

National Audit Office

Study Title

A Comparison of International Practices in the Management and Control of Hospital-acquired Infections

A Component of the VFM Follow-up Study of the National Audit Office Report: *The Management and Control of Hospital Acquired Infections in Acute NHS Hospitals in England* (2000).

Report

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Richard Wells Research Centre
Thames Valley University
32-38 Uxbridge Road, Ealing
London W5 2BS
e: robert.pratt@tvu.ac.uk
URL: <http://www.richardwellsresearch.com>



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Acknowledgements

We wish to acknowledge the contributions to this report by our country respondents in the United States of America, Australia, New Zealand, Belgium, Denmark, France, Germany, The Netherlands and Spain (see Technical Report for their names and contact details).

Abbreviations

The following abbreviations are used in this Report:

ACIP	Advisory Committee on Immunization Practices (USA)
ACSQH	Australian Council for Safety and Quality in Health (Australia)
AHBB	Association Belge d'Hygiene Hospitaliere (Belguim)
AICA	Australian Infection Control Association (Australia)
ANAES	French National Agency for Accreditation and Evaluation (France)
ANCA	National Council on AIDS (Australia)
APIC	Association for Professionals in Infection Control and Epidemiology Inc. (USA)
ASA	American Society of Anesthesiology (USA)
AUR	Antimicrobial use and resistance
BSI	Bloodstream infections
CDC DHPA	CDC's Division of Healthcare and Quality Promotion
CDC	Centers for Disease Control and Prevention (USA)
CDHA	Commonwealth Department of Health and Aged Care
CHRISP	Centre of Healthcare Related Infection Surveillance and Prevention (Australia)
CR-UTIs	Catheter-associated urinary tract infections
CTIN	Comite Technique National Nosocomiales (Also refers to National Committee for Infection Control (France)
DANMAP	Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (Denmark)
DG SANCO	European Commission for Health and Consumer Protection - Directorate General
DHQP	Division of Healthcare Quality Promotion (USA)
EAGA	Expert Advisory Group on Antibiotics (Australia)
EARRS	European Antimicrobial Resistance Surveillance System
EPINE	Estudio de Prevalencio de las Infecciones Nosocomiales en España
ESAP	European Study on Surgical Antimicrobial Prophylaxis (Also refers to European Study of Surgical Antibiotic Policies)
ESR	Environmental Science and Research (New Zealand)
EURONIS	European Nosocomial Infection Surveillance project
FDA	Food and Drug Administration (USA)

HAI	Hospital-acquired Infection(s); this abbreviation also refers to 'Healthcare-associated Infection(s)'
HELICS	Hospitals in Europe Link for Infection Control Through Surveillance
HICPAC	Healthcare Infection Control Practices Advisory Committee (USA)
HMO	Health maintenance organization
HRN	High-risk nursery
IC	Infection control
ICD	Infection control doctors
ICD	Infection Control Doctor
ICN	Infection Control Nurse
ICP	Infection Control Professionals
ICT	Infection control team
ICU	Intensive care unit
INVS	National Institute for Public Health (France)
IPH	Scientific Institute of Public Health – Louis Pasteur (Belgium)
JCAHO	Joint Commission on Accreditation of Healthcare Organizations (USA)
JETACAR	Joint Expert Technical Advisory Committee on Antibiotic resistance (Australia)
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
NCHH	National Centre for Hospital Hygiene (Denmark)
NCQA	National Committee for Quality Assurance (USA)
NHMRC	National Health & Medical Research Council (Australia)
NIH	National Institutes of Health (USA)
NNIS	National Nosocomial Infections Surveillance System (USA)
NRZ	National Reference Centre for Hospital Hygiene (Germany)
OAG	Office of the Auditor General (New Zealand)
ONERBA	Observatoire National de l'Epidemiologie de la Resistanced Bacterienne aux Antibiotiques (France)
OSHA	Occupational Safety and Health Administration (USA)
PREVINE	Programa Especifico para la Vigilancia de las Infecciones Nosocomiales en España
QIEP	Quality Improvement and Enhancement Program (Australia)
RIVM	National Institute of Public Health and Environment (The Netherlands)
RNSP	Ministere de l'Emploi et de la Solidarite, Secretariat d'Etat a la Sante (France)
SHEA	Society for Healthcare Epidemiology of America (USA)
SSI	Surgical-site infections
UTI	Urinary tract infections
VAP	Ventilator-associated pneumonia
VWS	Ministry of Health, Welfare and Sport (Germany)
WIP	Working Party on Infection Prevention (The Netherlands)

