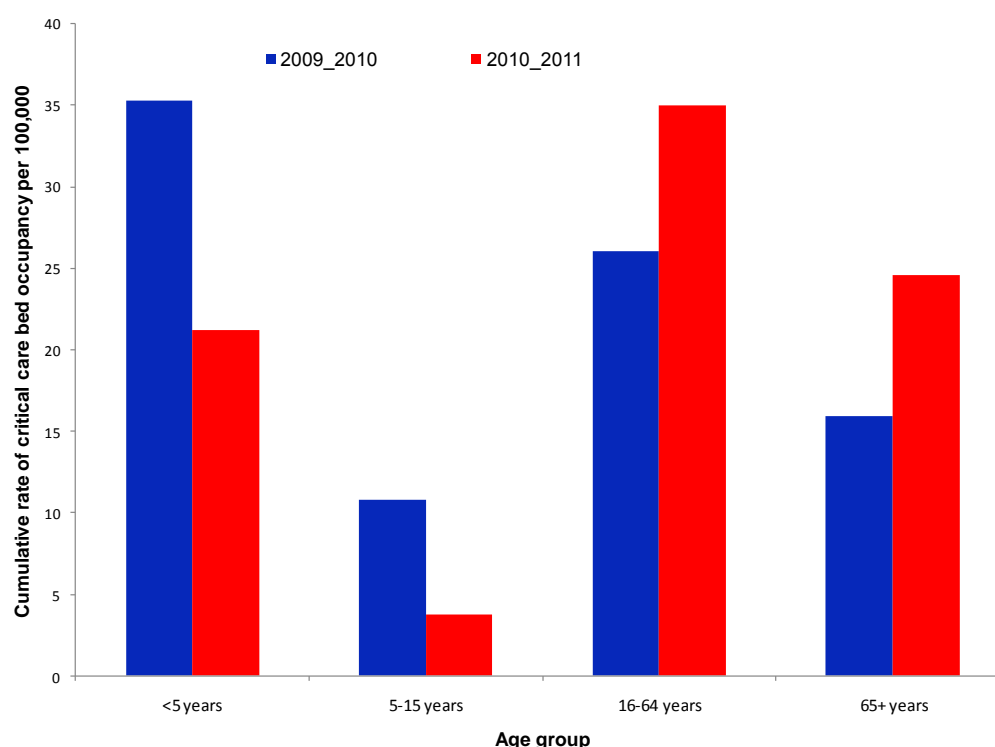
\* NB. There was missing data over the Christmas break for both seasons

Where data was available, the cumulative number of critical care bed days occupied with suspected or confirmed influenza cases in England was higher in 2010/11 (15,304 bed days from week 51 ending 26 December 2010 to week 7 ending 20

February 2011) than in 2009/10 (11,831 bed days from week 29 ending 19 July 2009 to week 7 ending 21 February 2010).

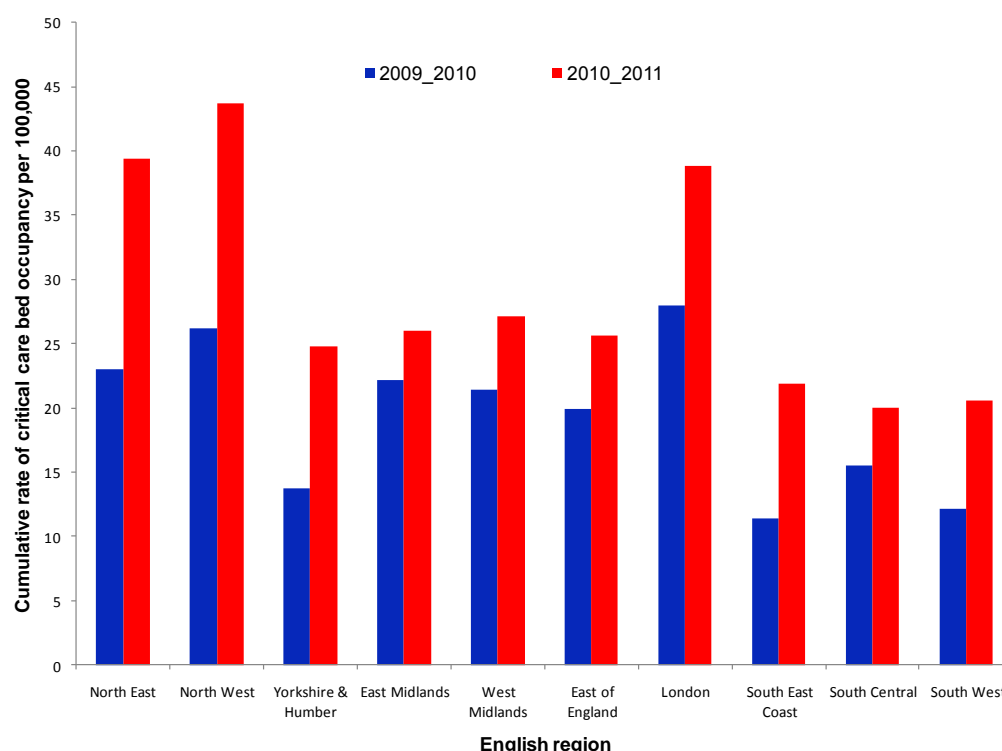
By age, the cumulative numbers of occupied beds per 100,000 were highest in 2010/11 for 16–64 year group (34.99 per 100,000), while children under five were most affected in 2009/10 (35.29 per 100,000) (Figure 32). The 5–15 year olds were the least affected for both seasons, but less for 2010/11 compared to 2009/10 (10.83 per 100,000 in 2009/10 and 3.75 per 100,000 in 2010/11).

Figure 32 Cumulative number of critical care beds occupied with suspected or confirmed influenza cases in England by age per 100,000 during 2009/10 and 2010/11 seasons



Cumulative numbers of critical care beds occupied with suspected or confirmed influenza cases in England per 100,000 were higher in all regions in 2010/11 compared to 2009/10 (Figure 33). In 2010/11, the highest were in the North West (43.74 per 100,000), the North East (39.43 per 100,000) and London (38.86 per 100,000). The region least affected was South Central (19.97 per 100,000). In 2009/10, the highest number of bed days per 100,000 of the population was seen in London (27.94 per 100,000), the North West (26.17 per 100,000) and the North East (23.02 per 100,000). The lowest was in the South East Coast (11.38 per 100,000).

Figure 33 Cumulative number of critical care beds occupied with suspected or confirmed influenza cases in England by region per 100,000 during 2009/10 and 2010/11 seasons

