Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

May 2007

Volume 8 Issue 5

hpsc EPI-Insight

Disease Surveillance Report of HPSC, Ireland

ISSN: 1393-9548

Contents

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Polio Eradication and Acute Flaccid Paralysis Surveillance

Since 1988, when the World Health Assembly resolved to eradicate polio the number of polio cases worldwide has decreased from 350,000 to 2,004 reported cases in 2006.[1,2] In 2006, only four countries (Nigeria, India, Afghanistan and Pakistan) remain polio-endemic. The dramatic decrease has been achieved as a result of successful immunisation programmes, augmented by quality surveillance for acute flaccid paralysis (AFP) and mop-up vaccination campaigns.[1,3]

The European region was certified "polio-free" in 2002. However, as long as a single child remains infected with poliovirus, children in all countries are at risk of polio. The poliovirus can easily be imported into a polio-free country and can spread rapidly amongst unimmunised populations. Between 2003 and 2005, 25 previously polio-free countries were re-infected due to importations.[4]

In Ireland, inactivated polio vaccine (IPV) is used instead of oral polio vaccine as part of the routine childhood immunisation programme. Uptake of three doses of IPV for Quarter 4, 2006 was 87% and 92% for 12 and 24 month old children respectively.[5] Exclusive use of IPV in immunisation against poliomyelitis requires the vaccination coverage to be very high, preferably above 95%, to overcome any concern about limited herd immunity.

Polio and AFP Surveillance

Any case that meets the clinical case definition of acute poliomyeltitis is notifiable to a medical officer of health under infectious disease legislation.[6,7] In addition, the National Virus Reference Laboratory (NVRL) requests that hospitals with paediatric populations in all Health Service Executive areas submit a monthly surveillance report to them stating whether or not they had any AFP.

The surveillance of AFP is the detection of flaccid paralysis of new onset in children under 15 years (and any suspected poliomyelitis case in a person of any age), with prompt virological testing to disprove or confirm poliovirus infection. AFP surveillance can promptly identify poliovirus circulation if it is occurring.

AFP occurs in about 1% of polio cases and is also caused by non-polio viruses e.g. other enteroviruses such as echoviruses, and coxsackieviruses. AFP surveillance systems are in place world-wide to ensure rapid identification and investigation of any potential polio case.

AFP surveillance allowed the detection of imported wild poliovirus originating in the Indian subcontinent into Bulgaria in 2001, leading to three cases in an under-vaccinated population subgroup. A rapid response from authorities interrupted transmission and prevented any further cases.

High quality AFP surveillance requires:

1. The ability to detect at least one case per year of non-polio AFP for every 100,000 children aged under 15 years (background rate)
2. The testing of at least two adequate stool specimens (taken at least 24 hours apart) collected within 14 days of onset in 80% or more of cases of AFP in a laboratory accredited by WHO.

All stool specimens in Ireland should be processed at the NVRL, the WHO accredited laboratory in Ireland.

During 2006, nine AFP cases were reported in Ireland, a rate of 1.04/100,000 population <15 years of age (based on the 2006 census of population)(table 1). Only 22% had adequate stools samples collected. Therefore the current AFP surveillance in Ireland fails to meet the WHO criteria for a high quality surveillance system (table 2).[8]

Table 1. Expected and reported cases of AFP in Ireland by HSE area, 2006

HSE area	Expected no. AFP cases	Actual no. AFP cases
East	3	2
Midland	0.5	0
Mid-West	0.7	1
North East	0.8	0
North West	0.5	1
South East	1.0	1
South	1.0	1
West	0.8	3
Ireland	**8.3**	**9**

Summary

Polio continues to be reported in a number of regions throughout the world.

