Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

February 2008

Volume 9 Issue 2

hpsc EPI-Insight

Disease Surveillance Report of HPSC, Ireland

ISSN: 1393-9548

Contents

hpsc
Health Protection Surveillance Centre
25-27 Middle Gardiner St
Dublin 1, Ireland
Ph +353 1 876 5300
Fx +353 1 856 1299
E info@mailx.hse.ie
www.hpsc.ie

Pneumococcal Typing in Ireland - A Pilot Project

Introduction

Diseases caused by *Streptococcus pneumoniae* are a major public health problem worldwide, affecting in particular young children, elderly people and patients with immunodeficiencies. WHO estimates that every year up to one million children aged <5 years die from pneumococcal disease. Over 90 serotypes of *S. pneumoniae* are known to cause disease in man; pneumococcal vaccines are designed to cover the serotypes most frequently associated with invasive pneumococcal disease (IPD). Two vaccines are available; the older 23-valent pneumococcal polysaccharide vaccine (PPV23) and the newer 7-valent pneumococcal conjugate vaccine (PCV7). PPV23 provides protection against pneumococcal disease due to the 23 most common serotypes in individuals over 2 years of age. PCV7 protects against seven serotypes (4, 6B, 9V, 14, 18C, 19F and 23F) and is highly efficacious in infants and young children. PCV7 was introduced for routine use in infants and toddlers in the US in 2000. Since then it has been licensed in more than 70 countries and has been included in a dozen national immunisation programmes, including the UK in September 2006. PCV7 will be included in the Irish immunisation schedule later in 2008. At present the vaccine is recommended for infants and children considered at increased risk of IPD.

The distribution of serotypes associated with IPD varies geographically and can also vary over time. It is recognised that age-specific population-based surveillance for IPD is the best method of characterising serotype distributions for a given population.

No comprehensive data on the serotype distribution of *S. pneumoniae* strains in circulation in Ireland have been available until recently. With the introduction of PCV7 to the routine infant immunisation schedule imminent, it was considered important to ascertain in advance the serotype distribution of strains in this country. In April 2007, a national pilot project commenced to provide this much needed pneumococcal typing information. It is a collaborative project involving the RCSI Education and Research Centre, Beaumont Hospital; the Children's University Hospital, Temple Street and the Health Protection Surveillance Centre (HPSC), with the support of the microbiology laboratories who submit isolates. Results from the first six months of the project are now available and are presented in this paper.

Methods

Invasive *S. pneumoniae* isolates were forwarded by clinical microbiology laboratories to RCSI /Beaumont for typing. Serotyping was performed using serological methods and multiplex PCR. Penicillin susceptibility was assessed using the E-Test® method following CLSI guidelines. Data on the isolates typed were collated on a MS Access database at HPSC and analysis performed using MS Access and MS Excel.

Results

The results from the first six months of the project (Apr – Sept 2007) are presented with the analysis based on the original specimen collection date. One hundred and thirty-five invasive *S. pneumoniae* isolates obtained in 23 laboratories over this period were submitted to RCSI for typing. Three isolates were contaminated, one was not viable and two were duplicates, therefore, 129 isolates were typed and form the basis for the analysis here. This represented 78% (129/166) of the *S. pneumoniae* isolates reported through the European Antimicrobial Surveillance System (EARSS) over that period.

Serotype distribution

Thirty one capsular serotypes and one non-typeable isolate were identified. The most common serotypes were 7F, 14, 9V, 6B, 4, 1, 19A and 19F. These eight serotypes accounted for 61% (79/129) of the isolates typed (figure 1). Five of these serotypes are covered by PCV7 (4, 6B, 9V, 14 and 19F), while all eight serotypes are covered by PPV23. Of the 129 isolates typed, 46% (n=59) belonged to serotypes covered by PCV7 and 91% (n=117) by PPV23. Ninety-two percent of isolates in children <2 years had serotypes covered by PCV7, while 89% of isolates from adults 65 years of age and older had serotypes covered by PPV23 (figure 2).

