Editorial

Infection Control and Hospital Epidemiology Outside the United States

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Florence Nightingale (1820-1907) is considered the first infection control (IC) nurse.[1] Her work with the epidemiologist William Farr in England was one of the first examples in history demonstrating the effectiveness of close collaboration between IC nurses and hospital epidemiologists. Another very important European contribution to the science of IC was that of Ignaz F. Semmelweis of Vienna, Austria, who demonstrated in 1847 the impact of hand antisepsis on cross-infection and maternal death from puerperal fever.[1]

Readers may have noticed that many of the articles in the January issue are from countries outside the United States. This was not the result of any effort of the editors to cluster international contributions, but rather a simple chance event that reflects the increasing number of quality submissions from international authors.

In the United States, landmark studies by Haley et al[2] in the 1970s triggered the rapid evolution of IC in the clinical setting. Ongoing surveillance of nosocomial infections (NIs) then was initiated and was stimulated further when IC and surveillance activities were mandated by the Joint Commission for the Accreditation of Healthcare Organizations. The implementation of diagnosis-related groups added a financial incentive to reduce the incidence of NIs.

In contrast, routine surveillance and large-scale trials to limit the incidence of NIs were not performed in Europe in the 1970s. IC efforts in Europe and other countries rely primarily on the microbiology laboratory and hospital hygiene. IC often is not mandatory. Most hospitals outside the United States still are reimbursed based on a fee for service or on days of hospitalization. Therefore, these countries lack financial incentives to reduce NI rates. However, morbidity and mortality associated with NIs are well-recognized problems in non-US countries. In Europe, the rapidly evolving healthcare system awaits changes such as those observed in the late 1980s in the United States that will add a financial incentive to combat NIs.

Human and financial resources allocated to IC have increased markedly in Western Europe. In Germany, a national reference center for NIs was created in the early 1990s (Nationales Referenzzentrum für Krankenhaushygiene in Berlin and Freiburg). The Netherlands relies on a sophisticated network for IC linking all teaching hospitals. In Belgium, the Institut Scientifique de la Santé Publique Louis Pasteur provides scientific support for hospital epidemiology activities. Moreover, the Association Belge pour l'Hygiène Hospitalière (IC nurses) and the Groupement pour le Dépistage, l'Etude et la Prévention des Infections Hospitalières (IC doctors) are working together to conduct surveillance and promote IC nationwide.

A first national study of the prevalence of NIs in the United Kingdom was conducted in 1980. An audit coordinated by the Public Health Laboratory Service in Colindale (London) and funded by the Department of Health was conducted from 1993 to 1994 with the objectives of developing a national database and IC practice guidelines that could be used by National Health Service, private, and voluntary hospitals. Local surveillance and control of NIs is the current practice in the United Kingdom. A recent report by a combined working party could be given as an example of a trend toward a global and nationwide approach to IC.[3] Currently, the Nosocomial Infection National Surveillance Scheme (NINSS) is being established by the Public Health Laboratory Service to develop surveillance of NI in the health service.[4]

