9. Durmaz B, Durmaz R, Sahin K. Methicillin-resistance among Turkish isolates of Staphylococcus aureus strains from nosocomial and community infections and their resistance patterns using various antimicrobial agents. J Hosp Infect. 1997;37(4):325-9.
10. Kanj SS, Ghaleb PA, Araj GF. Glycopeptide and oxacillin activity against Staphylococcus aureus isolates at a tertiary care center in Lebanon. J Med Liban. 2004;52(1):8-12.
11. Tiemersma EW, Bronzwaer SLAM, Lyytikäinen O *et al*. Methicillin-resistant Staphylococcus aureus in Europe, 1999–2002. Emerg Infect Dis. 2004;10(9):1627-34.
12. EARSS Management Team. EARSS Annual Report 2004. Bilthoven: RIVM Netherlands 2005.
13. Bouchillon SK, Johnson BM, Hoban DJ *et al*. Determining incidence of extended spectrum beta-lactamase producing Enterobacteriaceae, vancomycin-resistant *Enterococcus faecium* and methicillin-resistant *Staphylococcus aureus* in 38 centres from 17 countries: the PEARLS study 2001-2002. Int J Antimicrob Agents. 2004;24(2):119-24.
14. El Kholy A, Baseem H, Hall GS, Procop GW, Longworth DL. Antimicrobial resistance in Cairo, Egypt 1999-2000: a survey of five hospitals. J Antimicrob Chemother. 2003;51(3):625-30.
15. Felmingham D, Gruneberg RN. The Alexander Project 1996-1997: latest susceptibility data from this international study of bacterial pathogens from community-acquired lower respiratory tract infections. J Antimicrob Chemother. 2000;45(2):191-203.
16. Bronzwaer SLAM. Streptococcus pneumoniae susceptibility data in Europe. In Bronzwaer SLAM. European antimicrobial resistance surveillance as part of a Community strategy. Amersfoort. 2003;51–76.
17. Colak D, Naas T, Gunseren F, Fortineau N, Ogunc D, Gultekin M et al. First outbreak of vancomycin-resistant enterococci in a tertiary hospital in Turkey. J Antimicrob Chemother. 2002;50(3):397-401
18. Scicluna EA, ,Borg MA, Bruinsma N et al. Validity of antimicrobial susceptibility results from 29 Mediterranean laboratories in the ARMed Project. Clin Microbiol Infec. 2005;11(S2):626
19. Kunin CM. Resistance to antimicrobial drugs--a worldwide calamity. Ann Intern Med. 1993. 118:557-61.
20. Shannon KP, King A, Phillips I, Nicolas MH, Philippon A. Importance of organisms producing broad-spectrum SHV-group beta- lactamases into the United Kingdom. J. Antimicrob. Chemother. 1990;25:343-51.
21. Issack MI, Shannon KP, Qureshi SA, French GL. Extended-spectrum _-lactamase in Salmonella spp. J Hosp Infect. 1995;30:319-21
22. Bernards AT, Frenay HM, Lim BT, Hendriks WD, Dijkshoorn L, van Boven CP. Methicillin-resistant *Staphylococcus aureus* and *Acinetobacter baumannii*: an unexpected difference in epidemiologic behavior. Am J Infect Control. 1998;26:544-51.
23. Bermudes H, Arpin C, Jude F, el-Harrif Z, Bebear C, Quentin C. Molecular epidemiology of an outbreak due to extended-spectrum beta-lactamase-producing enterobacteria in a French hospital. Eur J Clin Microbiol Infect Dis. 1997;16:523-9.
24. WHO Global Strategy for Containment of Antimicrobial Resistance. Geneva: World Health Organisation. 2001.

ORIGINAL ARTICLES

Surveillance report

HEALTHCARE ASSOCIATED INFECTIONS IN UNIVERSITY HOSPITALS IN LATVIA, LITHUANIA AND SWEDEN: A SIMPLE PROTOCOL FOR QUALITY ASSESSMENT

J Struwe[1,2], U Dumpis[3], J Gulbinovic[4], Å Lagergren[1,2], U Bergman[5]

Surveillance of healthcare associated infections is an overlooked parameter of good clinical practice in most healthcare institutions, due to the workload demanded in the absence of adequate IT-systems. The aim of the present study was to investigate whether a simple protocol could be used to estimate the burden of healthcare associated infections in three university hospitals in Huddinge in Sweden, Riga in Latvia and Vilnius in Lithuania and form the basis for initiating a long term follow up system.