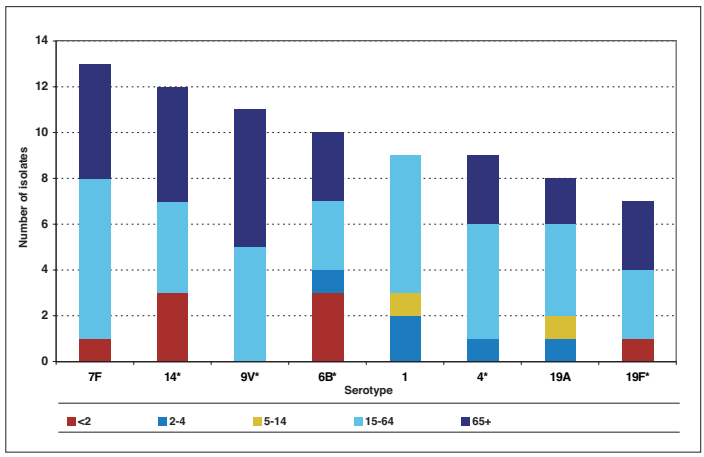

Figure 1. The eight most common serotypes of S. pneumoniae identified in Ireland by age group (years), April - September 2007 (n=79 of 129 isolates)

** Serotype covered by PCV7*

Penicillin non-susceptible *S. pneumoniae* (PNSP)

Seventeen of the isolates (13%) were PNSP. The serotypes associated with non-susceptibility to penicillin were 9V (n=8), 19F (n=4), 14 (n=3), 19A (n=1) and 6B (n=1). Seventy-two percent of

Continued page 4

Epidemiology of Verotoxigenic *E. coli* in Ireland, 2006

Introduction

Verotoxigenic *E. coli* (VTEC), and in particular *E. coli* O157, are an important cause of gastroenteric illness in Ireland. Unlike more common forms of gastroenteritis such as norovirus, illness can be very severe with up to 10% of patients developing haemolytic uraemic syndrome (HUS). The reported incidence in Ireland has risen from 2.4 per 100,000 in 2003 to 3.0 per 100,000 in 2005, with children most commonly affected and at higher risk of complications.[1] A small infective dose facilitates person-to-person transmission, both within households and in child-care facilities. Other important transmission routes include food (often minced beef products and most recently fresh produce such as lettuce and spinach), drinking water and contact with infected animals or contaminated environments.[2 3]

Materials and Methods

The case definition used for VTEC enhanced surveillance is available at (http://www.ndsc.ie/hpsc/A-Z/Gastroenteric/VTEC/SurveillanceForms/). Enhanced information was supplied by HSE personnel, and typing data were provided by the HSE Dublin Mid-Leinster Public Health Laboratory at Cherry Orchard Hospital. Clinicians were also requested to report suspected cases of VTEC i.e. cases of HUS or thrombotic thrombocytopenic purpura (TTP) of possible infective aetiology for which there was no laboratory or epidemiological evidence of VTEC infection. Data from the CSO 2002 census were used to calculate incidence rates for 2001-2003, and from the CSO 2006 census to calculate incidence rates for 2004-2006. Thus rates quoted for 2004 and 2005 may differ from those previously published.

Results

Incidence

In 2006, 153 confirmed and five probable cases of VTEC were notified to HPSC, a crude incidence rate (CIR) of 3.7 per 100,000 (table 1). This represents a 26% increase on the number of cases reported in 2005.

As in previous years, the most common serogroup reported was VTEC O157 (n=123) followed by VTEC O26 (n=31) (table 1). Three VTEC O157 cases were co-infected with non-O157 VTEC strains. Two confirmed VTEC O157 infections were due to sorbitol-fermenting *E. coli* O157, and one probable VTEC case was epidemiologically linked with these two cases. Although not notifiable, an additional four (HUS) cases without laboratory or epidemiological evidence of VTEC infection were reported as suspected VTEC cases.

Table 1. Number and CIR of confirmed and probable VTEC O157 and non-O157 VTEC, 1999-2006

Year	VTEC O157	CIR VTEC O157 (95% CI)	Non-O157 VTEC	CIR non-VTEC (95% CI)	Total	CIR Total (95% CI)
2001	52	1.3 (0.9-1.6)	N/A	N/A	N/A	N/A
2002	70	1.7 (1.3-2.2)	N/A	N/A	N/A	N/A
2003	88	2.2 (1.8-2.7)	7	0.2 (0.0-0.3)	95	2.4 (1.9-2.9)
2004	52	1.2 (0.9-1.6)	9	0.2 (0.1-0.4)	61	1.4 (1.1-1.8)
2005	108	2.6 (2.1-3.0)	17	0.4 (0.2-0.6)	125	3.0 (2.4-3.5)
2006	123[$]	2.9 (2.4-3.4)	35	0.8 (0.6-1.1)	158	3.7 (3.2-4.3)

[$] For simplicity, the 3 mixed O157/non-O157 infections are included in the rates calculated for VTEC O157 infections.