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TABLE

PUBLISHED NATIONAL RULES AND EFFECTIVE OR EXPECTED HUMAN RESOURCES FOR INFECTION CONTROL IN WESTERN EUROPEAN COUNTRIES

Country	Infection Control Nurse	Infection Control Doctor	Infection Control Committee	Surveillance for Nosocomial Infections	Standards, Laws, Regulations, and Guidelines
Belgium	1 per 1,000 points.[a]	1 per 2,400 points.[b]	1 per hospital.[c]	National surveillance program.[d] Prevalence study in 1984[e] and others.	National decrees in 1974,[f] 1987,[g] and 1988.[h] Recommendations on different subjects by Public Health Council.[5]
Denmark	No data.	1 for whole country.[i]	1 per hospital.[j]	Computer-based surveillance.[k]	National guidelines and quality audits on IC.[l]
Finland	Approximately 1 per 500 beds.[m]	None.[n]	1 per hospital.[o]	Surveillance in all hospitals.[p]	Manual.[q]
France	1 per 400-500 beds.[r]	1 per 800-1,000 beds.[r]	1 per hospital.[s]	Surveillance for risk situations and several prevalence studies.[t]	National law and 5-year program.[u]
Germany	1 per 300 beds.[v]	1 per 450 beds.[v]	1 per hospital.[v]	National prevalence study, 1994.[17] National surveillance system.[w]	Guidelines.[x] IC law in preparation.
Great Britain	1 per 477 beds.[y]	1 per hospital.[z]	1 per hospital.[aa]	Various forms of continuous surveillance and national prevalence studies.[bb]	National standard and guidelines.[cc]
Iceland	1 per 250 beds.[dd]	1 per hospital.[dd]	1 per hospital.[dd]	Surveillance of surgical-wound and bloodstream infections.[dd]	National guidelines.[dd]
The Netherlands	1 per 250 beds.[ee]	1 per 1,000 beds.[ff]	1 per hospital.[gg]	Continuous surveillance in every hospital.[hh]	National handbook and guidelines.[ii]
Norway	1 per 300-400 beds.[jj]	In three of five regions there is an ICD.[kk]	No data.	Prevalence studies. Incidence studies since 1997.[ll]	Regional guidelines.
Spain	1 per 550 beds.[mm]	No data.	No data.	Several national prevalence studies.[33]	Guidelines and a consensus paper.[nn]
Sweden	Approximately 60 in the whole country.[oo]	10-15 hospital epidemiologists in the whole country.[oo]	1 per hospital.[pp]	Prevalence studies.[qq]	"Memorandum" about IC quality indicators.[rr] Regional guidelines.
Switzerland	1 per 625 beds in university hospitals.[ss]	1 in 4 of 5 university hospitals.[ss]	1 in 4 of 5 university hospitals.[ss]	First national prevalence study in 1996.[tt]	No official guidelines or regulations.

Abbreviations: IC, infection control; ICC, infection control committee; ICD, infection control doctor; ICN, infection control nurse.

Note: data in the Table are derived from published material and structured interviews with key representatives or international colleagues.

a The number of beds is multiplied by a risk factor for each bed as follows: general ward=1; pediatric and maternal ward=1.5; surgical ward and neonates=2; intensive-care unit=3. Training consists of 150 hours of courses and 100 hours of practical work. IC teams are reimbursed by the state.[5]

b Three hundred hours of postgraduate training.[5]

c Obligatory since 1974.[6]

d Surveillance is mandatory for every hospital since 1974.[6]

e National Program for the Surveillance of Hospital Infections of the Federal Institute of Hygiene and Epidemiology. In 1984, nationwide prevalence study on postoperative wound infections, nosocomial urinary tract infections, and nosocomial bloodstream infections in surgical- and intensive-care patients.[7]

f Every hospital is obliged to set up an ICC.[6] In a survey in 1980, the committee existed only on paper in 23.5% of hospitals.[8]

g The medical director has the legal responsibility to take initiatives aimed at promoting and evaluating the quality of care in his hospital, including IC measurements.[9]

h There must be four authorities active in every healthcare institution to promote IC: the hospital director, an ICD, an ICN, and an ICC.[10]

i One hospital epidemiologist in the Statens Serum Institute in Copenhagen. The head of the microbiology department of each section is responsible for IC in his or her county.[11]

j Every hospital has either an ICC or an "infection control group."[11]

k Of all surgical wards, 80% participate in a computer-based surveillance run by the Statens Serum Institute; 20 orthopedic and obstetric-gynecologic units record and share their surveillance data.[11]

l Guidelines by the Central Infection Control Department of the Statens Serum Institute.[12] Three hospital system audits on structure, process, and outcome indicators run by the Statens Serum Institute.[11]