The medical records of all patients receiving antibiotics were reviewed according to a standardised protocol, focusing on the indications for the drugs and on the frequency of hospital acquired infection (HAI) in a point-prevalence survey. Only comparable specialities were included.

The proportion of patients treated with antibiotics (prophylaxis not included) were 63/280 (22%) in Huddinge, 73/649 (11%) in Riga and 99/682 (15%) in Vilnius. The proportion of admitted patients treated for a HAI were 15%, 3% and 4%, respectively, (both comparisons Huddinge versus other centres P<0.001). Surgical site infections were most common, followed by infections with an onset more than 2 days after admission without any of the other registered risk factors present. Our inexpensive and simple method showed that healthcare associated infections were a significant problem among patients admitted to Huddinge. The figures obtained can be used for further discussion and form a baseline for follow up at the local level. The comparison of figures between centres was far less relevant than the process the study created.

Euro Surveill. 2006;11(7/8): 167-71 Published online July/August 2006

Key words: Healthcare associated infection, hospital acquired infection, antibiotics, quality assessment

1. Department of Clinical Bacteriology and Infection Control, Karolinska Institute, Karolinska University Hospital, Huddinge, Sweden
2. Department of Infectious diseases, Karolinska Institutet, Karolinska University Hospital, Huddinge, Sweden
3. Department of Epidemiology, Stradins University Hospital, Riga, Latvia
4. Department of Pathology, Forensic medicine, and Pharmacology, Vilnius University, Vilnius, Lithuania
5. Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska Institutet, WHO Collaborating Centre for Drug Utilisation Research and Clinical Pharmacological Services, Karolinska University Hospital, Huddinge, Sweden

Introduction

Despite its relevance, the surveillance of healthcare associated infections is overlooked as a parameter of good clinical practice in most healthcare institutions. Apart from purely scientific projects, most of which have time limits, most registration initiatives are hampered by the workload for data collection, administration, feedback and long term sustainability. When long term registration is started, it often relies on a few devoted enthusiasts, rather than a broad acceptance among clinicians. Some of the major obstacles are that the purpose and ambition is ill-defined, protocols and criteria are too extensive and, when computer-based medical records exist, integration with microbiological results is poor.

In order to estimate the burden of healthcare associated infections in Karolinska University Hospital, Huddinge, Sweden (Huddinge), and to initiate a system for follow up over the years, we recently made a survey using a rather simple protocol based on patients receiving antibiotic treatment [1]. The specific aims of the present study were to see whether our protocol was useful for the assessment of the

prevalence of antibiotic use and healthcare associated infections in university hospitals in adjacent countries, i.e. Stradins University Hospital in Riga, Latvia (Riga) , and Vilnius University Hospital in Lithuania (Vilnius). Furthermore we wanted to address some of the questions that had arisen from a previous study in Huddinge and Vilnius where we made the somewhat surprising finding that antibiotic resistance was higher in Vilnius despite higher antibiotic pressure in Huddinge [2]. That study raised the question that perhaps differences in duration of hospital stay, healthcare associated infection rates and infection control practices (in particular access to alcohol-based hand-disinfectants) and use of antibiotics outside the hospital could explain this unexpected finding.

Material

Huddinge, Riga and Vilnius all are tertiary care university hospitals with about 1000 beds each.

The infection control team in Huddinge consisted of one doctor specialising in clinical bacteriology, two infection control nurses and a hospital epidemiology team of one doctor (infectious disease specialist) one nurse and one molecular epidemiologist. There was an infection control committee, led by the chief medical officer, with about 15 representatives from major clinics, operation theatres, sterilisation unit and building and construction that meets twice yearly. The infection control team in Riga consists of one infectious disease consultant, one half time hospital epidemiologist and one nurse assistant. Clinical microbiology is not recognised as a speciality in Latvia and its responsibilities are divided between the microbiologists and the infectious disease consultant. Vilnius university hospital has an infection control department divided between the sections for disinfection, sterilisation and epidemiology. The epidemiology section is responsible for infection control, and has three epidemiologists and three nurses.