Table 2. Number of confirmed and probable VTEC cases by quarter and HSE area, CIR and ASIR by HSE area, 2006

	E	M	MW	NE	NW	SE	S	W	Total
Quarter									
Q1	2	0	0	0	1	1	0	2	**6**
Q2	8	9	4	2	3	0	2	11	**39**
Q3	11	8	10	15	5	2	5	10	**66**
Q4	9	1	7	4	0	6	8	12	**47**
Serogroup									
VTEC O157	22	17	18	17	0	9	12	25	**120**
Non-O157 VTEC	7	1	3	3	9	0	2	10	**35**
Mixed O157/ non-O157 infection	1	0	0	1	0	0	1	0	**3**
Total	**30**	**18**	**21**	**21**	**9**	**9**	**15**	**35**	**158**
CIR VTEC* (95% CI)	2.0 (1.3-2.7)	7.2 (3.9-10.5)	5.8 (3.3-8.3)	5.3 (3.1-7.6)	3.8 (1.3-6.3)	2.0 (0.7-3.2)	2.4 (1.2-3.6)	8.5 (5.7-11.3)	**3.7 (3.2-4.3)**

Regional and seasonal distribution

Regional variation was noted in the numbers of cases notified (table 2), with the highest incidence rates for VTEC overall in the HSE West and HSE Midland. The serogroup distribution in the North West differed from other areas. In the NW, VTEC O26 was the only serogroup reported, whereas VTEC O157 was consistently the most common VTEC reported in all other areas. In common with previous years, the highest number of cases was reported in quarter 3, although relatively high numbers of cases were also reported in quarter 4, in particular during October.

Age-sex distribution

Disease incidence was highest among young children (table 3), and there were similar numbers of male (n=81) and female (n=76) cases (for one case sex was unknown). In contrast to previous years, the age distribution of non-O157 cases more closely matched that for VTEC O157 cases, possibly reflecting improved awareness and diagnosis of non-O157 infections among adult patients.

Clinical features

Information on symptoms was available for 151 cases, of whom 109 (72%) were reported as symptomatic. Reported symptoms included bloody diarrhoea (n=58), and HUS in 17 cases. HUS cases ranged in age from 1 to 76 years, and as expected, a higher proportion of paediatric (14/95) than adult (3/63) cases developed HUS. Three HUS cases were associated with non-O157 VTEC (one confirmed O103, one confirmed O26 and one probable O26 case), and there was one HUS case with a mixed O157/O26 infection. No deaths were reported in 2006.

Phage and verotoxin typing

In 2006, 118 VTEC O157 isolates were referred to the HSE PHL Dublin Mid-Leinster, (table 4). As in previous years, PT32 was the commonest phage type reported (n=56), accounting for 47% of the VTEC O157 reported. The verotoxin profiles of VTEC strains were typical. Eighty seven per cent of VTEC O157 strains carried the genes for VT2 only while 13% carried the genes for both VT1 and VT2 (table 4). In contrast, 66% of non-O157 VTEC isolates carried the genes for VT1 only, 18% for VT2 only, and 16% VT1 and VT2.

Environmental investigations

Thirty VTEC outbreaks were reported this year, comprising 90 of the 158 confirmed and probable cases notified (table 5). Three outbreaks were described as general outbreaks and 27 as family outbreaks. Twenty five were due to VTEC O157 and five due to VTEC O26. The suspected modes of transmission reported are listed in table 5.

For one family outbreak and for one sporadic case in 2006, examination of water from the private wells of the affected households confirmed the presence of the *E. coli* O157 indistinguishable from the associated human isolates.

Table 3. Age distribution of confirmed and probable VTEC cases and age-specific incidence rate, 2006

Age group	VTEC O157	Non-O157 VTEC	Total	Age-specific incidence rate
<5 yrs	44	15	59	19.5
5-14 yrs	27	9	36	6.4
>=15 yrs	52	11	63	1.9
Total	123	35	158	3.7

Table 4. Verotoxin and phage typing results for VTEC isolates referred to the PHL HSE Dublin Mid Leinster, 2006

Serogroup	PT	VT1 only	VT2 only	VT1 & VT2	Total
O157	2	0	1	0	1
	8	0	2	11	13
	14	0	3	0	3
	31	0	7	0	7
	32	0	52	4	56
	34	0	2	0	2
	51	0	3	0	3
	21/28	0	29	0	29
	RDNC	0	3	0	3
	N/K	0	1	0	1
O26	-	19	6	6	31
O ungroupable	-	1	1	0	2
O103	-	2	0	0	2
O113	-	1	0	0	1
O115	-	1	0	0	1
O8	-	1	0	0	1
Total	**-**	**25**	**110**	**21**	**156**

Note that for one case diagnosed by serodiagnosis and five probable cases reported on the basis of epidemiological linkage, isolates were not available for typing. Table 4 includes all strains isolated from mixed VTEC infections.