m The declared aim is to have one infection control nurse per 250 beds. Training of some ICN through two 8-week courses at the Nordic School of Public Health, Göteborg, Sweden. Link nurses on some wards.[11]

n The work is done by an infectious disease specialist and well-trained ICNs. The recommendation by the Finnish Medical Board in 1981 to create jobs has not been followed yet.[11]

o All larger hospitals have an ICC.[11]

p Larger hospitals follow 1981 recommendations by the Finnish Society for Hospital Infection Control for continuous surveillance; smaller hospitals concentrate on targeted surveillance.[11]

q Manual *Prevention of Infections in Hospitals*, with recommendations and guidelines first published in 1980 by the Finnish Society for Infection Control.[13]

r Recommendation by the Central Committee for Nosocomial Infections (Comité Technique national de l'Infection Nosocomiale, CTIN).[14]
s Mandatory by law since 1988. Local ICCs are assisted by a central committee for technical support and inter-regional committees.[14]
t Since 1996, national recommendations for continuous surveillance of risk situations in all hospitals. First prevalence study in 1990 in 40 hospitals; national prevalence study in 1996.[14]
u National law regulates IC. In 1994, the Minister of Social Affairs (Ministère des Affaires Sociales de la Santé et de la Ville) proposed a 5-year program to reduce nosocomial infections by 30% and to reduce resistance to antimicrobials.[14]
v Staffing according to guidelines.[15] In 1993, an evaluation of 2,034 German hospitals demonstrated that 35% of all hospitals have a hospital epidemiologist, 66% have an ICN, 86% an ICD, and 81% an ICC.[16]
w The National Reference Center for Hospital Epidemiology has developed a national surveillance system for intensive-care units and surgical patients (according to the National Nosocomial Infection Surveillance method).[18]
x Manual with guidelines developed in 1976 and further supplemented since; widely used.[15]
y Average in the Second National Survey (1993), but sometimes less than one ICN per 1,000 beds[19]; therefore link nurses on wards.[20]
z Mostly a consultant medical microbiologist with training in IC; has statutory power.[19]
aa Composed of representatives from the major support and clinical services.[19]
bb In a survey of IC activities in 1993, laboratory-based and targeted surveillance was most widespread. Fifty percent of hospitals also conducted ward-based surveillance; 20%, postdischarge surveillance.[19] National prevalence studies in 1967, 1980, and 1993.[21-23]
cc Standard as basis of quality issues by Cook report 1988, with revision in 1995 prepared by the Infection Control Standards Working Party.[24] Guidelines on the organization of IC are described in a document (*Hospital Infection Control: Guidance on the Control of Infections in Hospitals)* prepared by the Hospital Infection Working Group of the Department of Health and Public Health Laboratory Service.[25]
dd Two larger hospitals in Reykjavik of approximately 500 beds with two ICNs, an ICD, and an ICC.[11]
ee One ICN per 250 beds or at least one per hospital mandatory[26]; 63% and 33% are specifically trained nurses and medical technicians, respectively. Only 11 of 105 hospitals met the standard of one ICN per 250 beds.[27]
ff ICDs are clinical microbiologists. Eighty percent of hospitals did not meet standard of one ICD per 1,000 beds set in 1990.[26,27]
gg Recommended since 1966[28]; composition and tasks treated in regulations by Chief Inspectorate of Public Health.[29]
hh Standard[26] not yet fully realized; in 1991, 79% of all hospitals carried out some sort of surveillance, but only laboratory-based surveillance for 20%.[27]
ii Handbook created in 1966, revised 1976.[28] Most recent recommendations in 1990.[26] Meeting standards not required by law, but part of the accreditation of healthcare organizations.[5,30] Thirty-five guidelines for infection prevention and control published so far by the Health Council, based on Working Group on Infection Prevention (WIP, Werkgroep Infectiepreventie).[5]
jj Approximately 50 ICN in the whole country. Training: 6-month course, 6 months of practical work, and written examination.[11] IC survey in 1990 found an ICN in 35 (48%) of 74 hospitals.[31]
kk There was a doctor appointed as responsible for IC in 15 (20%) of 74 hospitals in 1990.[31] Clinical microbiologists in charge of IC.[11]
ll Quarterly prevalence studies in two of five regions since 1992. Incidence studies since 1997.[11] In the 1990 survey, 9 of 74 hospitals reported routine prospective surveillance for nosocomial infections.[31]
mm Evaluation in 1990-1991 in Spanish hospitals with more than 400 beds (return rate of questionnaire modified from the Study of the Efficacy of Nosocomial Infection Control was 70%). Result: 0.45 ± 0.71 ICN per 250 beds.[32]
nn In 1986, the National Health Institute, which owns 68% of Spanish hospital beds, released a document calling for an ICC, among other quality issues.[34] In 1994, an expert panel sponsored by the Office for Technology Assessment and Health Care (Spanish Ministry of Health) issued detailed recommendations for IC activities in Spanish hospitals.[35]
oo Some are clinical microbiologists or infectious diseases specialists.[11]
pp Most of the hospitals have an ICC.[11]
qq Mostly laboratory-based surveillance and prevalence studies performed two to four times per year.[11]
rr Quality indicators for structure, process, and outcome in IC prepared by a group of the Swedish Infection Control Association.[11]
ss Evaluation of the country's five university hospitals in 1993 revealed an average of 0.4 ICNs per 250 beds in Swiss university hospitals (range, 0.2-0.75). There is a training program for ICNs organized by the Swiss Nursing Society. An ICD and an ICC was found in four of the five university hospitals.[36] Most acute-care hospitals now have some IC activity, but no data are available. An ICD was hired in the fifth university hospital in 1998.
tt See reference 37. In 1995, four of the five university hospitals performed patient-oriented surveillance.[36]