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Introduction

The term "pneumococcal disease" refers to a group of clinical conditions caused by the bacterium *Streptococcus pneumoniae*. Invasive pneumococcal disease (IPD) includes conditions such as meningitis, pneumonia and septicaemia while non-invasive manifestations of the disease include otitis media, sinusitis and bronchitis. IPD is a disease mainly of young children and older adults. Individuals with severe chronic conditions or immunodeficiencies are also at increased risk of this disease. The treatment of IPD is complicated by the emergence of *S. pneumoniae* strains resistant to penicillin. The prescribing of broad-spectrum antibiotics or third or fourth line antibiotics in the community has been identified as a likely contributor to the rising levels of antimicrobial resistance in *S. pneumoniae*. The proportion of penicillin non-susceptible *S. pneumoniae* (PNSP) in some European countries is now over 35%.[1] In Ireland, the annual trends indicate that the proportion of PNSP has increased from just over 10% in 2004 to almost 16% in 2006.[2]

A substantial proportion of IPD can be prevented by vaccination. Two types of pneumococcal vaccine are available. The polysaccharide vaccine (PPV23) contains capsular antigens to the 23 serotypes which are associated with 90% of pneumococcal infections. This vaccine is not recommended for children under 2 years of age, as it is poorly immunogenic in this age group. The 7-valent pneumococcal conjugate vaccine (PCV7) contains capsular polysaccharide antigens to seven serotypes associated with approximately 70% of pneumococcal infections. Since the polysaccharide component of this vaccine is conjugated to a carrier protein (non-toxic diphtheria CRM_{197} protein), it elicits a T-cell dependent response and immunological memory even in infants and thus protects infants and young children against pneumococcal disease.

In August 2000, the US adopted universal childhood immunisation with the PCV7 vaccine for infants and children under 2 years of age. Catch-up vaccinations were targeted at children <5 years of age who were considered to be at increased risk of IPD. Reports from the US have demonstrated PCV7 is highly effective in reducing the burden of pneumococcal disease in children <5 years of age. There is also evidence of an increase in herd immunity as well as a decrease in antibiotic resistant strains causing disease.[3] [4] Therefore, the indications are that preventing the occurrence of IPD through vaccination may help alleviate the challenges of antibiotic resistance due to this organism.

In 2006, both The Netherlands and the United Kingdom introduced PCV7 to their respective routine infant immunisation schedules. Canada, Australia, Norway, Italy, Greece, Spain, Austria, Switzerland also offer universal pneumococcal vaccination in their infant schedules. Other countries including Ireland have selective immunisation programmes at present, whereby PCV7 is offered to infants and children considered to be at increased risk of IPD.[5]

In a recent position paper, the World Health Organization (WHO) indicated that it considered including PCV7 in national immunisation programmes a priority, taking into account the heavy burden of IPD occurring in young children and the availability now of a safe effective vaccine for this age group.

Materials and Methods

Since January 1st 2004, clinicians and laboratories are legally obliged to notify invasive *S. pneumoniae* disease in Ireland. Notifications are one source of IPD data in Ireland. In 2006, for regions using the Computerised Infectious Disease Reporting (CIDR) system, IPD data were entered directly. For regions not yet on the system, notifications were sent weekly to HPSC from where the data were entered on to CIDR. Following year-end, data cleaning and validation exercises were undertaken between Health Protection Surveillance Centre (HPSC) and the Departments of Public Health in the HSE areas.

The European Antimicrobial Resistance Surveillance Study (EARSS) is the other main source of IPD data in Ireland. In 2006 as in 2005, 42 Irish laboratories participated in the project having an estimated population coverage of approximately 98%. Participating laboratories collected data on the first invasive isolate per patient per quarter of *S. pneumoniae* from blood and CSF. These data submitted quarterly to HPSC were collated on the Whonet database.

The IPD notification data for 2006 (extracted from CIDR on 30th March 2007) and EARSS 2006 data are provisional, although the final figures are not expected to change greatly from those presented here. Denominator data used for the calculation of incidence rates were taken from the 2006 Census of Population.

Results

Notification Data

The number of IPD notifications made by clinicians and laboratories has increased each year since 2004. During that year, 169 notifications (4.0/100,000 total population) were made, increasing to 259 in 2005 (6.1/100,000) and to 292 in 2006 (6.9/100,000) (figure 1).