While therapeutic antibiotics can be given on clinical grounds by any doctor in all three hospitals, some substances are restricted to specialist use in Riga and Vilnius. Consultants in infectious disease are available in Huddinge and Riga. Huddinge has had a dedicated infection control programme since the year 2000 (including rational use of antibiotics), guidelines for rational antibiotic use were recently distributed in Vilnius, while no specific activities, other than occasional lectures, existed in Riga at the time of this survey.

Methods

A point-prevalence study was carried out so that every ward was visited once during May 2002. In order to avoid interference from public holidays, data were collected on Tuesdays, Wednesdays and Thursdays. All patients receiving antibiotics were identified. The authors reviewed the medical records according to the same protocol. If a patient was surveyed twice due to transfer between clinics (which was rare), only the first treatment episode was registered. Only infections treated with antibiotics were counted. The accuracy of the diagnosis made by the treating physician was not evaluated.

Based on the definition used by the Swedish National Board of Health and Welfare that a healthcare associated infection is 'any infection resulting from any treatment or investigation associated with health care, regardless of whether the causing agent originates from the patient or the hospital environment' [3], the following definitions for healthcare associated infections were used in this study:

- Surgical site infections (SSI): Infection in a surgical site within 30 days of surgery (within one year after implant surgery).
- device-related infections: infections associated with intravascular or urinary catheters or any other foreign material
- antibiotic associated diarrhoea (AAD): diarrhoea starting after admission, and after beginning treatment with antibiotics, with or without a positive test for *Clostridium difficile*
- neutropenic fever/ septicaemia associated with immune suppressive therapy in a patient with a neutrophil granulocyte count of less than 0.5 x 109/l.
- infections with onset more than 2 days after admission due to a non-infectious cause.

Access to hand disinfectants was calculated as the number of dispensers in patient rooms (or by the entrance of the room) divided by the number of patient beds.

Since no patient identification was collected and the surveillance was part of the quality assurance, approval of ethics committees was not considered necessary.

Results

During the year of the study (January-December 2002), the total number of admitted patients and bed-days were 46 063 and 220 453 in Huddinge, 35 421 and 293 375 in Riga, and 28 737 and 295 990 in Vilnius, respectively. This corresponds to an average hospital stay of 4.8, 8.3 and 10.3 days per patient, respectively

Table 1 show the number and proportions of patients treated with antibiotics for community acquired (CI) and healthcare associated infections (nosocomial infections, NI) in the hospitals. The comparable clinics accounted for 280/679 (41%) of all patients admitted at the time for the survey at Huddinge, 649/938 (69%) in Riga and 682/850 (80%) in Vilnius. The mean age of patients treated with antibiotics in the comparable departments was 61 years (range 0-82) in Huddinge, 56 years (range 0-99) in Riga and 53 years (range 0-88) in Vilnius. The mean duration of stay in the hospital before survey was 10 days (range 1-57) in Huddinge, 9 days (range 1 - 76) in Riga and 13 days (range 1-86) in Vilnius.

The proportion of patients treated with antibiotics in comparable departments was significantly higher in Huddinge, 63/280 (22%), compared to 73/649 (11%) in Riga and 99/682 (15%) in Vilnius, $P<0.001$, respectively. The rate of NIs was also significantly higher in the departments investigated at Huddinge (42/280, 15%) than in Riga (22/649, 3%) and in Vilnius (27/682, 4%), $P<0.001$, respectively. There was no significant difference between Riga and Vilnius with regard to proportions of treated patients and patients with NIs. Intensive care units and transplantation clinics had the highest rates of NIs in all hospitals. In Huddinge and Riga, nephrology also had comparatively high rates (40% and 24% respectively), whereas thoracic surgery had the highest rate in Vilnius (10%).

Surgical site infections were the quantitatively most important NI in all hospitals, and in Vilnius accounted for over 70% of all NIs [FIGURE]. New symptoms of infection appearing more than two days after admission without any other obvious reason was another common type of NI at Huddinge and Riga.

The prevalence of dispensers for alcohol-based hand disinfection in comparable departments was highest in Huddinge, 263/325 beds (81%) compared to 27/769 (4%) in Riga and 161/754 (21%) in Vilnius [TABLE 2].