Table 5. VTEC outbreaks by suspected mode of transmission, 2006

Suspected mode of transmission*	No. of outbreaks	No confirmed cases	No. ill
Animal contact	1	3	3
Person-to-person	5	21	8
Waterborne	1	2	2
P-P and foodborne	3	9	7
Foodborne	1	2	1
P-P and waterborne	1	3	2
Unknown/Not specified	18	50	43
Total	**30**	**90**	**66**

*P-P denotes person-to-person transmission

Discussion

In 2006, 158 confirmed and probable cases of VTEC were notified to HPSC, a CIR of 3.7 per 100,000. This is the highest annual total of VTEC infections reported since surveillance began in 1999, and represents a 26% increase on the number of cases reported in 2005. Ireland, along with the United Kingdom, has some of the highest reported incidence rates of VTEC infection in Europe.[4] The incidence rate for VTEC O157 of 2.9 per 100,000 in Ireland in 2006 compares with 4.8 per 100,000 in Scotland, 2.6 per 100,000 in Northern Ireland (provisional), and 1.9 per 100,000 in England and Wales.[5 6 7]

The rise in notifications in Ireland in 2006 was strongly influenced by the increased number of non-O157 infections reported compared to 2005 (35 vs. 17 cases). Since surveillance for non-O157 cases began in 2003, there has been a marked increase in the reported incidence of non-O157 infection, which almost certainly reflects increased awareness and improved diagnosis nationally of non-O157 infections. Interestingly, almost three-quarters of all non-O157 VTEC in 2006 were reported by three HSE areas (HSE W, HSE NE and HSE E). However, it should be noted that this variation could reflect either a true regional difference in the risk of infection or regional variation in laboratory diagnostic policy for non-O157.

For the second year running, cases of VTEC infection due to atypical sorbitol-fermenting VTEC O157 were reported. There were two confirmed cases and a third epidemiologically-linked HUS case from whom no VTEC was isolated. A number of human infections due to these atypical sorbitol-fermenting VTEC O157 strains were also reported in the UK in 2006, and they are an emerging concern in Europe, in particular, as they require different laboratory isolation techniques than typical non-sorbitol fermenting *E. coli* O157 strains.[8 9]

Person-to-person spread is an important mode of VTEC transmission in households, childcare facilities and institutions, and was suspected to have played a role in nine VTEC outbreaks in 2006. Hand hygiene advice and exclusion guidance are crucial measures in managing outbreaks in settings where vulnerable individuals are congregated.[10] During 2006, the Food Safety Authority of Ireland produced a leaflet for childcare facilities entitled '*E. coli* O157: protecting children in your care'.[11]

The second most common suspected mode of transmission reported in 2006 was food (four outbreaks), although no foods were found positive for VTEC during investigations. Confirmation of the role of food in small family outbreaks is difficult, as leftovers are rarely available for testing due to the potentially long interval between exposure and symptom onset. A growing number of foodborne VTEC outbreaks in the United States and Europe have been linked with fresh produce, in particular, lettuce and spinach.[2 12]

As in previous years, evidence was again obtained showing that untreated drinking water plays an important role in VTEC transmission in Ireland. There were two incidents where examination of water from the private wells of affected households confirmed the presence of *E. coli* O157 indistinguishable from the associated human isolates. Drinking water from untreated private water supplies remains an important risk factor for VTEC infection in Ireland.

Given the relatively high incidence of human VTEC infection in Ireland, a designated VTEC Reference Laboratory which is adequately resourced is essential. Sophisticated molecular typing tools employed by the DML PHL (such as pulsed field gel electrophoresis) are increasingly demonstrating their value in the investigation of outbreaks and clusters. Safeguarded resourcing of these essential elements of the service will ensure that the necessary surge capacity and responsiveness exists to effectively inform public health action during VTEC incidents.