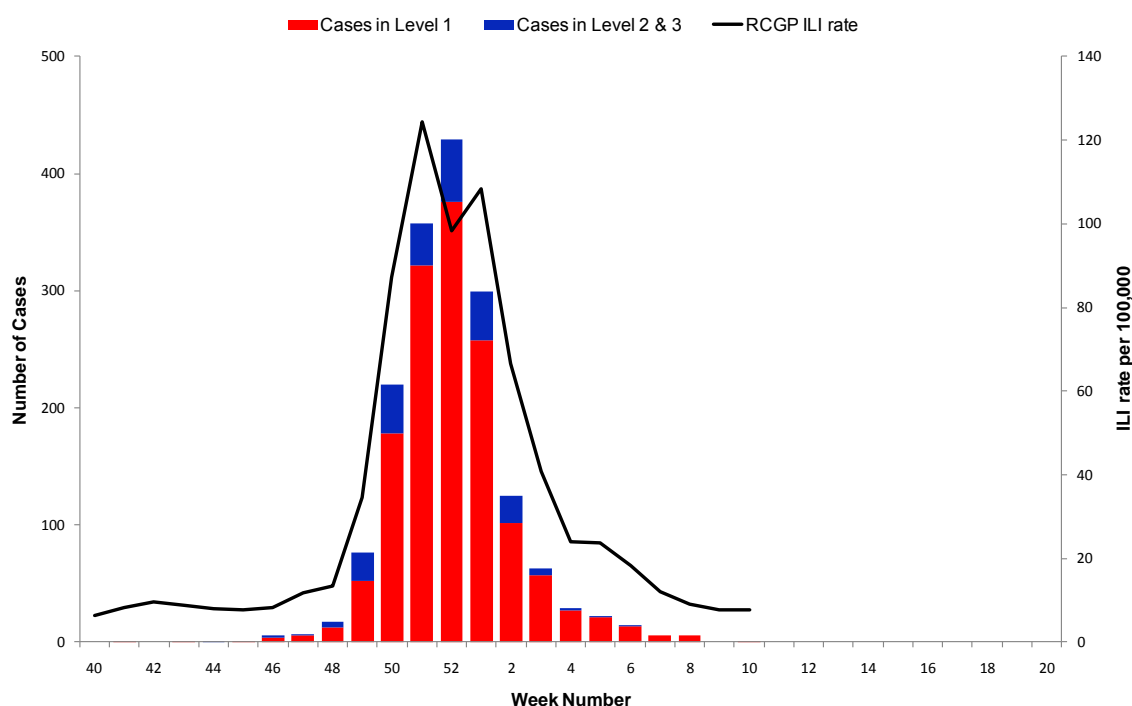


## UK Severe Influenza Surveillance System (USISS)

In the USISS scheme, from week 40 2010 (ending 10 October 2010) up to week 10 2011 (ending 13 March 2011), a total of 1,681 hospitalised confirmed influenza cases were reported from 23 Sentinel NHS acute trusts in England. Of these cases, 1,262 (75.1%) were due to influenza A/H1N1 (2009), four (0.2%) were influenza A/H3N2 and 51 (3.0%) were influenza A unknown subtype. Three hundred and sixty-four (21.7%) of the cases were influenza B. Case numbers increased steadily from week 48 (ending 5 December 2010) and peaked at week 52 (ending 2 January 2011) (Figure 34). A decrease in case numbers was seen starting in week 1 2011 (ending 9 January 2011). The weekly number of hospitalised cases followed the rate of ILI in primary care as measured by RCGP, with ILI cases peaking one week earlier than hospitalised cases. Of the 1,681 cases reported, 237 (14.1%) were treated in intensive care units (ICU). Of the cases in ICU, 206 (86.9%) were influenza A/H1N1 (2009) cases. Cases occurred mainly in those less than 65 years of age, with the largest proportion (44.0%) in the 15–44 year olds. The median age of cases was 33 years – older than that observed in 2009/10 (20 years).

Of the 555 SARI cases reported from the one participating acute trust, 279 (50.3%) were in patients over 65 years. Swabbing practices varied by age of the cases: 19 of 134 (14.2%) cases under 15, 56 of 142 (39.4%) cases aged 15–64 and 20 of 279 (7.2%) cases aged 65 and over were tested for influenza.

Figure 34 Weekly number of cases by level of care in 23 acute NHS Trusts in England with RCGP ILI consultation rates in England and Wales, October 2010 – March 2011



\*Data from 23 Trusts

## HOSPITALISATION IN SCOTLAND

Information on reports of laboratory confirmed cases of influenza with severe infection requiring hospital management in intensive care was received by HPS this winter. This system was analogous to that introduced during the pandemic but focussed on the more severe end of influenza disease spectrum.

Cumulatively, 114 severely ill cases requiring treatment in ICU and 63 deaths (Table 6) were reported to HPS during this flu season. The majority of these cases were infected with influenza A/H1N1 (2009) and were in the 15–64 age group. Information from these cases reveals that most of these individuals had underlying medical conditions (for example asthma or other CMO defined illnesses) or physiological conditions (e.g. pregnancy) that put them at risk of complications from influenza. Only a small number were known to have received this season's influenza vaccine. A summary of these individuals in ICU by region is given in Table 7.



Table 6 Table of influenza laboratory confirmed ICU cases or laboratory confirmed influenza cases in Scotland who have died in hospital by age group (age not known for three cases) during 2010/11

Severe cases (including ICU cases & deaths)	0-14 years	15-64 years	>65 years	Not Known
Severe cases (in ICU admission) & alive	12	94	7	1
Deaths (mainly individuals managed in ICU and known to have died) in hospital	1	41	19	2
<b>Total</b>	<b>13</b>	<b>135</b>	<b>26</b>	<b>3</b>

Table 7 Table of influenza confirmed cases in Scotland in ICU by region (excluding patients who have died) during 2010/11

ICU cases in Scotland by region	To end of week 15 2011 (ending 17 April 2011)
West of Scotland	45
East of Scotland	54
North of Scotland	15
<b>Total</b>	<b>114</b>

NHS board allocation into regions

West = AA, DG, FV, GG, LN

East = BO, FF, LO, TY

North = GR, HG, OR, SH, WI

## MORTALITY

### Number of reported confirmed fatal influenza cases and risk group

During 2010/11, the first laboratory-confirmed fatal influenza case was reported in week 36 2010 (ending 12 September 2010). By 4 May 2011, 602 confirmed fatal influenza cases from across the UK were reported to the HPA. Five hundred and thirty five (91.9%) of 582 confirmed cases with available information were associated with influenza A/H1N1 (2009) infection, seven with unsubtyped influenza A infection and 40 (6.6%) with influenza B infection. In addition, as of 4 May 2011, a further 91 probable cases remain under investigation in whom it had not yet been possible to ascertain if they were influenza related. It is important to note, that these fatal cases do not represent all influenza-related deaths: some fatal cases were not tested, others presented too late and some were not reported. However they provide a representative picture of the types of patients and underlying factors associated with severe disease.

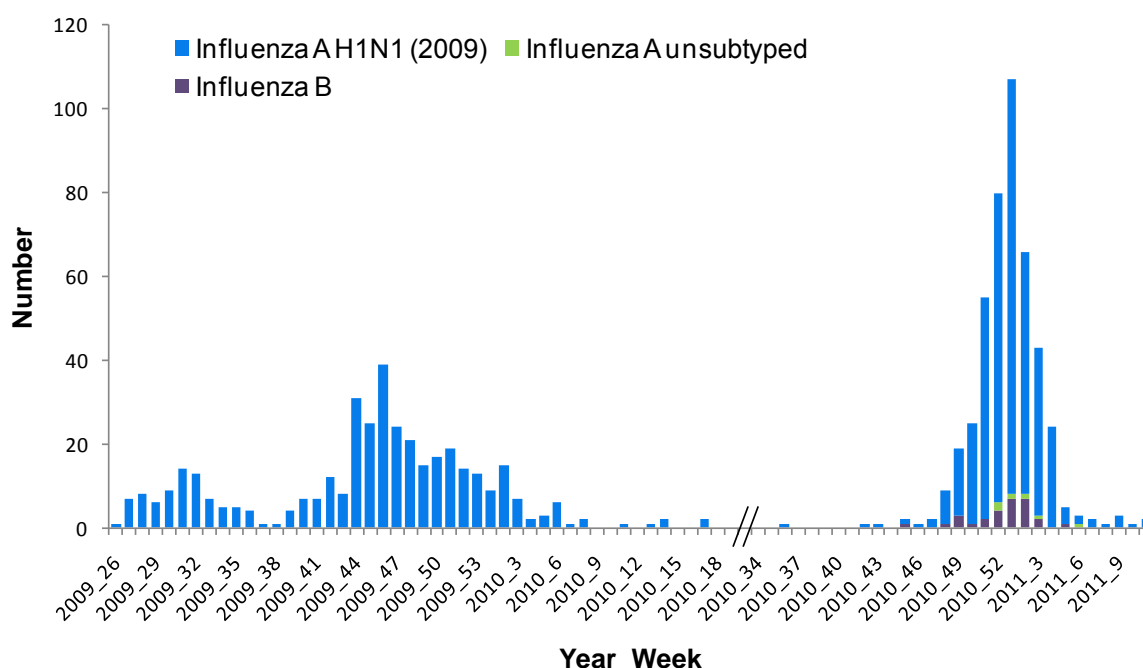
Out of the 602 confirmed fatal cases reported by 4 May 2011, 474 had occurred in England. The regional distribution of confirmed fatal cases across the UK is given in Table 8.