In 2006, there was a slight predominance of male cases over female cases (1.3:1.0). The age of cases ranged from one month to 100 years, with a median age 52 years.

Two hundred and thirty five of the notifications were classified as confirmed, 33 as probable, 17 as possible and the case classification was not reported for seven. The majority of cases were confirmed by blood culture (n=152), cultures from CSF and other sterile sites accounted for 13 cases, PCR for seven and urinary antigen for 30 cases. For the remaining 90 cases, details of the method of confirmation were not reported. The clinical diagnosis associated with the 292 notifications were meningitis (n=14), meningitis and septicaemia (n=5), pneumonia (n=13), septicaemia (n=12), peritonitis (n=1) and for the remainder (n=247) the diagnosis was not reported.

In 2006, the incidence rate was highest in the very old (>85 years) and the very young (<1 year), 45.8 per 100,000 population and 44.2 per 100, 000, respectively (figure 2). The 1-2 year olds and those in

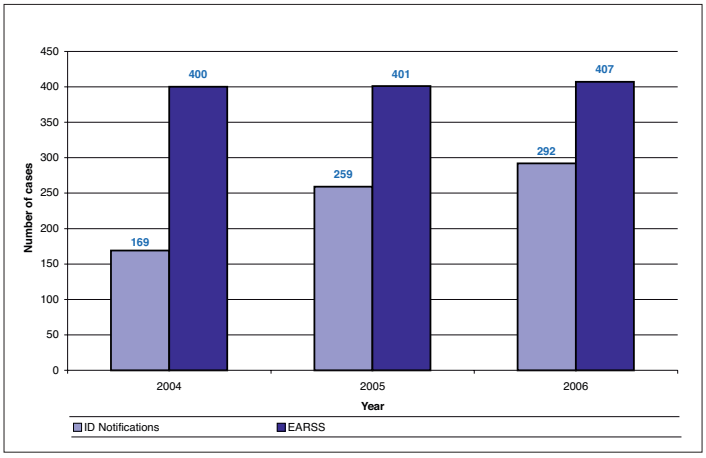

Figure 1: Number of invasive pneumococcal disease cases reported through the infectious disease notification process and EARSS, 2004-2006

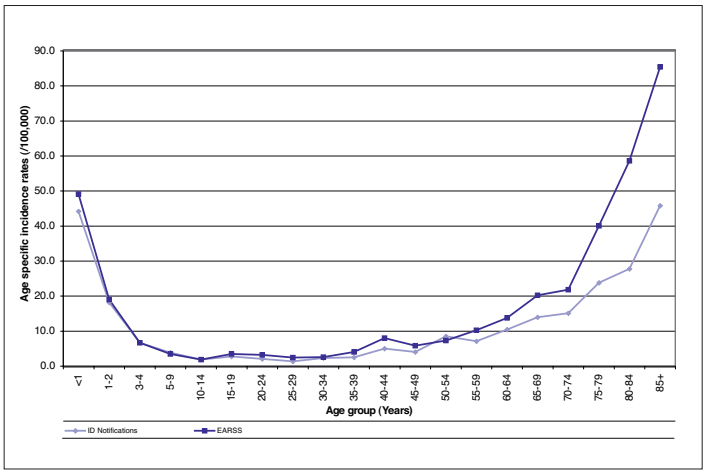

Figure 2. Age-specific incidence rates of invasive pneumococcal disease reported in 2006, through the infectious disease notification process and EARSS

age groups from 60 years of age and older had incidence rates of greater than 10 per 100,000 while those in age groups between 3 and 59 years of age had incidence rates of less than 10 per 100,0000 (figure 2).

EARSS Data

The number of *S. pneumoniae* isolates reported through EARSS has remained consistent over the last three years, ranging between 400 reports in 2004 and 407 in 2006 (9.4-9.6/100,000) (figure 1). As with the notification data, predominantly more male than female cases of IPD were reported by EARSS in 2006 with the same male to female ratio being reported by both systems, 1.3:1.0.