P Garvey, P McKeown, HPSC; A Carroll, E McNamara, HSE DML PHL

Acknowledgements

The authors wish to acknowledge the co-operation of microbiologists, medical scientists, SMOs, SPHMs, surveillance scientists, infection control nurses, PEHOs, and EHOs in providing the information on which this report is based.

References

1. Garvey P *et al*. Epidemiology of Verotoxigenic E. coli in Ireland, 2005. *Epi-Insight* 2006; **7**(9): 2-3.
2. CDC. Ongoing multistate outbreak of Escherichia coli serotype O157:H7 infections associated with consumption of fresh spinach—United States, September 2006. *MMWR* 2006; **55**(38): 1045-6.
3. O'Connor DR. Report of the Walkerton Enquiry. Ontario: Ontario Ministry of the Attorney General, 2002. Available at http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/.
4. EFSA. The community summary report on trends and sources of zoonoses, zoonotic agents, antimicrobial resistance and foodborne outbreaks in the European Union in 2005. *The EFSA Journal* 2006; **94**: 3-288.
5. Locking *et al* Gastro-intestinal and foodborne infections (E .coli O157, salmonellas, animal salmonellas, campylobacter - provisional 2006 figures). *HPS Wkly Report* 2007. **41**(1): 3-5.
6. CDSC NI. Laboratory reports of Escherichia coli 0157 (all specimen types), 1995-2006, Northern Ireland. Available at http://www.cdscni.org.uk/surveillance/Gastro/Escherichia_coli_O_157.htm.
7. HPA. Vero cytotoxin-producing E. coli, England and Wales, 1982-2006. Available at http://www.hpa.org.uk/infections/topics_az/ecoli/O157/data_ew.htm.
8. Editorial Team. E. coli O157 infections in the UK. *Euro Surveill* 2006; **11**(6). E060601.2. Available at http://www.eurosurveillance.org/ew/2006/060601.asp#2.
9. Karch H, Bielaszewska M. Sorbitol-fermenting Shiga toxin-producing Escherichia coli O157:H(-) strains: epidemiology, phenotypic and molecular characteristics, and microbiological diagnosis. *J Clin Microbiol* 2001; **39**(6):2043-9.
10. HPSC. Report of the HPSC Sub-Committee on Verotoxigenic E. coli. Available at http://www.ndsc.ie/hpsc/A-Z/Gastroenteric/VTEC/Guidance/.
11. FSAI. 2006. E. coli O157: protecting children in your care. Available at http://www.fsai.ie/publications/leaflets/Ecoli_children.pdf.
12. CDC. Preliminary FoodNet data on the incidence of infection with pathogens transmitted commonly through food —– 10 States, 2006. *MMWR* 2007; **56**(14); 336-339.

Pneumococcal Typing in Ireland - A Pilot Project (continued)

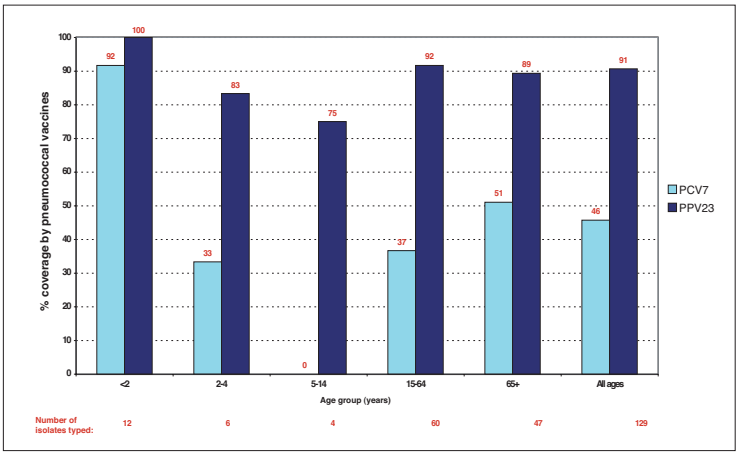

Figure 2. Proportion of typed S. pneumoniae isolates covered by the currently licensed pneumococcal vaccines.

Note: PPV23 not effective in children <2 years of age.