Table 8 Number of reported confirmed fatal influenza cases by region in the UK during 2010/11 influenza season, 1 September 2010 – 4 May 2011

Country	Region	Number
<b>England</b>		474
	East of England	35
	East Midlands	46
	London	43
	North East	34
	North West	96
	South East	48
	South West	29
	West Midlands	60
	Yorkshire and Humber	83
<b>Scotland</b>		63
<b>Wales</b>		34
<b>Northern Ireland</b>		31
<b>Total</b>		602

Following the report of the first influenza-related death in week 36, the number of deaths by week of death increased rapidly from week 48, with a peak in week 1 of 2011. Relative to 2009/10, the peak number of confirmed fatal influenza A/H1N1 (2009) related cases by week of death in England was 101 in week 1 2011 (ending 9 January 2011) compared to a peak of 39 fatal cases in week 46 2009 (ending 15 November 2009) (figure 35). In the peak week 1 (ending 9 January 2011), there were an additional eight deaths with influenza B infection and one from unsubtype influenza A infection.

Figure 35 Number of fatal confirmed influenza cases by week of death and sub-type reported in England June 2009 – May 2011



Reported confirmed fatal cases in the UK during the 2010/11 season were mainly in middle-aged and young adults. Amongst the 587 confirmed cases with information on age up to 4 May 2011: 9 (1.15 per 100,000 population) were less than one year of age, 16 (0.53 per 100, 000) were 1–4 years of age, 25 (0.36 per 100 000) were 5–14 years of age, 415 (1.01 per 100 000) in the 15–64 year group and 122 (1.21 per 100,000) older than 64 years. Out of 586 known confirmed cases, 265 were female and 321 were male, giving a male to female sex ratio of 1.21.

Three hundred and seventy three of 555 fatal cases in 2010/11 with available information (67.2%) up to 4 May 2011 were in one of the CMO-defined clinical risk groups for vaccination. The leading reported clinical risk factors for those with information were underlying respiratory disease including asthma (n=130) and immunosuppression (n=110). Nine fatal cases were reported to have been pregnant in 2010/11.

Based on information available up to 4 May 2011, of the 378 confirmed influenza related deaths in patients aged between six months to 64 years in England during 2010/11 season, the risk group status was known for 356 (94.2%) cases. The population mortality rates by risk group and rate ratio compared to those with no underlying risk factor are listed in Table 9. This shows that patients with underlying immunosuppression had the highest mortality rate followed by patients with underlying liver disease and patients with neurological disease. This is similar to observations during the pandemic (12).

Table 9 Influenza related mortality ratios and population mortality rates among those aged 6 months to 64 year olds of age by risk group in England, September 2010 – May 2011

	No. of fatal cases (%)	Mortality rate per 100,000 population	Crude RR	Age adjusted RR* (95% CI)
<b>In a risk group</b>	213 (59.8)	4	11.3	11.3 (9.1–14.0)
<b>Not in any risk group</b>	143 (40.2)	0.4	Baseline	Baseline
<b>Chronic renal disease</b>	19 (5.3)	4.8	13.8	18.5 (11.5–29.7)
<b>Chronic heart disease</b>	32 (9.0)	3.7	10.4	10.7 (7.3–15.7)
<b>Chronic respiratory disease</b>	59 (16.6)	2.4	6.9	7.4 (5.5–10.0)
<b>Chronic liver disease</b>	32 (9.0)	15.8	45.2	48.2 (32.8–70.6)
<b>Diabetes</b>	26 (7.3)	2.2	6.3	5.8 (3.8–8.9)
<b>Immunosuppression</b>	71 (19.9)	20	57	47.3 (35.5–63.1)
<b>Chronic neurological disease (Exc. Stroke/TIA)</b>	42 (11.8)	14.7	42	40.4 (28.7–56.8)
<b>Total (including 22 cases with no info on risk factors)</b>	378	0.8		

\* Mantel-Haenszel age-adjusted rate ratio (RR), with corresponding exact 95% CI were calculated for each risk group using the two available age groups (from six months up to 15 years and from 16 to 64 years)

Of all the UK fatal cases with available information on immunisation history, 229 of 307 (74.6%) had not received the 2010/11 trivalent influenza vaccine. One hundred and sixty of 179 cases (89.4%) with information had not received the monovalent pandemic influenza vaccine in 2009/10.

## ONS weekly excess all-cause mortality

In England and Wales during the 2010/11 winter season, all-cause all-age excess weekly death registrations above the threshold were observed between weeks 49 (ending 12 December 2010) and 3 (ending 23 January 2011) (Figure 36). A total of 3,757 excess death registrations above the 95% upper threshold were estimated to have occurred using the long-standing Serfling method (7) (Table 10). While the excess deaths are due to all causes and cannot be directly attributed to particular factors, it is notable that this excess occurred in a period when the UK experienced both a prolonged cold snap and increased influenza activity allowing for delays in death registration. Closure of registry offices over the Christmas and New Year bank holiday period was also temporally associated with an artefactual dip and subsequent increase at the end of December. This excess total is higher than observed for the 2009/10 pandemic but not as high as that observed in the 2008/09 season (Table 10).

Figure 36 Weekly deaths and excess mortality determined by the Serfling algorithm in England and Wales January 2009 – March 2011