Introduction

The National Audit Office (NAO) is undertaking a Value for Money study to evaluate improvements that the National Health Service has made in the management and control of hospital-acquired infections (HAI) as part of a follow-up to their report in February 2000 on *The Management and Control of Hospital-acquired Infections in Acute NHS Hospitals*. * As a component of this study, NAO wishes to compare infection prevention and control practices and the extent and costs of HAI in England with comparable countries. This report provides an insight into these issues in selected countries in North America, Australasia and the European Union.

* available online at: http://www.nao.gov.uk/publications/nao_reports/9900230es.pdf

Study Investigators

Robert J. Pratt, Professor of Nursing¹
Heather P. Loveday, Principal Lecturer (Research)¹
Carol M. Pellowe, Principal Lecturer (Research)¹
Peter Harper, Senior Lecturer (Research)¹
Simon Jones, Senior Research Assistant¹
Professor Barry Cookson, Medical Microbiologist²
Susan Macqueen, Infection Control Nurse³

Project Director
Lead Investigator
Investigator
Investigator
Data Manager
Specialist Adviser
Specialist Adviser

1. Richard Wells Research Centre, Thames Valley University, London
2. Health Protection Agency (Laboratory of Healthcare Infections) *
3. Great Ormond Street Hospital for Sick Children, London **

* Representing the Health Protection Agency

** Representing the Infection Control Nurses Association

Executive Summary

Comparison of International Practices in the Management and Control of Hospital-acquired Infections

Summary

Focus

This review focused on the occurrence, cost and strategic response to hospital-acquired infections (HAI) in a range of comparable countries ('select countries') with western healthcare systems, mature infection control structures and arrangements, and established networks of infection control professionals.

Selected Countries

The following countries in North America, Australasia and in the European Union (EU)* were included in our review:

- United States of America
- Australia
- New Zealand
- Belgium
- Denmark
- France
- Germany
- The Netherlands
- Spain

Approach to Data Collection

Three methods were used to access relevant information:

- a formal review of the international literature using electronic searches of appropriate databases;
- a review of relevant web-based databases maintained by national governments, departments of health and professional bodies in select countries;
- a targeted e-mail survey of key government departments, professional organisations, learned societies and relevant networks in select countries.

Methodological Issues

Although our review sought to retrieve as much relevant data as possible within the resource available, a number of constraints need to be acknowledged. There was prior recognition of a lack of published studies concerning the prevalence and costs of HAI and the review included both a review of English language literature appearing in peer reviewed journals and data produced by national governments, professional organisations and learned societies that is available as hard copy or could be accessed electronically. The use of an electronic survey directed at key specialists in the select countries aimed to provide the opportunity to clarify issues and identify other sources of data.

The survey was emailed at the beginning of the SARS outbreak in May 2003. This led to delays in specialists responding and, in some instances although helpful, the information provided lacked detail. In the case of the European data very few reports published on the web or from national agencies were available in English. The HELICS website was extremely useful, but the information within published reports and available online was out of date and there are delays in publishing the results of the HELICS III projects which would have been particularly useful to include in our review. Personal communication between the reviewers and specialists in the select countries helped to clarify some issues but did not result in the level of detail we had anticipated.

Analysis

A descriptive text-based and comparative analysis of data from the literature, web sites and email respondents was conducted using an analytical framework developed from the review issues (see Technical Report).

Drawing Comparisons

This review draws broad comparisons between the countries selected for the review and these should be read with circumspection.^{1,2} There are a number of important factors that contribute to an individual country's approach to HAI. On a macro-scale the structure of health care system and the basis of funding health services may have a direct impact on the priorities, extent and costs of HAI. Similarly, published rates of HAI may reflect differences in the surveillance system approach to case detection, differences in numerator and denominator definitions, and the complexity and intensity of surveillance activity rather than significant differences in rates of HAI. Although the review focused on broadly comparable countries, differences in case mix and risk factors such as the severity of patient illness, patient classification and length of hospital stay, make direct comparison unreliable.