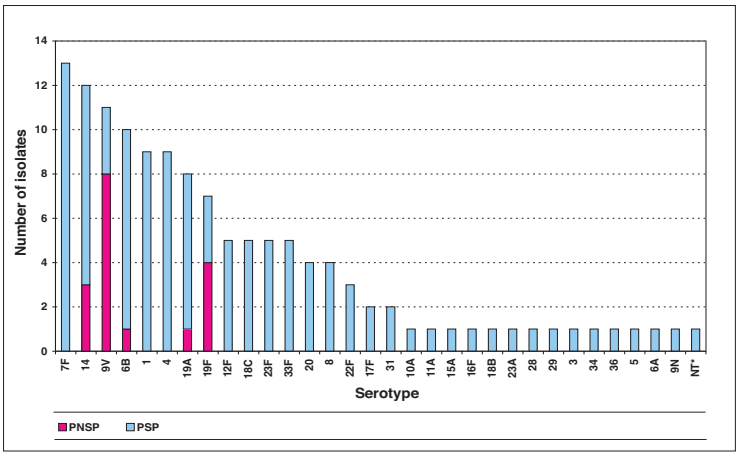

Figure 3. Number of S. pneumoniae isolates by serotype and penicillin susceptibility status in Ireland, April - September 2007 (n=129)

PNSP, penicillin-non-susceptible S. pneumoniae; PSP, penicillin-susceptible S. pneumoniae
**NT, non-typeable*

the *S. pneumoniae* 9V isolates were PNSP, whereas the proportion of resistant isolates ranged between 10-57% for the other serotypes (figure 3). One of the serotypes, 9V, is covered by both PCV7 and PPV23 and accounted for almost 50% (n=8/17) of all the PNSP isolates.

Discussion

Although the number of *S. pneumoniae* isolates typed is still relatively low, particularly in children, the first six months of this pilot typing project have produced useful results. In summary, some of the most common pneumococcal serotypes in circulation in Ireland are covered by PCV7. Ninety-two percent of serotypes infecting children aged <2 years are covered by this conjugate vaccine, while 89% of serotypes associated with disease in elderly adults aged 65 years and older are covered by PPV23. Serotype 9V, the strain most commonly associated with non-susceptibility to penicillin is covered by both pneumococcal vaccines.

Ireland requires good complete public health and laboratory surveillance data (including serotyping information) on an ongoing basis to fully understand the epidemiology of IPD in this country. Such information will be of vital importance in the lead up to and following the introduction of PCV7 in order to evaluate the impact of the intervention and to formulate future health policy as newer vaccines become available. To assist in this process laboratories are encouraged to submit invasive pneumococcal isolates for typing to RCSI/Beaumont Hospital and as specified in the Infectious Diseases (Amendment) Regulations 2003 to notify at least weekly the relevant department of public health of any IPD cases diagnosed.

This pilot typing project is to continue throughout 2008. The importance of establishing an appropriately resourced National Streptococcus Reference Laboratory in Ireland with ongoing funding cannot be over emphasised.

M Fitzgerald, S Murchan, S Cotter HPSC; I Vickers, M Cafferkey, Temple Street Hospital; H Humphreys, RSCI/Beaumont Hospital

Acknowledgements
The authors thank the laboratories who have to date participated in the project; your support is much appreciated. Thanks to everyone involved in the surveillance of IPD in Ireland.

The Five Nations Health Protection Conference

The Five Nations Health Protection Conference will take place on Tuesday 29th and Wednesday 30th April 2008 at the Sheraton Fota Island Hotel, Cork, Republic of Ireland.

The conference will address important public health issues that have arisen since the last meeting and provide fresh perspectives on established areas of disease prevention and control.

The conference committee can confirm that the keynote address is to be delivered by Dr Denis Coulombier, from ECDC. A draft programme of events is available at www.wales.nhs.uk/sites3/page.cfm?orgId=717&pid=21711.

Short papers will also be presented by those actively working in health protection. Papers and posters will be presented in the following sessions:

- **Making Surveillance Work:** What's the best way to count what counts?
- **Environmental Issues** - New challenges for health protection
- **Health Protection in Vulnerable People** - Prisons, schools etc.
- **Outbreak and Incidents:** Evidence or intuition?
- **Late Breakers & Hot Topics**
- **Poster Sessions** - Both days.

Submission of abstracts to the Late Breaker and Hot Topics session can be made via the 5 Nations Health Protection Conference website above before **Friday, 8th February 2008.**

To register to attend the conference, please go to the website above. The closing date for registration is **Friday, 11th April 2008**.

The conference organising committee is drawn from the Health Protection Agency in England, the National Public Health Service for Wales, CDSC in Northern Ireland, Health Protection Scotland, the Health Protection Surveillance Centre for the Republic of Ireland, and the Public Health Medicine Environmental Group.