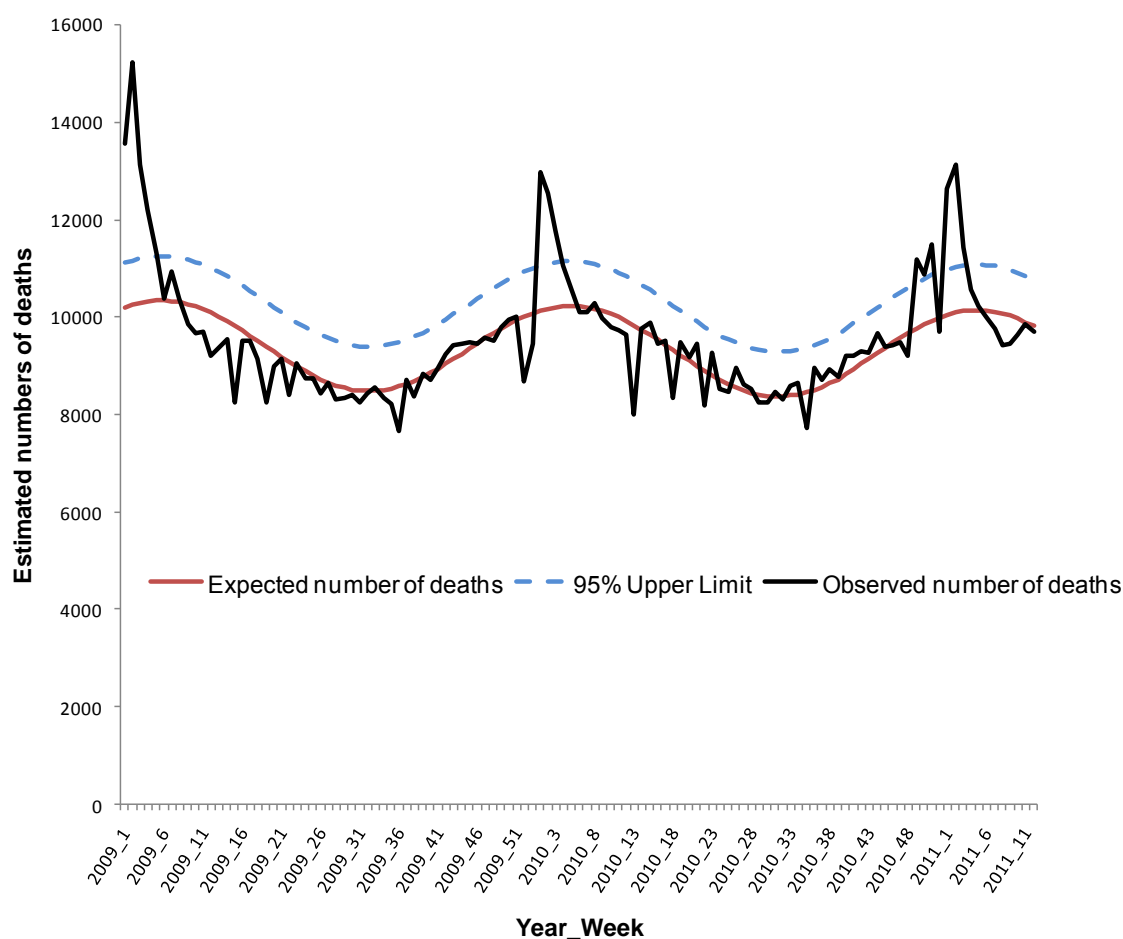


Table 10 Number and proportion of excess deaths in England and Wales in the different influenza seasons\*

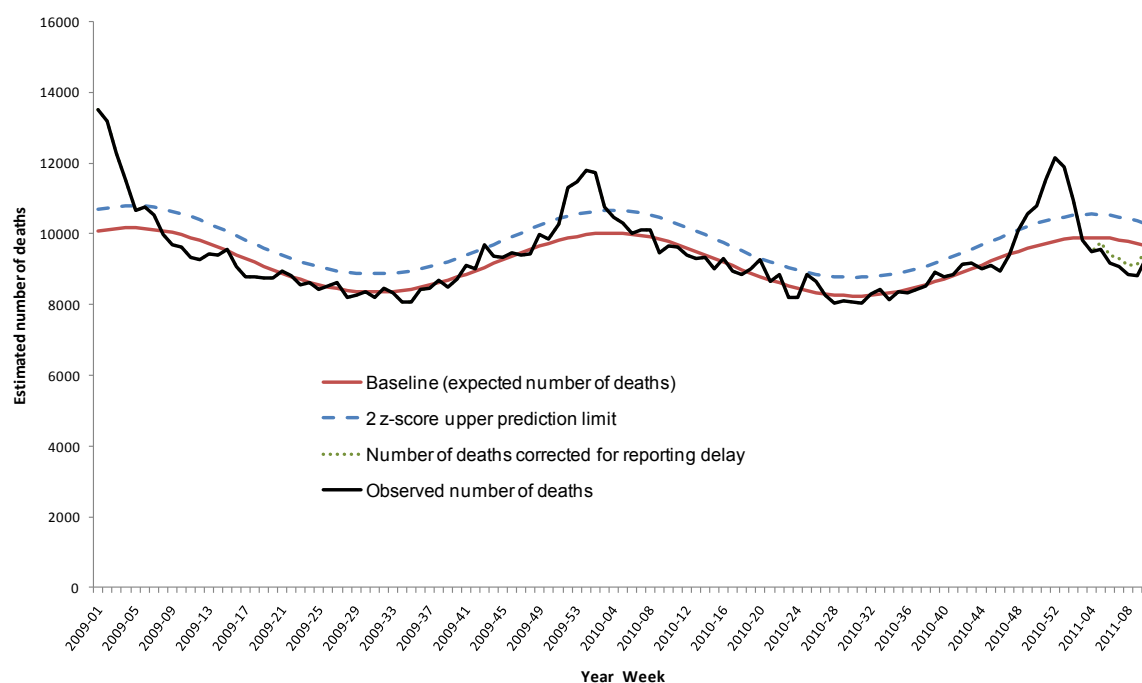
Season	Excess above threshold (95% CI)	Total number of deaths	% deaths in excess
2000/01	828 (561–1,095)	383,805	0.2
2001/02	6,877 (6,610–7,144)	388,552	1.8
2002/03	6,413 (6,146–6,680)	386,946	1.7
2003/04	4,577 (4,310–5,074)	377,242	1.2
2004/05	1,806 (1,539–2,073)	372,259	0.5
2005/06	Not detected	361,910	0.0
2006/07	Not detected	318,775	0.0
2007/08	873 (573–1,407)	321,853	0.3
2008/09	9,904 (9,637–10,171)	327,334	3.0
2009/10	2,963 (2,696–3,230)	315,931	0.9
2010/11	3,757 (3,340–4,291)	243,581	1.5

\*Data for the 2010/11 season is available until week 11 2011 (ending 20 March 2011)

The peak number of deaths recorded as resulting from respiratory diseases was 2,686 in week 2 2011 (ending 16 January 2011). This was also the week when the highest proportion of deaths was due to respiratory disease (20.9%).

Using weekly mortality data by date of death from ONS, an alternative newly developed method for estimating excess all cause mortality (based on the EuroMOMO algorithm (8)) similarly detected excess all-cause mortality above the threshold over the Christmas and New Year period from week 48 2010 (ending 5 December 2010) to week 2 2011 (ending 16 January 2011) in England and Wales (Figure 37). Geographically, a significant excess was observed across all regions of England and Wales with the possible exception of North East England.

Figure 37 Number of reported deaths and excess mortality calculated by EuroMOMO in England and Wales January 2009 – March 2011



The EuroMOMO method also permitted examination of age-specific excess mortality. The observed excess occurred in both adults and the elderly. A significant excess mortality in adults aged 15–64 was seen between week 50 (ending 19 December 2010) and week 1 (ending 9 January 2011). A large excess was also seen in adults aged 65 years or older from week 48 (ending 5 December 2010) to week 2 (ending 16 January 2011). No excess was seen in children under five and a small excess was seen in children aged 5–14 years in weeks 51 (ending 26 December 2010) and week 1 (ending 9 January 2011).

The Christmas period over which excess mortality occurred corresponds to the period over December when notably cold weather was observed in 2010/11. This is likely to be an important contributory factor to the excess deaths observed in the elderly this season. Young and middle-aged adults were where the burden of influenza fell predominantly this season (as highlighted in the surveillance of individual fatal

influenza cases). Consequently, it is much more likely a significant proportion of the excess mortality in this group was due to influenza. The period of excess mortality coincided with a dip in positivity of other respiratory viruses, suggesting other respiratory viruses did not contribute to a significant extent to the observed excess.

## Weekly Scottish deaths

Information on reports of deaths in Scotland due to confirmed flu illness was received by HPS this winter. Whilst the majority of ICU cases have been in those between the ages of 15 and 64 years, there was a small number – 26 – of ICU cases aged 65 years and over, 19 of whom subsequently died from complications of influenza (Table 6). This mirrors the finding during last year's influenza pandemic that whilst those over the age of 65 accounted for a minority of cases, the mortality rates were high in this age group. Vaccination status was known for most of those dying with influenza to date and most had not been vaccinated against seasonal influenza this year. A summary of these influenza confirmed cases who died by region is given in Table 11.