In 1992, the Comité Technique National de l'Infection Nosocomiale divided France into five large geographical areas for the coordination of IC activities. A national prevalence study of NIs has been conducted. Surveillance networks for surgical-site infections, intensive-care-unit–acquired infections, or control of multiresistant organisms were developed, and national IC guidelines have been issued. These examples illustrate trends in Western Europe; many other examples could have been cited.

As of the end of the 1990s, most countries in Western Europe have guidelines for the prevention of NIs and a recommendation for IC nurse and physician ratios based on hospital size (Table). Strategies and resources to prevent NIs differ between countries. Many hospitals rely on written guidelines for IC; some are available on the Internet. Only a few hospitals perform ongoing surveillance for NIs similar to that of US hospitals that are linked with the National Nosocomial Infection Surveillance (NNIS) System of the Centers for Disease Control and Prevention, Atlanta, Georgia. Prevalence studies are preferred, primarily due to limited resources. Repetitive prevalence surveys commonly are used to assess the importance of NIs and the impact of IC.[38,39] Large, multicenter, multinational prevalence studies have been conducted, in particular in intensive-care units.[40,41] The European Prevalence of Infection in Intensive Care study[40] showed a linear relationship between the prevalence of NIs in critical care and mortality. It became clear that the prevalence of NIs in Western Europe was very similar to that observed in the United States. However, Europe lacks a centralized entity such as the NNIS System, where data are collected, analyzed, and reported in a standardized fashion.

National and international meetings provide further evidence for the rapidly evolving activities and importance of IC outside the United States. Examples in Europe include, in particular, internationally recognized meetings of the Hospital Infection Society in the United Kingdom and the International Conference on the Prevention of Infection in France. The European Society for Clinical Microbiology and Infectious Diseases is heading several study groups and collaborative surveys of NIs and IC. Finally, training programs for IC practitioners are available in several countries, and participation is mandatory in some.