The age-specific incidence rates of IPD as reported through EARSS in 2006 followed a similar trend to the notification data with the very young and the very old being most affected (figure 2). The incidence rate was 40 per 100,000 or greater in the <1 year olds (49.1/100,000) and the 75-79 year olds (40/100,000), 80-84 year olds (58.6/100,000) and 85 year olds and older (85.4/100,000). For the vast majority of the age groups, the incidence of IPD was higher when reported through EARSS than by the notification system. For infants, children and young-middle aged adults, the difference was very slight. However, the difference between the incidences of IPD reported through the two systems increased with increasing age, especially from the age of 55 years onwards, considerably more cases were reported through EARSS than via the notification process (figure 2).

The discrepancies in reporting between the two systems are probably a reflection of reporting practices where laboratories are reporting directly to EARSS at HPSC but are not simultaneously reporting these cases to departments of public health in the HSE areas. However, as more laboratories commence using the CIDR system the discrepancy between the notification data and the EARSS data should hopefully diminish.

Typing Data

In 2006, just 14% (57/407) of all *S. pneumoniae* isolates reported through EARSS were serotyped, with five of the 42 laboratories participating. The predominant types identified were 6b, 4, 1, 3, 9V and 14. These accounted for 58% of the serotyped isolates (table 1). The 23-valent pneumococcal polysaccharide vaccine, PPV23, would have covered 98% of the isolates serotyped while 56% would have been covered by the 7-valent conjugate vaccine, PCV7. In children under 2 years of age, 73% of isolates serotyped belonged to types covered by PCV7 and in adults 65 years of age or more 95% of the isolates serotyped would have been covered by PPV23 (table 1).

Discussion

Notification data underestimates the burden of IPD in Ireland, when compared with EARSS data. In particular, the incidence of IPD in older adults was considerably underestimated by the notification data. Despite the differences between the two systems the overall trends were the same with the very young and the very old being the most vulnerable.

In Ireland, based on the 2002 Immunisation Guidelines by the National Immunisation Advisory Committee (NIAC), pneumococcal vaccination is recommended for certain at-risk groups which includes vaccination of the elderly aged 65 years and older with PPV23. In these same guidelines NIAC recommended PCV7 for infants and children under 2 years of age considered to be at increased risk of IPD. However, those not considered at risk of IPD in this age group are not offered PCV7 vaccination at present. The current pneumococcal vaccination policy has been reviewed by NIAC which has recommended the inclusion of PCV7 in the routine childhood immunisation schedule. These revisions to the schedule will be included in the updated immunisation guidelines due out in the latter half of this year.

Serotyping data were available on only 14% of *S. pneumoniae* isolates in 2006. Based on the data available, PCV7 would have covered 73% of the typed isolates in the <2 year olds and in adults 65 years of age and older 95% of the isolates typed would have been covered by PPV23. More comprehensive serotyping data are required on invasive *S. pneumoniae* isolates in order to determine the distribution of *S. pneumoniae* isolates in Ireland by serogroup, to fully evaluate the impact of any vaccine programmes and to ascertain the serotypes associated with penicillin non-susceptible *S. pneumoniae*. To bridge this gap, a pilot project for the typing of invasive *S. pneumoniae* isolates in Ireland is in the process of being put in place in a collaboration between HPSC, Professor Hilary Humphreys of Beaumont Hospital and Professor Mary Cafferkey of the Children's University Hospital, Temple Street. Details of the typing service due to commence shortly will be communicated to participating EARSS laboratories through the EARSS Steering Committee.

In conclusion, the surveillance of IPD needs strengthening in Ireland. All clinicians and laboratories are encouraged to notify cases of this disease through the weekly infectious disease notification system. However, this year looks promising regarding improvements in the