Table 11 Table of influenza confirmed cases who died by region in Scotland during 2010/11

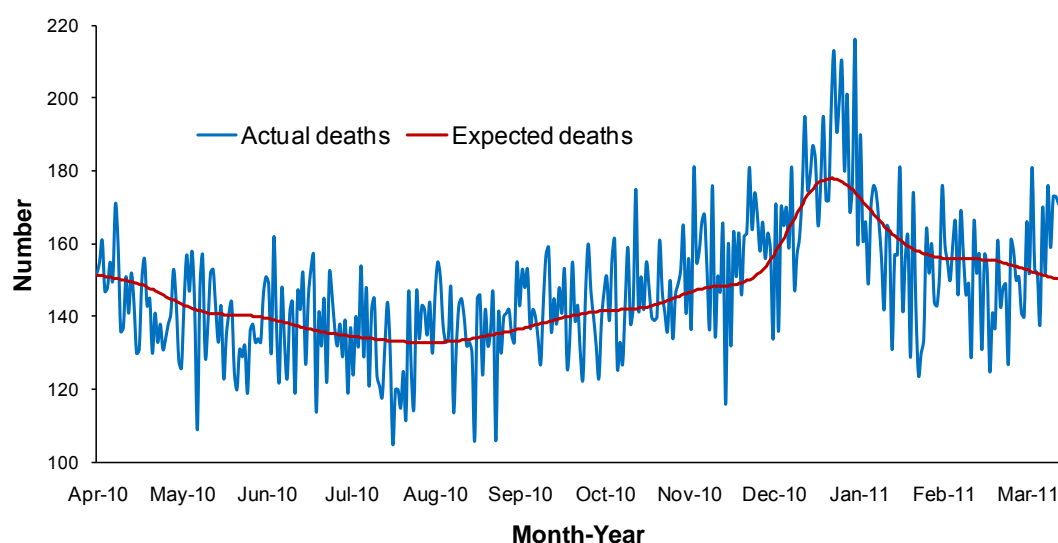
Deaths in Scotland by region	To end of week 15 2011 (ending 17 April 2011)
West of Scotland	37
East of Scotland	18
North of Scotland	8
<b>Total</b>	<b>63</b>

Note: Figures in Tables 6, 7 and 11 have been updated to reflect additional information received from NHS boards. Some of the figures quoted may differ slightly from previous weeks.

Information on mortality from all causes is available from the General Registrar's Office for Scotland. Data presented relate to all causes of death (not specifically to influenza-related deaths). Excess deaths during the winter months are often attributed in part to influenza.

There is evidence that there were slightly more deaths than expected in early January (Figure 38). The excess on the whole was across a number of age groups and affected both males and females. Overall, during November 2010 to February 2011 it has been estimated that there were around 500 excess deaths (all causes not specifically flu). This compares to around 380 during the same period of the pandemic year.

Figure 38 Actual and expected deaths in Scotland from all causes April 2010 to March 2011



## VACCINATION

### VACCINE UPTAKE

In England, 72.8% of patients aged over 65 years and 50.4% of patients aged under 65 years in a clinical risk group had received the 2010/11 trivalent seasonal flu vaccine by 28 February 2011 (Table 12). Compared with 2009/10, uptake in the over 65 year olds increased slightly, but it decreased in those patients under 65 at risk.

Uptake in patients aged 65 years and over increased from 2009/10 to 2010/11 in Scotland (from 73.6% to 75.4%) and Wales (from 63.5% to 65.8%) but decreased slightly in Northern Ireland (from 77.0% to 74.9%).

Cumulative data from the final monthly collection of 2010/11 flu vaccine uptake for frontline healthcare workers in England showed 34.7% had been vaccinated with the 2010/11 seasonal influenza vaccine by 28 February 2011 – an increase compared to the previous season (25.7%). This is higher than seen in Scotland (26.7%) and Wales (19.0%).

2010/11 was the first season in which pregnant women were routinely vaccinated in the UK with seasonal influenza vaccine. 56.6% of those pregnant women in a clinical risk group were vaccinated compared to 36.6% of healthy pregnant women in England. Figures reported from Scotland were higher (74.8% of pregnant women in a



clinical risk group and 64.9% of healthy pregnant women). It should be noted that there are residual issues about the accuracy of the denominator data – the majority of care for pregnant women is delivered by midwifery services which may affect the accuracy of recording within their general practice. Wales had lower uptake and Northern Ireland only reported data for healthy pregnant women (Table 12).

Table 12 Seasonal influenza vaccine uptake in the UK in 2009/10 and 2010/11 seasons

	Proportion of group vaccinated (%)			
	England*	Northern Ireland	Scotland#	Wales
>65 years 2010/11 season	72.8	74.9	75.4	65.8
>65 years 2009/10 season	72.4	77	75	63.5
<65 years at risk 2010/11 season	50.4	78.7	56.1	48.6
<65 years at risk 2009/10 season	51.6	80	53.3	49.1
Healthcare workers 2010/11 season	34.7	N/A	26.2	19.0'
Healthcare workers 2009/10 season	25.7	N/A	31	11.6
Healthy pregnant women 2010/11 season	36.6	59.9^	64.9	39.7
Pregnant women at risk 2010/11 season	56.6	N/C	74.8	55.3

\*The uptake figure for healthcare workers for 2009/10 is the comparable figure to week end 28 February 2010. NB the 2009/10 healthcare workers swine & seasonal flu vaccination campaign was a weekly collection which ran until 31st August 2010. Final seasonal uptake was 26.4%.

N/C refers to data not collected in the relevant country

N/A refers to data not presented in the report

^The calculation is based on May 2010 to March 2011 figures

'This 2010/11 occupational health uptake is provisional and based on data from six out of seven Health Board areas

# Estimated seasonal flu vaccine uptake for 2010/11 subject to validation by National Services Scotland – Practitioner Services Division. Provisional healthcare worker vaccine uptake for 2010/2011 season

## VACCINE EFFECTIVENESS/STRAIN COMPARISON

A UK vaccine effectiveness study was published mid 2010/11 season (13). After adjusting for age group, month of sample collection and surveillance scheme, flu vaccine effectiveness against confirmed H1N1 (2009) infection was found to be 34% (95% CI 10–60%) if vaccinated only with monovalent pandemic H1N1 (2009) vaccine in 2009/10 season, 46% (95% CI 7–69%) if vaccinated only with trivalent seasonal influenza vaccine in the 2010/11 season and 63% (95% CI 37–78%) if vaccinated in both seasons (Table 13). The reduction in monovalent influenza A/H1N1 (2009) adjuvanted vaccine effectiveness after 12 months compared to studies undertaken during 2009/10 (14,15) suggest that protection may wane after 12 months following vaccination.

When other types of influenza virus (influenza A H3 or influenza B) were considered, the trivalent influenza vaccine (when again adjusted for age group, month of sample collection and surveillance scheme) resulted in a vaccine effectiveness of 50% (95% CI 17–70%).

In conclusion, this season's trivalent vaccine provided protection against the two main strains circulating in 2010/11; influenza A/H1N1 (2009) and influenza B (13).

Table 13 Number and proportion of samples positive for influenza A/H1N1 (2009) according to vaccination status in the UK September 2010 – January 2011 (11)

<b>Vaccination status</b>	<b>Season</b>	<b>Influenza A/H1N1 (2009) positive/total (%)</b>	<b>Crude vaccine effectiveness % (95% CI)</b>	<b>Adjusted vaccine effectiveness % (95% CI)</b>
<b>Unvaccinated</b>	N/A	1,014/2,554 (39.7)	N/A	N/A
<b>Vaccinated</b>	2009/10	26/130 (20.0)	62 (41–75)	34 (10–60)
<b>Vaccinated</b>	2010/11	22/100 (22.0)	57 (31–73)	46 (7–69)
<b>Vaccinated</b>	2009/10 and 2010/11	21/107 (19.6)	63 (40–77)	63 (37–78)

## RECOMMENDATIONS FOR 2011/12 SEASON

The recommended composition for influenza trivalent vaccines for use in the 2010/11 northern hemisphere influenza season were A/California/7/2009 (H1N1)-like virus, an A/Perth/16/2009 (H3N2)-like virus and a B/Brisbane/60/2008-like virus. The WHO proposed no change in the trivalent vaccine strains for the forthcoming season and recommended the following viruses be used for influenza northern hemisphere vaccines in the 2011/12 influenza season: an A/California/7/2009 (H1N1)-like virus, an A/Perth/16/2009 (H3N2)-like virus and a B/Brisbane/60/2008-like virus (16). For the forthcoming season target groups remain unchanged compared to the 2010/11 season, with pregnant women and other routine targeted groups recommended for vaccination (over 65 year olds, risk group, healthcare workers, carers etc.) (17).

