Increase in invasive *Streptococcus pyogenes* and *Streptococcus pneumoniae* infections in England, December 2010 to January 2011

K Zakikhany[1,2], M A Degail[1,3], T Lamagni[1], P Waight[1], R Guy[1], H Zhao[1], A Efstratiou[1], R Pebody[1], R George[1], M Ramsay (mary.ramsay@hpa.org.uk)[1]

1. Health Protection Agency (HPA), London, United Kingdom
2. The European Programme for Public Health Microbiology Training (EUPHEM), European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden
3. The European Programme for Intervention Epidemiology Training (EPIET), European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden

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Increases in invasive *Streptococcus pyogenes* and *S. pneumoniae* above the seasonally expected levels are currently being seen in England. Preliminary analyses suggest that the high level of influenza activity seen this winter may be contributing to an increased risk of concurrent invasive bacterial and influenza infections in children and young adults.

Following the early and rapidly escalating start of the 2010/11 influenza season in England [1,2] the Health Protection Agency (HPA) became aware of a number of anecdotal reports of invasive bacterial infections complicating seasonal influenza or influenza A(H1N1) 2009. In parallel, analyses of routine surveillance data identified increases in *Streptococcus pyogenes* and *S. pneumoniae* infections [3,4]. This triggered a cascaded alert from the United Kingdom (UK) Chief Medical Officer to healthcare professionals to be vigilant for bacterial co-infections complicating influenza cases [5].

The UK has experienced intense and widespread influenza activity this winter season due primarily to influenza A(H1N1)2009 virus with a significant contribution

Table 1

Cases of invasive *Streptococcus pyogenes, Streptococcus pneumoniae, Staphylococcus aureus, Haemophilus influenzae* and *Neisseria meningitidis* infection diagnosed in England between 1 July and 14 January, 2007 to 2011

	Age (years)	2007/08	2008/09	2009/10	2010/11
S. pyogenes	<15	78	93	93	114
	15-44	137	159	122	140
	≥ 45	303	342	279	371
	Total	**518**	**594**	**494**	**625**
S. pneumoniae	<15	252	275	333	228
	15-44	456	470	434	526
	≥ 45	1,456	1,723	1,550	1,606
	Total	**2,164**	**2,468**	**2,317**	**2,360**
S. aureus	<15	1,077	956	1,177	1,114
	15-44	1,702	1,306	1,310	1,232
	≥ 45	6,134	5,137	4,787	4,509
	Total	**8,913**	**7,399**	**7,274**	**6,855**
H. influenzae	<15	55	58	43	55
	15-44	37	34	30	18
	≥ 45	134	200	141	174
	Total	**226**	**292**	**214**	**247**
N. meningitidis	<15	425	427	302	357
	15-44	137	102	89	94
	≥ 45	75	103	63	98
	Total	**637**	**632**	**454**	**549**

from influenza B. To rapidly estimate the potential contribution of influenza to incident cases of invasive bacterial infections, routine laboratory surveillance and information on isolate submission data were analysed for the 2010/11 influenza season and compared with historical data to identify patterns suggestive of a possible interaction with influenza.