This summary highlights the key issues identified from the analysis of retrieved literature and email survey responses. The following discussion centres around the two central components of the review: the **extent and costs of HAI** in the select countries and the elements of **national strategy and policy** that drive current efforts to reduce the incidence of preventable HAI.

Discussion

Extent and Costs of Hospital-acquired Infections

Extent

All the countries reviewed have established HAI surveillance programmes that are managed and conducted by either government agencies or University departments. The most mature of these is the National Nosocomial Infections Surveillance (NNIS) System operated by the Centers for Disease Control and Prevention (CDC) in the USA which has been influential in the development of the definitions and data collection modules in surveillance systems in the other countries included in the review (and the United Kingdom).

Box 1 – Prevalence Survey

A prevalence survey estimates the total number of active (existing and new) occurrences of a disease or infection in a defined population over a specific period of time (period prevalence) or at a specific point in time (point prevalence). They provide cross-sectional or snapshot data. Prevalence rates are influenced by the duration of a patients stay and the duration of infections.³

National prevalence surveys of HAI are conducted at varying intervals. Denmark and France have a regular schedule of surveys conducted at three and five year intervals respectively, in contrast Belgium has not carried out a national survey since 1984. Data from surveys in the selected countries show a HAI prevalence rate of between and four (Germany) and ten percent (USA).^{4,5}

Box 2 – Incidence Study

Incidence is the number of new cases of a disease or infection that occur in a defined population over a specific period of time. They provide longitudinal data. Collecting incidence data is more labour intensive and time consuming than collecting prevalence data and therefore is more costly. It is therefore used in a targeted way to identify trend associated with specific sites of infection e.g., ventilator associated pneumonia; high risk units such as ICU; or where a specific infection issue is causing concern, e.g., urinary tract infections associated with catheter use in elderly care.³

Although our review identified that national surveillance programmes are broadly comparable in that they are voluntary schemes with participating hospitals providing data for a minimum period of three months in any data collection period; they vary in terms of the number and scope of surveillance modules, the units of measurement and protocols for data collection. The schemes feedback incidence data to individual hospitals and generate anonymous inter-hospital comparisons that provide longitudinal data.

However, variations in protocols and numbers and frequency of hospital participation between countries make direct comparison unreliable. Table 1 shows the extent of in HAI in selected countries calculated as prevalence rates. The national rate of specific infections is shown in Table 2 and demonstrates the different ways in which rates are presented.

Table 1 – Prevalence of HAI in general

	Denmark	France	Germany	Spain
Prevalence	8.0%	6-10%	4%	8.3%
Date	2001	1999	2000	2002

Table 2- Rates of HAI by infection site and organism

	USA	Denmark	France	Germany	Netherlands	Spain
Surgical Site Infection	20% of HAI	2%	10.5%		3.4%	
Blood-stream Infection	15% Catheter-related	0.2% bacteraemia 0.2% septicaemia	6%	2.2 BSI per 1000 CVC days	1000-1500 <i>Staphylococcus aureus</i> bacteraemia per year	
Urinary tract Infection	35% of HAI Catheter-related	2.1%	36%			
MRSA		1998-2001 MRSA bacteraemia doubled from 54 to 105 cases	64% of all <i>Staphylococcal</i> infections	0.31 MRSA infections per 1000 pt/days	<1% of all bacteraemia	40.2%
Type of data	% of all HAI	Prevalence	Prevalence	Incidence	Prevalence	Prevalence

The comparatively low rates of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia in countries such as Denmark and the Netherlands are attributed by them to the very strict application of screening and isolation guidelines together with stringent antibiotic prescribing policies. In the Netherlands, the past ten years has seen the ‘search and destroy’ strategy prevent MRSA infection from becoming endemic.⁶ In Denmark, the consistent and strict application of guidelines and the development of systems to monitor resistance patterns lead to the early identification and management of local clusters of MRSA infection.⁷

The current trend in Europe through the DG SANCO funded HELICS collaboration to share protocols and develop standardised surveillance protocols for targeted areas of surveillance (such as ICU) are likely to make future comparisons possible.⁸

Costs

Up to date data concerning the economic impact of HAI in the selected countries is lacking with some countries referring to economic costs that were estimated in the 1980s by extrapolating from the results of the SENIC study conducted in the USA in 1985.⁹ Published literature in the field concentrates on how economic analysis tools might be used to inform the issue of controlling HAI rather than presenting analyses of the economic impact. Where data does exist, it is generally based on the direct costs borne by hospital in the treatment of HAI and ignores the preventive, future and indirect costs. Table 3 summarises the estimated costs available to the reviewers.