## International situation

---

### Europe

The UK was the first country in Europe to report influenza activity in 2010/11. This was followed by a broad geographical pattern of west to east progression of influenza across the continent in line with some, but not all, previous seasons (18). An increased impact relative to the pandemic was observed in the UK and a similar phenomenon was also seen in several other European countries. Severe cases and deaths, as in the UK, were mostly reported in the 15–64 year olds predominantly with underlying clinical conditions.

The peak week for positive specimens from sentinel GP practices was in week 52 (ending 2 January 2011) at approximately 56% (19). Fifteen of the 25 countries reported increases of influenza during this week.

As in the UK, the majority of influenza viruses detected in 2010/11 were influenza A, but an increased number of influenza B viruses were detected relative to 2009/10. In the peak week 52 (ending 2 January 2011), 73% of detections were type A and 27% were type B. Over 90% of subtyped influenza A viruses were H1N1 (2009). As the season progressed, an increasing proportion of influenza B was detected. Week 11 (ending 20 March 2011) was the first week of the season that the proportion of influenza B viruses was higher than the influenza A viruses. However, there was heterogeneity observed in virus distribution between countries. For example there was high influenza B activity in Scandinavia and high influenza A/H1N1 (2009) activity in Ireland (19). As seen in the UK, intense ICU activity was reported by several other countries in Europe but was not seen throughout the continent. Out of all severe hospitalised respiratory cases, 66.6% (3,079/4,624) were due to an influenza infection predominantly due to infection with influenza A/H1N1 (2009) in Europe.

### North America

The proportion of out-patient visits for ILI in the United States went above baseline in week 51 (ending 26 December 2010) (20). Despite dropping below the national baseline in week 12 (ending 27 March 2011), the proportion of deaths attributable to pneumonia and influenza remained at or above the epidemic threshold.

The viral circulation seen in Europe was different to that observed initially in North America where reports showed an influenza season dominated by influenza A/H3N2 and influenza B viruses (3). However as activity declined, influenza A/H1N1 (2009) levels increased proportionately towards the end of the season. Canada reported a continuing increase in the proportion of influenza B viruses towards the end of the season (21).

### Elsewhere

Towards the end of the season, influenza activity in the tropics, North Africa and the Middle East mainly involved co-circulation of influenza B and influenza A/H1N1 (2009) (22). Temperate Asia reported the majority of cases involving influenza A/H1N1 (2009) with influenza A/H3N2 and influenza B circulating in lower numbers. While Australia reported persistent low-level out-of-season influenza activity, the predominant virus was influenza A/H3N2.

Since 2003, 538 human cases of H5N1 avian influenza have been reported to WHO from 15 countries, 70 in 2010/11 so far (23). Out of these 70 cases, 35 have reportedly died (50%).

## Discussion and conclusions

---

Seasonal influenza activity in 2010/11 was unexpectedly high. Some indicators were higher than observed during the 2009/10 pandemic. As seen during the pandemic, younger people rather than the elderly continued to be mostly affected, with the highest ILI rates seen in 1–4 year olds and the lowest in 75+ year olds. However, compared to during the pandemic, there was a shift in several indicators from children to adults aged 15–64 years. Community surveillance mirrored what was seen in clinical surveillance. Serological data following the second wave of influenza A/H1N1 (2009) during the winter of 2009 had indicated it was unlikely that the UK would experience significant activity from this virus (24). However influenza A/H1N1 (2009) was the predominant strain detected, with virological activity reflecting clinical activity. In addition, a significant proportion of detections were due to influenza B, with a proportionally higher level in Scotland relative to other countries in the UK.

Severe hospitalised influenza cases resulting in increased intensive care unit bed occupancy were reported early and prior to a notable increase in GP consultation rates. Compared to the pandemic, a substantially higher daily occupancy rate of patients with influenza in critical care beds was seen in the winter of 2010/11. Furthermore, a higher proportion of adults aged over 16 years were hospitalised relative to the previous season. As shown from the USISS study, the majority of hospitalised confirmed influenza cases resulted from infection with influenza A/H1N1 (2009), with trends resembling RCGP ILI rates.

Up to 4 May 2011, 602 confirmed deaths associated with influenza had been reported from across the UK and 91 probable cases were still under investigation at the time of writing this report. The majority of these fatal cases were in younger and middle-aged adults with underlying clinical risk factors. The leading risk factors were chronic liver disease, immunosuppression and neurological disease. The number of excess deaths estimated during 2010/11 was higher than that observed during the 2009/10 season, both overall and by age-group. The period over which they occurred corresponded to the period of December when notably cold weather and increased influenza activity were simultaneously observed – suggesting both factors were contributory. It also coincided with a dip in positivity of other respiratory viruses other than influenza, suggesting these did not contribute significantly to the observed excess.

The WHO recommended vigilance regarding the pandemic influenza A/H1N1 (2009) subtype due to its unpredictable behaviour. There was no evidence of significant antigenic drift in the influenza A/H1N1 (2009) virus during 2010/11. However, 3.1% of influenza A/H1N1 (2009) viruses tested this season have been found to carry the mutation commonly associated with resistance to the antiviral drug oseltamivir. In addition, there have been reports of concurrent bacterial infections this season, particularly in younger adults. Both of these issues will need to be monitored closely as part of influenza surveillance for the next winter season.

The UK was the first to report the start of influenza activity in the 2010/11 season in Europe and a broad pattern of west to east progression was seen. In common with results from the UK, the majority of influenza detections this year were influenza A/H1N1 (2009) in many European countries with an increased number of influenza B viruses detected relative to 2009/10. However considerable heterogeneity in virology patterns and ICU activity was observed across the continent. In particular, in some countries of Scandinavia, influenza B rather than H1N1 (2009) was the predominant circulating virus.

Small increases in vaccine uptake were seen in the over 65 year olds relative to last year across the UK, but the uptake in those patients under 65 years at risk varied across countries. Pregnant women were targeted again for vaccination in 2010/11 following the introduction of the programme during the pandemic, 36.6% of healthy pregnant women in England were vaccinated while the uptake was 56.6% in pregnant women at risk. Cumulative data from the final monthly collection of flu vaccine uptake by frontline healthcare workers showed 34.7% were vaccinated by 28 February 2011 in England. This results demonstrate the need to improve the uptake of the trivalent vaccine in the 2011/12 winter season.

A mid-season influenza vaccine effectiveness study undertaken in the UK concluded that the 2010/11 season's trivalent vaccine did provide protection against the two main circulating viruses (influenza A/H1N1 (2009) and influenza B). The WHO has proposed no change in the vaccine for the 2011/12 season, with pregnant women again recommended by JCVI to receive the vaccine along with the other normal groups for the 2011/12 season.

In conclusion, influenza A/H1N1 (2009) was the main seasonal influenza virus in 2010/11, continuing to circulate and cause more disease in younger people than previously seen with seasonal influenza. Severe disease was reported more often in young and middle aged adults in the 2010/11 season, rather than children, compared with the previous pandemic period in 2009/10. Influenza B also circulated at higher levels in 2010/11 than in 2009/10.