Infection control has evolved rapidly outside the United States and Europe over the last decades. In Canada, the Canadian Nosocomial Infection Surveillance Program provides assistance and funding to some 20 hospitals to conduct collaborative surveillance studies on NIs around the country; a series of IC guidelines have been developed by the Laboratoire Canadien de Lutte Contre les Maladies (http://hwcweb.hwc.ca/hpb/lcdc/hp_eng.htlm). As recently stated,[42] substantial progress has been made in recent years to improve IC in hospitals in countries with limited resources, including national initiatives in Asia and Latin America. Reductions in NI rates have been observed following the implementation of surveillance and control programs in some Latin America institutions. Efforts to develop uniform and global IC strategies still are needed.

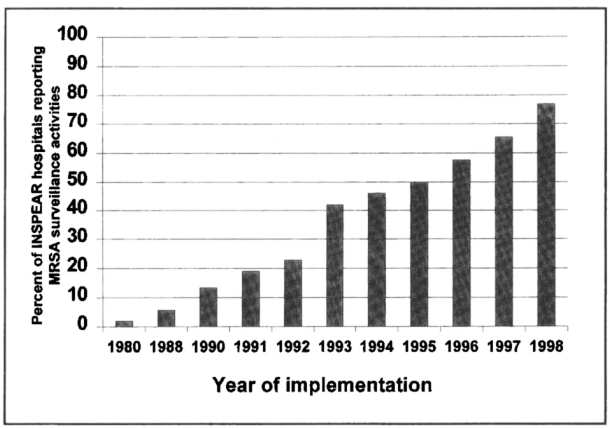

FIGURE 1. Trends in methicillin-resistant *Staphylococus aureus* (MRSA) surveillance activities—International Networks for the Study and Prevention of Emerging Antimicrobial Resistance (INSPEAR) project. In 1998, a questionnaire survey of MRSA surveillance and control activities was conducted among INSPEAR hospitals. The data presented are preliminary (as of August 1998) and summarize results obtained from 52 hospitals (teaching hospitals, 73%; public hospitals, 85%) in Argentina, Austria, Belgium, Brazil, Bulgaria, China, Croatia, Czech Republic, France, Germany, Greece, Italy, Poland, Romania, Spain, Switzerland, The Netherlands, Tunisia, the United Kingdom, and the United States). Types of MRSA surveillance and control activities varied widely among INSPEAR hospitals. For further information regarding the INSPEAR project, contact H. Richet, MD, at hmr3@cdc.gov.

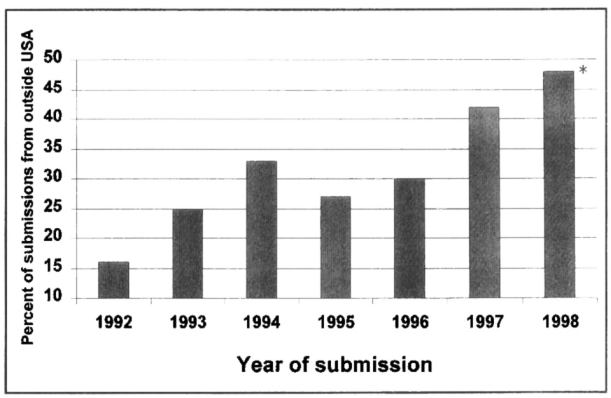

FIGURE 2. Proportion of international contributions to *Infection Control and Hospital Epidemiology,* 1992 to 1998.
* Submissions as of October 1, 1998. Accepted submissions may have been published in the year of submission or thereafter.

International collaboration outside the United States frequently is hampered by different legal regulations, term and case definitions, microbiological methods (many European countries define their own break points for susceptibility testing) and, last but not least, different languages. In Europe, the European Union provides a common field for transnational collaboration and uniform regulation. Politically, France, Germany, and the United Kingdom have new center-left governments that might facilitate international collaboration in infectious diseases and IC.