Discussion

One of our aims in this first international survey of healthcare associated infections in Latvia, Lithuania and Sweden was to test a simple tool for quality assessment, which does not request major human and financial resources. All participants agreed that the protocol was useful even if the obtained figures should be interpreted carefully. In a comparative study between the Netherlands and Belgium, one of the major conclusions was that even though comparison of crude infection rates did not seem meaningful due to differences in the case mix, patient turnover and post-discharge surveillance, international comparisons yield 'interesting insights regarding quality of care' [4]. We agree with this and think that although it was useful to compare experiences during the process, and valuable discussions were held while interpreting the results, the figures we obtained are mainly useful for comparison and analysis at the local level.

Our present finding of prevalence's of healthcare associated infections of 15% among the included clinics in Huddinge, 3% in Riga and 4% in Vilnius, shows that antibiotic treatment of healthcare associated complications was a significant problem, at least in Huddinge. The figures from this study confirm the magnitude of the problem from previous surveys when the same protocol was used in Huddinge one year earlier. At that time 11% of the inpatients were

Table 1

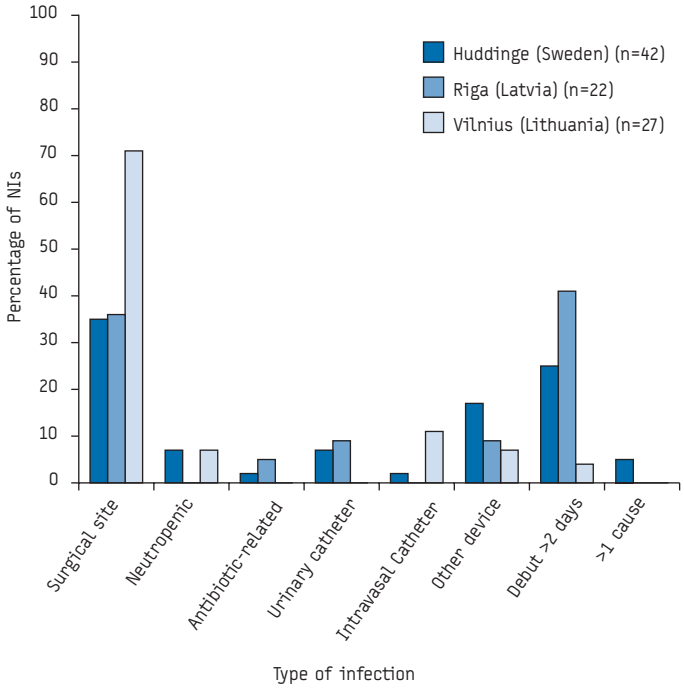
Proportion of patients treated with antibiotics for a nosocomial infection (NI) in three university hospitals in Sweden, Latvia, and Lithuania

	Huddinge (Sweden)				Riga (Latvia)				Vilnius (Lithuania)			
Comparable departments	NI	(%)	treated/ admitted	(%)	NI	(%)	treated/ admitted	(%)	NI	(%)	treated/ admitted	(%)
Abdominal surgery	1	(3)	5/40	(13)	3	(4)	7/72	(10)	3	(4)	9/75	(12)
Cardiology	2	(6)	3/36	(8)	1	(1)	7/166	(4)	0	(0)	2/120	(2)
Gastroenterology	5	(33)	6/15	(40)	0	(0)	3/48	(6)	0	(0)	3/45	(7)
Gynaecology	1	(13)	1/8	(13)	1	(3)	2/29	(7)	0	(0)	0/17	(0)
Intensive care unit												
-General	4	(50)	6/8	(75)	3	(38)	4/8	(50)	3	(33)	6/9	(67)
-Thoracic	2	(50)	2/4	(50)	0	(0)	0/6	(0)	2	(10)	2/20	(10)
Nephrology	8	(40)	10/20	(50)	5	(24)	5/21	(24)	0	(0)	3/37	(8)
Neurology	2	(4)	5/45	(11)	0	(0)	0/41	(0)	0	(0)	3/51	(6)
Otolaryngology	1	(7)	3/14	(21)	0	(0)	5/24	(21)	1	(2)	14/49	(29)
Pulmonology	2	(18)	4/11	(36)	1	(2)	17/57	(30)	0	(0)	22/48	(46)
Rehabilitation	0	(0)	0/15	(0)	0	(0)	1/46	(2)	1	(7)	2/15	(13)
Thoracic/cardiac surgery	2	(14)	2/14	(14)	5	(6)	8/87	(9)	12	(10)	18/126	(14)
Transplantation	10	(32)	10/31	(32)	3	(18)	3/17	(18)	3	(20)	3/15	(20)
Urology	2	(11)	5/19	(26)	0	(0)	11/27	(41)	2	(4)	12/55	(22)
Subtotal comparable departments	42	(15)	63/280	(22)	22	(3)	73/649	(11)	27	(4)	99/682	(15)
Subtotal of all other departments	49	(12)	122/399	(30)	14	(5)	31/289	(11)	3	(2)	6/168	(4)
Total entire hospitals	**91**	**(13)**	**185/679**	**(27)**	**36**	**(4)**	**104/938**	**(11)**	**30**	**(4)**	**105/850**	**(12)**