# Acknowledgements

---

Compiled by H Green<sup>1</sup> and R Pebody<sup>1</sup>

With contributions from: D Fleming<sup>2</sup>, H Durnall<sup>2</sup>, B Smyth<sup>3</sup>, C Kearns<sup>3</sup>, P Cabrey<sup>3</sup>, J McMenamin<sup>4</sup>, A Reynolds<sup>4</sup>, J Bishop<sup>4</sup>, C Robertson<sup>4</sup>, S Cottrell<sup>5</sup>, R Lewis<sup>5</sup>, A Elliot<sup>6</sup>, S Smith<sup>6</sup>, G Smith<sup>6</sup>, P Loveridge<sup>6</sup>, K Eames<sup>7</sup>, E Brooks-Pollock<sup>7</sup>, E Millett<sup>8</sup>, A. Hayward<sup>8</sup>, H Zhao<sup>1</sup>, J Field<sup>1</sup>, K Howell<sup>1</sup>, P Sebastian Pillai<sup>1</sup>, A Lackenby<sup>1</sup>, J Ellis<sup>1</sup>, K Henderson<sup>1</sup>, S Bolotin<sup>1</sup>, N Andrews<sup>1</sup>, F Begum<sup>1</sup>, and J Watson<sup>1</sup>

<sup>1</sup>Health Protection Agency, Colindale

<sup>2</sup>Royal College of General Practitioners

<sup>3</sup>Public Health Agency, Northern Ireland

<sup>4</sup>Health Protection Scotland

<sup>5</sup>Public Health, Wales

<sup>6</sup>Health Protection Agency, Real Time Syndromic Surveillance Team

<sup>7</sup>Flusurvey, London School of Hygiene and Tropical Medicine

<sup>8</sup>Flu Watch, University College London

## England

Staff in the respiratory disease department at HPA, Colindale; Technical staff at the Respiratory Virus Unit, Colindale and the Regional Microbiology Network; Staff in the HCAI department, Colindale; NHS Direct, University of Nottingham, QSurveillance®, EMIS and EMIS practices for syndromic surveillance, all GPs participating in sentinel schemes, colleagues at the Department of Health; P Hardelid and colleagues at EuroMOMO

## Northern Ireland

Conall McCaughey and staff of the Regional Virus Laboratory, Belfast; Staff in the five Northern Ireland Health and Social Care Trusts; John Scates and staff at the Health and Social Care Board; staff at the Northern Ireland Statistics and Research Agency; Paul Cabrey, Dr Maureen McCartney, Dr Richard Smithson and Geraldine Reid, Public Health Agency Northern Ireland

## Wales

Public Health Wales CDSC: Roland Salmon, Daniel Thomas, Simon Cottrell and Richard Lewis. Public Health Wales Specialist Virology Centre: Liz McCruden and Catherine Moore.

## Scotland

Heather Murdoch, Andrew Palmer, Rachael Darroch, Alison Potts, Fiona Johnston, John Love, Stewart Robison, Daniel Nicholson, Louise Primrose-Shaw, Jennifer Weir, Eisin McDonald, Kevin Pollock, Tricia Cassels, Nnoli Okechukwu, Martin Scott, Lynne Otterson, Stuart Yule and other HPS colleagues. Dr Bill Carman, Catherine Frew, Rory Gunson, West of Scotland Specialist Virology Centre and colleagues in each of the Scottish Virology laboratories, Kim Kavanagh University of Strathclyde, Dr George Crooks and colleagues in NHS-24, Gordon Munro and colleagues GRO(S), Annemarie Van Helsum and colleagues NSS PTI, Scottish General Practitioners, NHS board Health Protection and Infection Control teams



# List of Tables

Number	Title	Page
1	Thresholds per 100,000 for ILI consultation rates for different GP sentinel surveillance schemes, UK	8
2	Overall and peak week proportion of positive RCGP/RMN influenza samples by age-group in England and Wales October 2010 – March 2011	36
3	Overall and peak week proportion of samples positive for influenza from GP sentinel schemes in the UK October 2010 – March 2011	37
4	Number of influenza specimens resistant to the antivirals oseltamivir and zanamivir in UK during 2010/11 season	39
5	Number of H1N1 specimens resistant to the antiviral oseltamivir in the UK May 2009 – April 2010	39
6	Table of influenza laboratory confirmed ICU cases or laboratory confirmed influenza cases in Scotland who have died in hospital by age group (age not known for three cases) during 2010/11	47
7	Table of influenza confirmed cases in Scotland in ICU by region (excluding patients who have died) during 2010/11	47
8	Number of reported confirmed fatal influenza cases by region in the UK during 2010/11 influenza season, 1 September 2010 – 4 May 2011	48
9	Influenza related mortality ratios and population mortality rates among those aged 6 months to 64 year olds of age by risk group in England, September 2010 – May 2011	50
10	Number and proportion of excess deaths in England and Wales in the different influenza seasons	51
11	Table of influenza confirmed cases who died by region in Scotland during 2010/11	53
12	Seasonal influenza vaccine uptake in the UK in 2009/10 and 2010/11 seasons	55
13	Number and proportion of samples positive for influenza A/H1N1 (2009) according to vaccination status in the UK September 2010 – January 2011	56

# List of Figures

Number	Title	Page
1	Overall weekly RCGP ILI rate in England and Wales January 2009 – March 2011	14
2	RCGP weekly ILI rate per 100,000 in England and Wales from various seasons since 1999/00	15
3	UK weekly ILI GP consultation rates by country April 2009 – March 2011	16
4	Weekly overall ILI/ARI rate in Scotland via PIPEr January 2009 – March 2011	16
5	Overall weekly GP ILI consultation rate in Northern Ireland from various seasons since 2003/04	17
6	Overall weekly GP ILI consultation rate in Wales from various seasons since 1999/00	18
7	Weekly ILI GP consultation rates by age group within the UK October 2010 – March 2011	19
8	RCGP weekly ILI GP consultation rates in adults and children in England and Wales January 2009 – March 2011	19
9	HPA/QSurveillance overall weekly ILI consultation rate in England, Wales and Northern Ireland April 2009 – March 2011	21
10	HPA/QSurveillance weekly ILI consultation rate by age group in England, Wales and Northern Ireland April 2009 – March 2011	22
11	HPA/QSurveillance peak weekly ILI rate per 100,000 by region in England, Wales and Northern Ireland October 2010 – March 2011	23
12	RCGP weekly Acute Bronchitis consultation rate in England and Wales April 2009 – March 2011	24
13	RCGP weekly Acute Bronchitis consultation rate by age group in England and Wales October 2009 – March 2011	24
14	RCGP overall weekly pneumonia consultation rate in England and Wales October 2010 – March 2011	25
15	NHS Direct weekly proportion of calls for cold/flu and fever in children in England and Wales in 2010/11 and 2008/09 seasons	26
16	NHS Direct weekly proportion of calls for cold/flu by age group in England and Wales October 2010 – March 2011	27
17	NHS-24 weekly proportion of calls for cold/flu and fever in children in Scotland in 2010/11 and 2008/09 seasons	28
18	NHS-24 weekly proportion of calls for cold/flu by age group in Scotland October 2010 – March 2011	28
19	OOH weekly proportion of calls for flu/flu-like-illness by age group in Northern Ireland April 2009 – March 2011	29
20	Flusurvey weekly incidence of influenza in participants in the UK December 2010 – March 2011	30
21	Cumulative proportion of ILI cases within the Flu Watch cohort visiting the GP by age-group in England in 2010/11	31
22	Outbreaks of acute respiratory disease reported in England in 2010/11 season	32
23	Number of reported outbreaks of acute respiratory disease by setting in England by week in 2010/11 season	32

24	DataMart weekly number of positive influenza samples by influenza type with overall proportion positive in England April 2009 – March 2011	33
25	Distribution of DataMart specimens by influenza type in England for 2009/10 and 2010/11 seasons	34
26	Age distribution of proportion of positive DataMart specimens by influenza type in England October 2010 – March 2011	35
27	RCGP/RMN weekly number of positive samples in England and Wales by influenza type with overall proportion positive April 2009 – March 2011	36
28	Proportion of samples positive for influenza by type from GP sentinel schemes in the UK during 2010/11 season	37
29	Weekly proportion of DataMart positive RSV samples by age-group in England October 2010 – March 2011	40
30	Number of laboratory confirmed reports of viral respiratory pathogens (excluding influenza) submitted through non-sentinel sources (ECOSS) in Scotland week 40 2010 to week 13 2011	41
31	Daily number of critical care beds occupied with suspected or confirmed influenza cases in England through the Winterwatch scheme during 2009/10 and 2010/11 seasons	43
32	Cumulative number of critical care beds occupied with suspected or confirmed influenza cases in England by age per 100,000 during 2009/10 and 2010/11 seasons	44
33	Cumulative number of critical care beds occupied with suspected or confirmed influenza cases in England by region per 100,000 during 2009/10 and 2010/11 seasons	45
34	Weekly number of cases by level of care in 23 acute NHS Trusts in England with RCGP ILI consultation rates in England and Wales, October 2010 – March 2011	46
35	Number of fatal confirmed influenza cases by week of death and sub-type reported in England June 2009 – May 2011	49
36	Weekly deaths and excess mortality determined by the Serfling algorithm in England and Wales January 2009 – March 2011	51
37	Number of reported deaths and excess mortality calculated by EuroMOMO in England and Wales January 2009 – March 2011	52
38	Actual and expected deaths in Scotland from all causes April 2010 to March 2011	54