The data we report are derived mostly from published material. However, even excellent work is not always published or is published in journals difficult to obtain or to read in the native language. Experiences in the study of antimicrobial resistance, antibiotic use, and IC in several parts of the world—and in Eastern Europe in particular—are reported infrequently in the English peer-reviewed literature. Furthermore, large networks are being created within Europe or including European hospitals: eg, European Community Nosocomial Infection Survey,[43] EURO.NIS; Hospitals in Europe Link for Infection Control Through Surveillance, HELICS; and European Antimicrobial Resistance Surveillance System, EARSS. There is a large body of evidence for the growing importance of IC activities worldwide. Secular trends in methicillin-resistant *Staphylococcus aureus* surveillance activities in several continents nicely illustrate these trends (Figure 1).

Long before the United States became one of the leading countries in NI control and prevention, several European journals already covered issues associated with IC. Examples are publications such as *Zentralblatt für Mikrobiologie und Hygiene,* first issued in 1894, *Journal of Hygiene* (Cambridge) in 1938, and the *Journal of Hospital Infection* (London) in 1980. The increasing number of non-US contributions to *Infection Control and Hospital Epidemiology* in the last 7 years (Figure 2) reflects the growing scientific interest around the globe in problems dealing with NIs, as well as trends towards increasing use of epidemiological tools to control infections. Articles in this issue are from Australia, Belgium, Brazil, China, Israel, The Netherlands, Pakistan, Switzerland, and the United States; one is a fascinating report of an outbreak of nosocomial malaria in a country that has had no malaria for decades—a paradigm for the internationalization of IC.

Much has been learned in Europe from US-based research. US researchers have learned—or may learn—from experience outside the United States; examples might include antibiotic control, as pioneered in Scandinavian countries; selective digestive decontamination to reduce endogenous infections in high-risk critically ill patients; or more widespread use and promotion of hand antisepsis rather than conventional hand washing to prevent cross-infections, as suggested by Semmelweis in 1847. As we enter an exciting future of fruitful worldwide collaboration for infection control, *Infection Control and Hospital Epidemiology* will continue to provide an excellent international platform to exchange information, in which the fate of a contribution is determined by quality and not by country of origin.

REFERENCES

1. LaForce FM. The control of infections in hospitals: 1750 to 1950. In: Wenzel RP, ed. *Prevention and Control of Nosocomial Infections.* Baltimore, MD: Williams & Wilkins; 1993:1-12.
2. Haley RW, Culver DH, White JW, Morgan NW, Emori TG, Munn WP, et al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *Am J Epidemiol* 1985;121:182-205.
3. Report of a combined working party of the British Society for Antimicrobial Chemotherapy, the Hospital Infection Society and the Infection Control Nurses Association: revised guidelines for the control of methicillin-resistant *Staphylococcus aureus* infection in hospitals. *J Hosp Infect* 1998;39:253-290.
4. Crowe MJ, Cooke EM: Review of case definitions for nosocomial infection—towards a consensus. Presentation by the Nosocomial Infection