being treated with antibiotics for a healthcare associated infection [1]. In 2001, using British National Prevalence Survey definitions, 4.1% of inpatients in Riga were found to have a healthcare associated infection [5,6]. The rate of healthcare associated infections, which we found in Lithuania, was lower than the 9.2% previously reported from other Lithuanian university hospitals using the above mentioned British criteria [5,7]. In studies from the other Nordic countries, a nationwide Norwegian survey in mixed types of hospitals showed a prevalence of 6.1% [8]. In iterated surveys of Norwegian university hospitals the rate has been 6-9.1% [9,10] while prevalence's of 10.4 % and 12.1% were found in Danish surveys of a mix of hospitals and clinics [11]. In surveys of university hospitals in other European countries, where somewhat different criteria and methods have been used, prevalence rates ranging from 4.3% to 13.5 % have been reported [12-16]. Though these figures cannot be adequately compared due to variation in criteria and case mix between the studies, they still illustrate that the numbers obtained with our protocol seemed to be in a reasonable order of magnitude. We, like others [17], do not think that extension of a survey beyond one day significantly affected our data quality.

Figure

Relative occurence of different nosocomial infections (NIs) in comparable departments in three university hospitals in Sweden, Latvia, and Lithuania



Contrary to expectations, we found that the prevalence of healthcare associated infections was higher in Huddinge than in Riga and Vilnius, despite Huddinge's better facilities and infection control resources. The climate in all three countries is quite similar. There were no registered epidemics at the time of the survey. There was no major difference in demographic characteristics of patients. All three hospitals are referral centres for complicated cases. Furthermore, the survey was performed by a small number of experienced investigators at the same time of the year (May). Thus, we do not believe that any of these factors were related to the differences. Although our attempt to record risk factors as indicators of the severity of the patients' illnesses failed, our impression was that the shorter mean admission time at Huddinge meant that the patients were more severely ill when discharged, while comparatively healthier patients were admitted to hospital more easily in Riga and in Vilnius. Furthermore, while high levels of C-reactive protein (CRP) per se, without focal symptoms or clinical findings, was probably too frequent an indication for treatment with antibiotics in Huddinge, the limited use of CRP in Riga and Vilnius might, rightly or wrongly, spare some patients from antibiotic treatment. Testing a scoring system for rational antibiotic prescribing might be a useful quality indicator for future studies [16]. Absence of restrictions may further have contributed to a more liberal use of antibiotics at Huddinge.

Based on our previous finding that antibiotic resistance was higher in Vilnius despite lower antibiotic pressure [2], we thought that inferior hygienic routines and lower compliance for hand disinfection might be an explanation. In this study, however, the rate of healthcare associated infections was higher in Huddinge despite easier access to hand disinfectants, a factor that has been proven to reduce the rate of NIs [18]. However, due to the lack of hand washing basins, staff in Riga and Vilnius is instead encouraged to use pocket containers of alcohol containing solutions. As such containers were not registered in the survey, the difference in availability may actually not be as big as it seems. One way to assess the relative importance of insufficient hygiene practices would be to detect clonal spread by epidemiological typing of prospectively collected bacterial isolates.