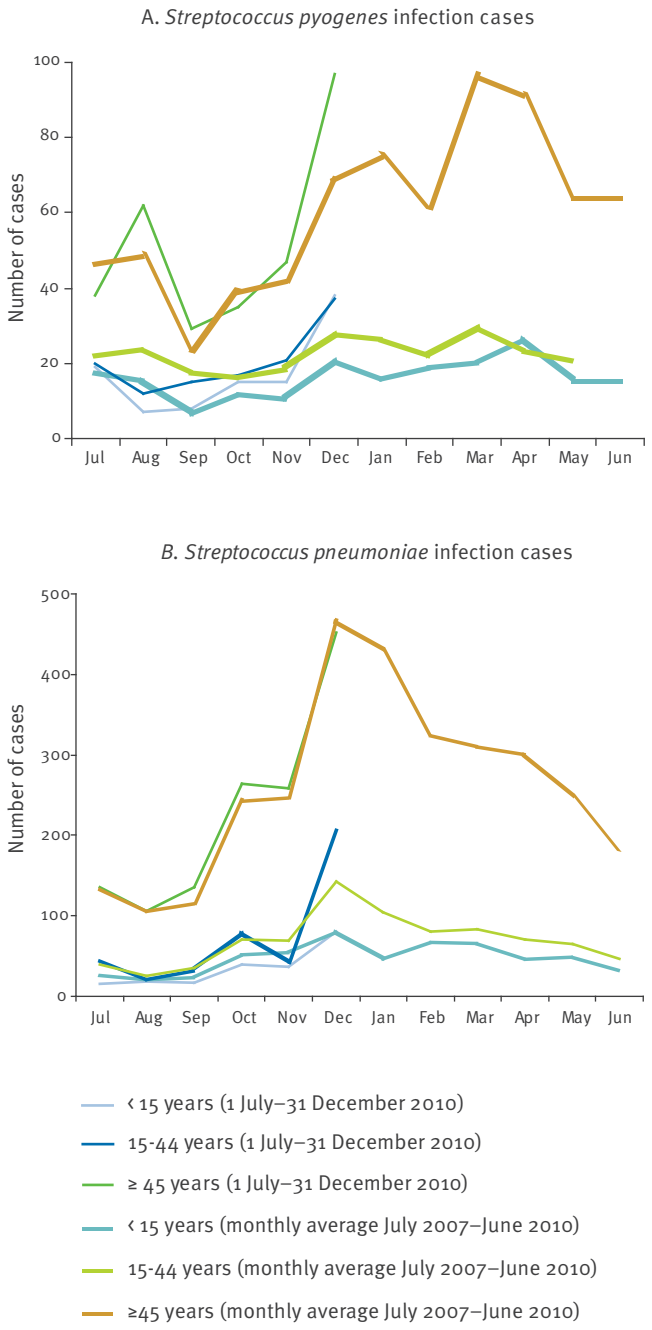
Identification of cases

Cases of invasive *S. pyogenes*, *S. pneumoniae*, and *Haemophilus influenzae* infection (defined through the isolation of these organisms from a normally sterile site) were identified through isolate referral to the national or regional reference laboratories. Cases of meningococcal infection included those with a clinically compatible illness where an isolate of *Neisseria meningitidis* was referred or where meningococcal DNA was detected in a clinical specimen at the national reference laboratory. Confirmed infections due to *Staphylococcus aureus* and *S. pyogenes* were derived from reports to the HPA from laboratories in England. Cases of influenza were defined as persons with influenza-like illness (ILI) with laboratory-confirmed influenza A or B infection reported by local or regional laboratories in England [6].

To obtain a minimum estimate of the potential importance of influenza as a risk factor for invasive bacterial infection, invasive bacterial surveillance data between 1 November 2010 and 14 January 2011 were matched on unique patient identifier (National Health Service (NHS) number, or name and date of birth if NHS number was unavailable) to laboratory-confirmed influenza diagnoses. Cases in both datasets with sample dates within two weeks of each other were considered as possible co-infections.

Figure 1

Age-specific reports of invasive *Streptococcus pyogenes* infection (n=532) (A) and referred *Streptococcus pneumoniae* isolates (n=1,983) (B) England, 1 July–31 December 2010, compared to monthly average (July 2007–June 2010)



Results

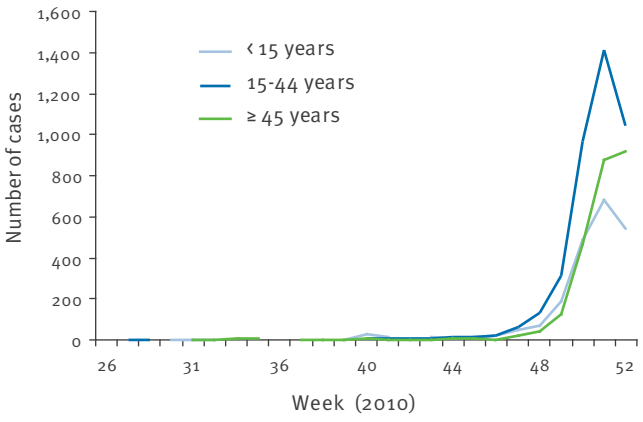
Invasive bacterial infections in England

When compared to the same period in the previous three years, surveillance data for 2010 and 2011 (1 July 2010 to 14 January 2011) do not indicate an overall increase in the number of invasive *S. pneumoniae*, *S. aureus*, *H. influenzae* or *N. meningitidis* infections (Table 1). In contrast, numbers of invasive *S. pyogenes* infections showed a slight elevation overall (Table 1), although more pronounced in December 2010 when 173 reports were received compared to an average of 99 for the same month in 2002–09 (range 68 to 147).

Increases in invasive *S. pyogenes* disease cases were noted in all age groups (Figure 1A) and were seen across all regions of England with the exception of Yorkshire and the Humber. Increases in invasive *S. pneumoniae* infections were seen exclusively in young adults (15-44

Figure 2

Confirmed cases of influenza A and B by sample date and age group, England, 1 July–31 December 2010, (n=8,645)



years) (Table 1), with numbers in December 2010 being much higher than the average for the same month of the previous three years (2007–09) (Figure 1B).