Surveillance Unit (NISU) to the Hospital Infection Liaison Group, subcommittee of the Federation of Infection Societies (FIS). *J Hosp Infect* 1998;39:3-11.
5. Reybrouck G. The situation in Belgium and The Netherlands. *Zentralbl Hyg Umweltmed* 1996;199:178-187.
6. Koninklijk Besluit van 24 april 1974 houdende aanvulling van het Koninklijk Besluit van 23 oktober 1964 tot bepaling van de normen die door de ziekenhuizen en hun diensten moeten worden nageleefd. Arrêté Royal du 24 avril 1974 complétant l'arrêté Royal du 23 octobre 1964 portant sur la fixation des normes auxquelles les hôpitaux et leurs services doivent répondre. *Belgisch Staatsblad* 19 juli 1974.
7. Mertens R, Kegels G, Stroobant A, Reybrouck G, Lamotte JM, Potveliege C, et al. The national prevalence survey of nosocomial infections in Belgium. *J Hosp Infect* 1984;9:219-229.
8. De Wever A. Fonctionnement du comité d'hygiène hospitalière. *Hôpital belge* 1980;148:35-48.
9. Koninklijk Besluit van 15 december 1987 houdende uitvoering van de artikels 13 tot en met 17 van de wet op de ziekenhuizen, zoals gecoördineerd door het Koninklijk Besluit van 7 augustus 1987. Arrêté Royal du 15 décembre 1987 portant exécution des articles 13 à 17 inclus de la loi sur les hôpitaux, coordonée par arrêté Royal du 7 août 1987. *Belgisch Staatsblad* 25 december 1987.
10. Koninklijk Besluit van 7 november 1988 houdende aanvulling van het Koninklijk Besluit van 23 october 1964 tot bepaling van de normen die door de ziekenhuizen en hin diensten moeten worden nageleefd. Arrêté Royal du 7 novembre 1988 complétant l'arrêté Royal du 23 octobre 1964 portant sur la fixation des normes auxquelles les hôpitaux et leurs services doivent répondre. *Belgisch Staatsblad* 24 november 1988.
11. Ojajärvi J. The situation of hospital hygiene in Scandinavia. *Zentralbl Hyg Umweltmed* 1996;199:172-177.
12. Nyström B. Infection control policies and guidelines—Scandinavian experience. *J Hosp Infect* 1991;18:106-109.
13. Sairaalahygiena II. Sairaalainfectioiden rekisteröinti. Sairaalahygieniatoimintojen organisointi. (Hospital hygiene II. Surveillance of hospital infections. Organization of hospital infection control activities). Suositus 16.4.1981. Sairaalatitto, jukaisu 2/1981.
14. Brücker G. Actual state of hospital hygiene in France. *Zentralbl Hyg Umweltmed*1996;199:156-167.
15. Richtlinien des Robert-Koch-Instituts für Krankenhaushygiene und Infektionsprävention. Jena, Germany: Gustav Fischer Verlag; 1991.
16. Zastrow KD, Schoneberg I. Results on the status of the organizational structures in hospital hygiene in Germany, I: overall evaluation with special reference to acute hospitals. *Gesundheitswesen* 1993;55:55-59.
17. Gastmeier P, Kampf G, Wischnewski N, Hauer T, Schulgen G, Schumacher M, et al. Prevalence of nosocomial infections in representative German hospitals. *J Hosp Infect* 1998;38:37-49.
18. Gastmeier P, Sohr D, Koch J, Geffers C, Nassauer A, Daschner F, et al. Creation of a reference data system for surveillance of nosocomial infections. *Klinikarzt* 1998;27:204-209.
19. Emmerson AM. Hospital hygiene in Great Britain. *Zentralbl Hyg Umweltmed* 1996;199:168-171.
20. Teare EL, Peacock A. The development of an infection control link-nurse programme in a district general hospital. *J Hosp Infect* 1996;34:267-278.
21. Ayliffe GA. Cross-sectional surveys of infection. In: Brachman PS, Eichkhoff TC, eds. *Proceedings of the International Conference on Nosocomial Infections.* Chicago, IL: American Hospital Association; 1971:282-284.