Table 2

Number of available beds in comparable and non-comparable clinics, and percentage of beds with dispenser for alcohol based hand disinfectants in university hospitals in Sweden, Latvia, and Lithuania

	Huddinge (Sweden)		Riga (Latvia)		Vilnius (Lithuania)	
	Hand disinfection/ available beds	(%)	Hand disinfection/ available beds	(%)	Hand disinfection/ available beds	(%)
Comparable departments						
Abdominal surgery	38/38	(100)	0/101	(0)	26/90	(29)
Cardiology	39/47	(83)	13/195	(7)	8/117	(7)
Gastroenterology	9/47	(50)	0/50	(0)	4/50	(8)
Gynaecology	15/15	(100)	0/39	(0)	1/28	(4)
Intensive care unit						
-General	8/8	(100)	4/10	(40)	5/12	(42)
-Thoracic	4/4	(100)	3/9	(33)	15/20	(75)
Nephrology	20/20	(100)	1/26	(4)	1/40	(3)
Neurology	35/54	(65)	0/48	(0)	2/64	(3)
Otolaryngology	10/26	(38)	0/35	(0)	9/45	(20)
Pulmonology	12/14	(86)	0/65	(0)	4/55	(7)
Rehabilitation	8/16	(50)	0/45	(0)	2/18	(11)
Thoracic/cardiac surgery	17/17	(100)	1/96	(1)	62/143	(43)
Transplantation	26/26	(100)	5/20	(25)	12/22	(55)
Urology	22/22	(100)	0/30	(0)	10/50	(20)
Subtotal comparable departments	263/325	(81)	27/769	(4)	161/754	(21)
Subtotal of all other departments	326/441	(74)	11/301	(4)	18/172	(10)
Total entire hospitals	**589/766**	**(77)**	**38/1070**	**(4)**	**179/926**	**(19)**

We believe that restricting surveillance to patients receiving antibiotic treatment is justified if one is satisfied with detecting the most significant bacterial infections, rather than aiming to pinpoint the true prevalence of all healthcare associated infections. Although others have pointed out that as many as 6% of infections are missed [19], we believe that the advantages out rule the disadvantages when resources are limited. The patients are easy to identify (even if there are a few cases with poor documentation, leading to difficulties in distinguishing treatment from prolonged prophylaxis), the workload is smaller, since, in our experience, only 10%-40% of all admitted patients need to be surveyed. Furthermore, the need for training of those who register is less extensive. Our model, in which representatives from the infection control team and consultants in infectious disease performed the survey, created an additional opportunity to pick up questions related to antibiotic treatment or infection control when making rounds of the wards, a measure which has been proven to contribute to lower infection rates [20]. Important limitations were that neither untreated infections nor healthcare associated infections treated with antiviral or antifungal therapy were included. This risk for underestimating the true prevalence might be overestimated by the fact that we did not evaluate the accuracy of the indications for antibiotic treatment, which were probably too broad. Finally, our inclusion of all neutropenic fevers regardless of duration of hospital stay, culture findings and port of entry, led to a higher number of healthcare associated cases than would have been included by criteria used in other studies.

We conclude that our methodology with a simple protocol for point-prevalence surveys of antibiotic treatment and healthcare associated infections was applicable in three countries with differing economic circumstances. We think that direct comparisons of infection rates between countries should be interpreted with caution, because of the different organisation of hospital healthcare systems, but that such comparisons can nevertheless give rise to valuable discussions and contribute to identifying problematic areas in different countries. Our simple approach makes repeated studies easy to perform with limited economic and human resources. Such repeated procedures could be used for internal quality assurance in the long term.

Acknowledgements:

The study was supported by grants from the East Europe Committee of the Swedish Health Care Community (SEEC), the study at Huddinge, Sweden, also by the Swedish Strategic Programme for the Rational Use of Antimicrobial Agents (STRAMA, http://en.strama.se/dyn/,84,,.html).

A copy of the protocol can be obtained from the authors on request.