These increases coincided with increased influenza activity in December 2010, in particular in children (under 15 years-old) and young adults (15-44 years-old) (Figure 2).

Concurrent bacterial infections in seasonal influenza and influenza A (H1N1) 2009 cases in England

Linkage of influenza surveillance data to the 4,232 invasive bacterial surveillance records reported since the beginning of the 2011/11 influenza season (1 November 2010) to 14 January 2011, identified 144 (3.4%) cases co-infected with influenza (Table 2). Of the bacterial co-infections, the majority (85%) were diagnosed within the seven days after the date of laboratory-confirmed influenza diagnosis (122/143). Around three quarters (109/143) of identified co-infections were influenza A, 26% (37/143) were influenza B and 2% had both infections. *S. pyogenes* and *S. pneumoniae* had the highest proportion of confirmed influenza co-infections compared to the other bacterial infections. Cases of *S. pyogenes* under the age of 15 years had the highest likelihood of influenza co-infection (14%) followed by cases aged between 15 and 44 years (13%). Similarly, the highest proportion of co-infections with *S. pneumoniae* and influenza was found in the 15-44-year-olds (Table 2).

Discussion

Routine monitoring of surveillance data in England has identified a widespread increase in invasive *S. pyogenes* in December 2010 beyond the seasonally expected. A similar trend was not observed for other invasive bacterial pathogens where overall case numbers remained in line with previous seasons. Analysis of case fatality rates for all invasive bacterial pathogens studied were within the usual range.

Periodic upsurges in invasive *S. pyogenes* disease are reported by both European and non-European countries [7]. The drivers behind these increases are not fully understood but are likely to reflect both natural cycles governed by population susceptibility and heightened transmission in specific risk groups (e.g. injecting drug users). Our preliminary findings suggest that the heightened influenza activity this season has contributed to an increased risk of invasive *S. pyogenes* infection in children and young adults as co-infections with *S. pyogenes* and influenza were specifically observed in these age groups. This is in line with incidence rates of influenza and influenza-like illness (ILI) which were highest in December 2010 in children (1-4 year) (211.2 per 100,000 population) and young adults (15-44 years) (156.3 per 100,000 population) [2]. Similarly, the rise in invasive *S. pneumoniae* infections observed in young adults (15-44-year-olds age groups) may be partly attributable to concurrent influenza which was most commonly found in this age group. Increases in the numbers of *S. pneumoniae* infections in the younger age groups may have been prevented through the introduction of the 7-valent conjugate pneumococcal vaccine for children in 2006 [8], and the subsequent change to a 13-valent conjugate vaccine in 2010 [9]. Trends in older age groups, however, may have also been affected by recent changes in the vaccine programme.

As we were only able to match to laboratory-confirmed influenza, it is likely that we have underestimated the number of true cases of co-infections in the population, and influenza may be a more significant contributor to the overall rate of invasive infections. Furthermore, the importance of influenza as a risk factor for inva-

Table 2

Age distribution of invasive bacterial infections with concurrent influenza A or B infection in England, 1 November 2010–14 January 2011

	Total		<15 year-olds		15-44–year-olds		≥ 45–year-olds	
	Number	Cases of concurrent influenza infection (%)	Number	Cases of concurrent influenza infection (%)	Number	Cases of concurrent influenza infection (%)	Number	Cases of concurrent influenza infection (%)
Streptococcus pyogenes	302	27 (9)	58	8 (14)	62	8 (13)	182	11 (6)
Streptococcus pneumoniae	1,288	76 (6)	125	10 (8)	305	33 (11)	858	33 (4)
Staphylococcus aureus	2,063	31 (2)	332	10 (3)	376	8 (2)	1,355	13 (1)
Haemophilus influenzae	126	3 (2)	29	2 (7)	9	0 (0)	88	1 (1)
Neisseria meningitidis	449	6 (1)	269	3 (1.1)	101	3 (3)	79	0 (0)
All bacterial infections	4,232	143[a]	817	33	857	52	2,566	58

[a] A total of 144 bacterial cases co-infected with influenza were identified but no information on age was available for one case.

sive bacterial infection is likely to vary across different parts of the country [10].

The changes observed in invasive *S. pyogenes* infections may be due to factors other than influenza, in part supported by the observed increase in older age groups, such as the unusually cold weather experienced in England during December 2010. The latter suggestion is supported by the observation of increases in infections in older age groups, who have been relatively unaffected by influenza.

Given the on-going influenza activity in the UK, continued vigilance for changes in the incidence of *S. pyogenes* and *S. pneumoniae* infections is essential. As the start of the 2010/11 influenza season in the UK was ahead of other European countries and influenza transmission is now underway elsewhere in Europe, other national public health institutes should be alert to the possibility of similar observations.

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