22. Meers PD, Ayliffe GAJ, Emmerson AM, Leigh DA, Mayon-White RT, Mackintosh CA, et al. Report on the National Survey of Infection in Hospitals. *J Hosp Infect* 1980;2(suppl):1-51.
23. Emmerson AM, Enstone JE, Griffin M, Kelsey MC, Smyth ETM. The second national prevalence survey of infections in hospitals—overview of the results. *J Hosp Infect* 1996;32:157-190.
24. Infection Control Standards Working Party, Public Health Laboratory Service. *Standards in Infection Control in Hospitals.* London, England: PHLS; 1993.
25. Infection Control Standards Working Party, Public Health Laboratory Service. *Hospital Infection Control; Guidance on the Control of Infection in Hospitals.* London, England: PHLS; 1995.
26. Preventie en bestrijding van ziekenhuiseninfecties. 's-Gravenhage, Nederland: Gezonheidsraad; 1990.
27. Paardekooper JL, Veerman-Brenzikofer M, Wille JC, Hoog-Rueb W. VHIG-Enquête 1991. *Tijdschr Hyg Infectieprev* 1992;11:86-89.
28. Richtlijnen ter preventie en bestrijding van zikenhuisinfecties, 4de druck. 's-Gravenhage, Nederland: Staatsuitgeverij; 1968.
29. Richtlijnen voor een reglement van de infectiecommissie in een ziekenhuis. Leidschendam, Nederland: Geneesekundige Hoofdispectie van de Volksgezondheid; 1977.
30. Besluit eisen voor erkenning ziekenhuizen. 's-Gravenhage, Nederland: Nederlandse Staatscourtant; November 29, 1984.
31. Backe B, Sander J, Lingaas E. Infection control in Norwegian somatic hospitals, 1990. *Tidsskr Nor Laegeforen* 1992;112:237-244.
32. Plitt-Gomez C, Molina-Quilis R, Ruiz-Bremon A, de Pedro-Cuesta J. Nursing in nosocomial infection control in Spain. *J Adv Nurs* 1995;21:440-446.
33. Vaque J, Rossello J, Trilla A, Monge V, Garcia-Caballero J, Arribas JL, et al. Nosocomial infections in Spain: results of five nationwide serial prevalence surveys (EPINE Project, 1990 to 1994). Nosocomial Infections Prevalence Study in Spain. *Infect Control Hosp Epidemiol* 1996;17:293-297.
34. Trilla A, Vaque J, Rasello J, Salles M, Marco F, Prat A, et al. Prevention and control of nosocomial infections in Spain: current problems and future trends. *Infect Control Hosp Epidemiol* 1996;17:617-622.
35. Subdireccion General de Prestaciones y Evaluacion de Tecnologias Sanitarias (Ministerio de Sanidad y Consumo): Informe dubre Infeccion Hospitalaria. *Med Clin (Barc)* 1994;102:20-24.
36. Pittet D, Francioli P, von Overbeck J, Raeber PA, Ruef C, Widmer AF. Infection control in Switzerland. *Infect Control Hosp Epidemiol* 1995;16:49-56.
37. Pittet D, Harbarth S, Ruef C, Francioli P, Sudre PH, Pétignat C, et al. Prevalence and risk factors for nosocomial infections in four university hospitals in Switzerland. *Infect Control Hosp Epidemiol* 1999;20:37-42.
38. Spencer RC. Prevalence studies in nosocomial infections [editorial]. *Eur J Clin Microbiol Infect Dis* 1992;11:95-98.
39. French GL, Cheng AF, Wong SL, Donnan S. Repeated prevalence surveys for monitoring effectiveness of hospital infection control. *Lancet* 1989;2:1021-1023.
40. Vincent JL, Bihari DJ, Suter PM, Bruning HA, White G, Nicolas-Chanioin MH, et al. The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. *JAMA* 1995;274:639-644.
41. Daschner FD, Frey P, Wolff G, Baumann PC, Suter P. Nosocomial infections in intensive care wards: a multicenter prospective study. *Intensive Care Med* 1982;8:5-9.
42. Huskins WC, O'Rourke EJ, Rhinehart E, Goldman DA. Infection control in countries with limited resources. In: Mayhall CG, ed. *Hospital Epidemiology and Infection Control.* Baltimore, MD: Williams & Wilkins; 1996:1176-1200.
43. European Community COMAC: EURO.NIS Nosocomial Infection Surveillance, Phase 2B. ISSN 0017-9124. *Health Services Research;* 1991.