Table 1. Number of S. pneumoniae isolates by serotype, in 2006

	Number of isolates			Serotypes covered by	
Serotype	**All ages**	**<2 years**	**65 years +**	**PPV23**	**PCV7**
1	5	0	0	Yes	No
3	5	1	3	Yes	No
4	6	0	2	Yes	Yes
6B	7	3	3	Yes	Yes
7F	3	2	1	Yes	No
8	2	0	1	Yes	No
9N	1	0	0	Yes	No
9V	5	1	2	Yes	Yes
10A	2	0	0	Yes	No
14	5	3	1	Yes	Yes
15A	1	0	1	No	No
18C	4	2	1	Yes	Yes
19A	3	1	0	Yes	No
19F	1	1	0	Yes	Yes
22F	2	0	2	Yes	No
23F	4	1	2	Yes	Yes
33F	1	0	1	Yes	No
Total	**57**	**15**	**20**	**Yes**	**No**
% PPV23*	98.2	NA	95.0		
% PCV7*	56.1	73.3	NR		

* % isolates typed covered by pneumococcal vaccines
NA – Not applicable, since PPV23 not immunogenic in children <2 years of age
NR – Not relevant, since PCV7 not recommended in adults since PPV23 effective in this age group and is also protective against greater number of serotypes

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Table 2. WHO recommended standards for AFP surveillance and Irish performance

WHO target	Ireland's performance 2006
Ability to detect at least one non-polio AFP case /100,000 children < 15 years of age*	1.04/100,000 non-polio AFP cases reported in children < 15 years of age
Two adequate specimens collected from at least 80% of AFP cases**	Two adequate specimens collected from 22% AFP cases
All specimens processed in WHO accredited lab	100% specimens processed in NVRL

** Expected non-polio AFP rate (background rate)*
*** At least 24 hours apart within 14 days of onset of paralysis, adequately shipped to the laboratory*

Until polio eradication has been globally achieved polio virus could be imported into Ireland. Currently, Ireland only partially meets the WHO criteria for high quality AFP surveillance in Ireland: AFP rate is 1.04/100,000 population < 15 years of age; but submission of stool samples on these cases is inadequate (22% of cases) and does not meet WHO standards.

Ensuring high quality AFP surveillance and high IPV vaccination rates are necessary to maintain polio-free status, to rapidly identify importation of polio cases and respond quickly in the event that polio importation does occur.

All physicians should:

- **Report all cases of AFP among children < 15 years of age to the medical officer of health.**
- **Submit at least two stool samples from AFP cases < 15 years of age to the NVRL (at least 24 hours apart within 14 days of onset of paralysis).**
- **Encourage polio immunisation.**
- **All hospitals with paediatric populations should submit the monthly AFP surveillance forms to the NVRL. This is usually done by identified individuals (infection control nurse or paediatrician).**

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surveillance of IPD. The availability of a pilot serotyping facility at Beaumont Hospital for *S. pneumoniae* isolates, efforts to implement an enhanced surveillance system in collaboration with the Departments of Public Health and the laboratories, and the continuation of existing surveillance systems, will all contribute to providing improved and more in-depth information on the epidemiology of IPD in Ireland. Such surveillance initiatives will also help establish a more accurate baseline measurement of this disease. This information in turn can be used to inform public health policy, monitor the impact of any pneumococcal vaccination programmes and to measure vaccine efficacy. This information will also be vital in ascertaining serotype distributions of *S. pneumoniae* isolates in advance of and after implementation of any future vaccination initiatives.

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Acknowledgements

The authors wish to thank all who contributed to the data for this paper, the notifying clinicians and laboratories, the departments of public health for the collation and reporting of regional notifications and the participating EARSS laboratories.

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Hepatitis Group Established

The Health Service Executive has established a group to make recommendations on an action plan for hepatitis C in Ireland. In 2004, the Eastern Regional Health Authority produced a strategy document on hepatitis C for the Eastern Region of the country. With the establishment of the Health Service Executive and further developments in treatment of hepatitis C it is timely that a group has been established to update the recommendations of the 2004 report and bring a national perspective to the report. Accordingly, a multi-disciplinary group of 20 persons, representing many disciplines and service users and with a wide geographic base, has been established to report by the summer of 2007 on priority actions in relation to hepatitis C. The group is looking at hepatitis C from the perspective of surveillance, treatment and prevention. Any specific items that any reader feels should be considered by the group should be sent to joebarry@tcd.ie.

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