References

1. Struve J, Sjögren A. Every tenth hospitalized patient is given antibiotics for a nosocomial infection. Läkartidningen. 2002;32-33:3211-213. (In Swedish, English abstract).
2. Gulbinovic J, Myrback KE, Bytautiene J, Wettermark B, Struwe J, Bergman U. Marked differences in antibiotic use and resistance between university hospitals in Vilnius, Lithuania, and Huddinge, Sweden. Microb Drug Resist. 2001;7(4):383-9.
3. Swedish National Board of Health and Welfare:SoS-report 1998:19 Health-care related infection. (In Swedish).
4. Mertens R, Van den Berg JM, Veerman-Brenzikofer ML, Kurz X, Jans B, Klazinga N. International comparison of results of infection surveillance: The Netherlands versus Belgium. Infect Control Hosp Epidemiol. 1994;15:574-8.
5. Meers PD, Ayliffe GAJ, Emmerson AM, Leigh DA, Mayon-White RT, Mackintosh CA, Stronge JL. Report on the national survey of infections in hospitals, 1980. J Hosp Infect. 1981;2 (Suppl.) 1-53.
6. Dumpis U, Balode A, V_gante D, Narbute I, Valinteliene V, P_rags V, Martinsons A, and Vingre I. Prevalence of nosocomial infections in two Latvian hospitals. Euro Surveill. 2003;8(3):73-8.
7. Valinteliene R, Jurkuvenas V, Jepsen OB. Prevalence of hospital-acquired infection in a Lithuanian hospital. J Hosp Infection 1996;34:321-9.
8. Scheel O, Stormark M. National prevalence survey on hospital infections in Norway. J Hosp Infect. 1999;41(4):331-5.
9. Andersen BM, Ringertz SH, Gullord TP, Hermansen W, Lelek M, Norman BI, Nystad MT, Rod KA, Roed RT, Smidesang IJ, Solheim N, Tandberg S, Halsnes R, Wenche Hoystad M. A three-year survey of nosocomial and community-acquired infections, antibiotic treatment and re-hospitalization in a Norwegian health region. J Hosp Infect. 2000;44(3):214-23.
10. Berild D, Ringertz SH and Lelek M. Appropriate antibiotic use according to diagnoses and bacteriological findings: Report of 12 point-prevalence studies on antibiotic use in a university hospital. Scand J Infect Dis. 2002;34(1):56-60
11. Jepsen OB, Mortensen N. Prevalence of nosocomial infections and infection control in Denmark. J Hosp Infect. 1980;153°:237-44
12. EPINE Working Group. Prevalence of hospital acquired infections in Spain. J Hosp Infect 1992;20:1-13

13. Emmerson AM, Enstone JE, Griffin M, Kelsey MC, Smyth ET. The Second National Prevalence Survey of infection in hospitals--overview of the results. J Hosp Infect. 1996;32(3):175-90.
14. Gastmeier P, Kampf G, Wischnewski N, Hauer T, Schulgen G, Schumacher M, Daschner F, Ruden H. Prevalence of nosocomial infections in representative German hospitals. J Hosp Infect. 1998;38(1): 37-49
15. Gikas A, Pediatitis I, Roumbelaki M. Repeated multi-centre prevalence surveys of hospital-acquired infection in Greek hospitals. CICnet. Cretan Infection Control Network. J Hosp Infect. 1999;41(1): 11-8.
16. Vlahovic-Palcevski V, Francetic I, Palcevski G, Novak S, Bergman U. Antimicrobial prescribing at a university hospital: justified or 'just in case':testing a new scoring system as a key quality indicator. Pharmacoepidemiol Drug Saf. 2005;14(8):561-6.
17. Harbarth S, Ruef C, Francioli P, Widmer A, Pittet D. Nosocomial infections in Swiss university hospitals: a multi-centre survey and review of the published experience. Swiss-Noso Network. Schweiz Med Wochenschr. 1999;129(42):1521-8.
18. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, Perneger TV. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Infection Control Programme. Lancet. 2000;356(9238):1307-12.
19. Gastmeier P, Brauer H, Hauer T, Schumacher M, Daschner F, Ruden H. How many nosocomial infections are missed if identification is restricted to patients with either microbiology reports or antibiotic administration? Infect Control Hosp Epidemiol. 1999;20(2):124-7.
20. Haley RW, Culver DR, White JW, Morgan WM, Emori TG, Munn VP, Hooton TM. The efficacy of infection control programs in preventing nosocomial infections in U.S. hospitals. Am J Epidemiol. 1985;121(2):182-205

ORIGINAL ARTICLES

Euroroundup

PNEUMOCOCCAL DISEASE SURVEILLANCE IN EUROPE

RG Pebody[1], W Hellenbrand[2], F D'Ancona[3], P Ruutu[4], on behalf of the European Union funded Pnc-EURO contributing group*

Pneumococcal disease (Pnc) is responsible for invasive pneumococcal disease (IPD) – mainly meningitis and septicaemia - and is an infection of public health importance in Europe. Following the licensure of an effective conjugate vaccine (PCV) in Europe, several European countries, including France, Germany, the Netherlands, Norway, Spain and the United Kingdom, are introducing universal Pnc childhood immunisation programmes. As part of a European Union (EU) funded project on pneumococcal disease (Pnc-EURO), a questionnaire was distributed in late 2003 to each of the current 25 European Union member states as well as Norway and Switzerland to get a clearer picture of national surveillance for invasive pneumococcal disease (IPD) in Europe. All respondents were contacted in 2006 and asked to provide an update to the questionnaire.