## References

---

- (1) World Health Organization. (2009). Transcript of statement by Margaret Chan, Director-General of the World Health Organization, 11 June 2009. Available online: [http://www.who.int/mediacentre/influenzaAH1N1\\_presstranscript\\_20090611.pdf](http://www.who.int/mediacentre/influenzaAH1N1_presstranscript_20090611.pdf).
- (2) World Health Organization. (2010). H1N1 in post-pandemic period. Director-General's opening statement at virtual press conference. Available online: [http://www.who.int/mediacentre/news/statements/2010/h1n1\\_vpc\\_20100810/en/index.html](http://www.who.int/mediacentre/news/statements/2010/h1n1_vpc_20100810/en/index.html).
- (3) World Health Organization. (2011). Weekly epidemiological record 18 February 2011. Available online: <http://www.who.int/wer/2011/wer8608/en/index.html>
- (4) World Health Organization. (2010). WHO recommendations for the post-pandemic period. Available online: [http://www.who.int/csr/disease/swineflu/notes/briefing\\_20100810/en/index.html](http://www.who.int/csr/disease/swineflu/notes/briefing_20100810/en/index.html).
- (5) Health Protection Agency. (2010). 2009/10 National Influenza Annual Report. Available online: <http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/SeasonalInfluenza/EpidemiologicalData/07influsInfluenzaannualreports/>
- (6) Health Protection Agency. (2009). National weekly influenza report. Available online: [http://www.hpa.org.uk/web/HPAwebFile/HPAweb\\_C/1246433639498](http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1246433639498)
- (7) Serfling RE. Methods for current statistical analysis of excess pneumonia-influenza deaths. Public Health Reports. 1963;6:494-506. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1915276/pdf/pubhealthreporig00078-0040.pdf>
- (8) European monitoring of excess mortality for public health action. (2011). <http://www.euromomo.eu/>
- (9) Department of Health. (2010). Joint committee on vaccination and immunisation advice on the H1N1v and 2010/11 seasonal influenza vaccination programmes. Available online: [http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@ab/documents/digitalasset/dh\\_118093.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@ab/documents/digitalasset/dh_118093.pdf)
- (10) Zakikhany K, Degail MA, Lamagni T, Waight P, Guy R, Zhao H, et al. Increase in invasive Streptococcus pyogenes and Streptococcus pneumoniae infections in England, December 2010 to January 2011. Euro Surveillance. 2011;16(5). pii=19785. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19785>

- (11) Department of Health. (2011). Influenza, meningococcal infection and other bacterial co-infection including pneumococcal and invasive group A streptococcal infection. Available online:  
<https://www.cas.dh.gov.uk/ViewAndAcknowledgment/viewAlert.aspx?AlertID=101528>
- (12) Pebody R, McLean E, Zhao H, Cleary P, Bracebridge S, Foster K, et al. Pandemic Influenza A (H1N1) 2009 and mortality in the United Kingdom: risk factors for death, April 2009 to March 2010. *Euro Surveillance*. 2010;15(20). pii=19571. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19571>
- (13) Pebody R, Hardelid P, Fleming DM, McMenamin J, Andrews N, Robertson C, et al. Effectiveness of seasonal 2010/11 and pandemic influenza A (H1N1) 2009 vaccines in preventing influenza infection in the United Kingdom: mid-season analysis 2010/11. *Euro Surveillance*. 2011;16(6). pii=19791. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19791>
- (14) Valenciano M, Kissling E, Cohen JM, Oroszi B, Barret AS, Rizzo C, et al. Estimates of pandemic influenza vaccine effectiveness in Europe, 2009–2010: Results of influenza monitoring vaccine effectiveness in Europe (I-MOVE) multicentre case-control study. *PLoS Med*. 2011;8(1):e1000388. Available from: <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000388>
- (15) Hardelid P, Fleming DM, McMenamin J, Andrews N, Robertson C, Sebastian Pillai P, et al. Effectiveness of pandemic and seasonal influenza vaccine in preventing pandemic influenza A(H1N1)2009 infection in England and Scotland 2009-2010. *Euro Surveillance*. 2011;16(2):pii=19763. Available from: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19763>
- (16) World Health Organization. (2011). Recommended composition of influenza virus vaccines for use in the 2011-2012 northern hemisphere influenza season. Available online:  
[http://www.who.int/csr/disease/influenza/recommendations\\_2011\\_12north/en/index.html](http://www.who.int/csr/disease/influenza/recommendations_2011_12north/en/index.html)
- (17) Health Protection Agency. (2011). Letter from the Chief Medical Officer advising of the preparation and assurance for 2011-2012 seasonal influenza immunisation programme. Available online:  
[http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/documents/digitalasset/dh\\_125100.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_125100.pdf)
- (18) European Centre for Disease Prevention and Control. (2011). Seasonal influenza 2010-2011 in Europe (EU/EEA countries). Available online:  
[http://www.ecdc.europa.eu/en/publications/Publications/110125\\_RA\\_Seasonal\\_Influenza\\_EU-EEA\\_2010-2011.pdf](http://www.ecdc.europa.eu/en/publications/Publications/110125_RA_Seasonal_Influenza_EU-EEA_2010-2011.pdf)

- (19) European Centre for Disease Prevention and Control. (2011). Weekly Influenza Surveillance Overview. Available online: [http://ecdc.europa.eu/en/healthtopics/influenza/epidemiological\\_data/Pages/Weekly\\_Influenza\\_Surveillance\\_Overview.aspx](http://ecdc.europa.eu/en/healthtopics/influenza/epidemiological_data/Pages/Weekly_Influenza_Surveillance_Overview.aspx)
- (20) Center for Disease Control and Prevention. (2011). FluView – A weekly influenza surveillance report prepared by the influenza division. Available online: <http://www.cdc.gov/flu/weekly/>
- (21) Public Health Agency of Canada. (2011). FluWatch – Weekly Reports 2010-2011 Season. Available online: <http://www.phac-aspc.gc.ca/fluwatch/10-11/index-eng.php>
- (22) World Health Organization. (2011). Influenza Updates. Available online: <http://www.who.int/csr/disease/influenza/en/>
- (23) World Health Organization. (2011). Avian influenza. Available online: [http://www.who.int/csr/disease/avian\\_influenza/en/index.html](http://www.who.int/csr/disease/avian_influenza/en/index.html)
- (24) Hardelid P, Andrews NJ, Hoschler K, Stanford E, Baguelin M, Waight PA, et al. Assessment of baseline age-specific antibody prevalence and incidence of infection to novel influenza A/H1N1 2009. Health Technology Assessment. 2010;14(55):115–192. Available from: <http://www.hta.ac.uk/fullmono/mon1455.pdf>
-

## Health Protection Agency

2nd Floor

151 Buckingham Palace Road

London

SW1W 9SZ

[www.hpa.org.uk](http://www.hpa.org.uk)



Corporate member of  
Plain English Campaign  
Committed to clearer communication

**339**

For information or queries relating to this document please contact:

Respiratory Diseases Department

Email: [respcdsc@hpa.org.uk](mailto:respcdsc@hpa.org.uk)

May 2011

© Health Protection Agency

This publication is also available in large print