Twenty two of the 27 countries targeted completed and returned the questionnaire. Four of the 22 responding countries have no reporting requirement for IPD. Eighteen countries reported a total of 27 national surveillance systems. Case definitions employed in these systems differed. Fourteen of the 18 countries reported collection of IPD strains to a single reference lab for serotyping and in 12 countries to a single laboratory for susceptibility testing. Thirteen countries undertook laboratory quality assurance. Information on age and sex were widely collected, but only 11/27 systems collected information on pneumococcal polysaccharide vaccine status, while 5/27 systems collected information on pneumococcal conjugate vaccine status. The incidence of IPD reported in each of the 18 countries ranged from 0.4 to 20/100 000 in the general population, with a total of 23 470 IPD cases reported over a 12 month period. Surveillance for IPD in Europe is very heterogeneous. Several countries lack surveillance systems. Large differences in reported disease incidence may reflect both true differences, and also variations in patient and healthcare factors, including surveillance. If IPD surveillance in Europe can be strengthened, countries will be able to make informed decisions regarding the introduction of new pneumococcal vaccines and also to monitor and compare the impact and effectiveness of new programmes.

Euro Surveill. 2006;11(9): 171-8 Published online September 2006

1. Health Protection Agency, London, England
2. Robert Koch-Institut, Berlin, Germany
3. Istituto Superiore di Sanità, Rome, Italy
4. Kansanterveyslaitos, Helsinki, Finland

Key words: Invasive pneumococcal disease, surveillance systems, conjugate and polysaccharide vaccines

Introduction

Pneumococcal disease (Pnc) has been highlighted as an infection of public health importance in Europe [1]. It has a wide range of clinical manifestations, particularly in young children and older persons. These range from less frequent invasive disease (IPD), presenting mainly as meningitis and septicaemia, to more common but generally non-invasive conditions such as pneumonia, sinusitis and otitis media. Increasing antimicrobial resistance, particularly to penicillin and erythromycin, has occurred in certain parts of Europe [2]. However, the true burden due to pneumococcal disease in Europe is uncertain. Differences in the incidence of IPD have been well-documented, and explained (at least partly) by patient and healthcare factors such as blood culture practice and pre-admission antibiotic administration [3].

A 23-valent Pnc polysaccharide vaccine (PPV) was licensed in Europe during the 1980s and targeted at groups at higher risk of invasive pneumococcal disease. In recent years, many European countries have introduced PPV into national immunisation schedules for all elderly people [4]. A new 7-valent Pnc conjugate vaccine (PCV) has been recommended in the United States national immunisation programme for all children since 2000, where reductions in IPD due to vaccine serotypes in both vaccinated and - indicative of a herd immunity effect - in older, unvaccinated cohorts have been observed [5,6]. In the US, there is now increasing evidence of the emergence of non-vaccine serotypes ('serotype replacement') for both invasive and non-invasive disease [6,7,8]. In 2001, PCV was licensed in Europe [9]. At first, a number of European countries introduced PCV for children at higher risk of Pnc disease [4]. More recently, several countries in Europe, including Norway [10], France [11], Germany [12], the Netherlands [13], Spain and the UK [14], have introduced or are planning to introduce PCV into their routine childhood immunisation programmes. Programmes vary both in the number of doses recommended in the primary course (two doses in UK and Norway versus three in France, Germany and the Netherlands), the age of administration (3 and 5 months in Norway and 2, 3 and 4 months in France, Germany and the Netherlands), the use of a catch up campaign (e.g. UK) and co-administration with other vaccines.

One of the main objectives of the EU funded project, Pneumococcal Disease in Europe (Pnc-Euro) was to establish the epidemiology of *Streptococcus pneumoniae* in a variety of European countries prior to