Table 3 – Estimated costs of HAI in selected countries

Country	USA ⁴	Australia ¹⁰	New Zealand ¹¹	Belgium ¹²	Netherlands ¹³
Cost	4.5-5.7 billion US \$ per year additional costs to patient care	180 million Australian \$ per year ¹	137 million US\$ per year ²	194 million Bf cost saving if guidelines on antibiotic prophylaxis followed	2.8 million E estimated 10 year cost of MRSA measured in 1 medical centre.

¹ This data was produced in 1988 and is therefore likely to be an underestimate.

² This figure was estimated from the costs associated with HAI in two hospitals in Auckland.

One review of 55 economic papers published between 1990 and 2000 identified the attributable costs of HAI and the related costs of interventions.¹⁴ The majority of the papers retrieved in this review were from the USA and Europe and presented a simple cost analysis that did not include a comparison group. The analysis, summarised in Table 4, concluded that the mean attributable costs of the infections were greater than the mean corresponding interventions. However, many of the studies reviewed were small scale and therefore the standard deviations are large.

Table 4 – Attributable cost of HAI

Infection	Attributable Costs US \$ (Mean SD)	Intervention Costs US \$ (Mean SD)
HIA in general	13,973 (17,998)	1138 (1442)
Surgical site infection	15,646 (13,820)	27 (single study)
Bloodstream infection	38,703 (3122)	5622 (9066)
Pneumonia	17,677 (20,455)	All interventions were found to be cost saving
Urinary tract infection	No studies retrieved	1962 (single study)
Methicillin resistant <i>Staphylococcus aureus</i>	35,367 (2915)	4808 (3368)

Adapted from Stone PW, Larson E, Kowar LN. A systematic audit of economic evidence linking nosocomial infections and infection control interventions: 1990-2000. *Am J Infect Control* 2002; **30**:145-52.

Bloodstream infections (BSI) and MRSA infections have the highest attributable costs. A study conducted in Denmark, similar to that conducted by Plowman and Graves in the UK, suggested that costs were similar to those in the UK.¹⁵

Strategy and policy related to reducing the risk of hospital-acquired infections hospital-acquired infections

National Policy/Strategy

All the countries reviewed identified that a national strategy for preventing HAI had been developed over the past twenty years as a response to the threats of antimicrobial resistance and increasing rates and costs of infection in healthcare facilities. The development of more recent strategies in the USA, Australia, New Zealand and France have been influenced by patient safety and risk management agendas and are closely linked to accreditation of healthcare services. In other countries, strategic direction for preventing HAI is implicitly contained in a range of linked activities including legislation, surveillance programmes, guideline development and funding streams for specific components of activity. The agencies responsible for the different aspects of HAI prevention and control strategy and activity in the selected countries are summarised in Table 5.

Research Programmes

The priorities within research are set at national level and studies are conducted by specialist government funded institutes or university research departments. The USA has recently established a consortium of Prevention EpiCenters to conduct a research programme focused on preventing HAI all of which are based in academic centres. The aims of this programme are to:

- Enhance the understanding of the cost-effectiveness and prevention effectiveness of interventions to prevent healthcare-associated infections and other adverse healthcare events, including those due to medical errors.
- Promote improved information system capacity for monitoring, tracking, and assessing healthcare-associated infections, other adverse health events, and medical errors, and integrate quality improvement activities in healthcare organizations across the spectrum of delivery sites.
- Promote development of an epidemiology infrastructure across the spectrum of healthcare delivery sites.
- Use the Prevention Epicenters consortium to conduct research and development activities to further program goals for surveillance and prevention.

In Europe research programmes are conducted by national networks and European collaborations and none of the countries surveyed identified that there was a ring-fenced research fund for HAI but indicated that funding came from general healthcare research funding. Current research initiatives are focused on the establishing the epidemiology of antimicrobial resistance in different settings but particularly ICU and developing standardised surveillance methods. Similar to the UK, most European research is conducted by university research departments.

Table 5 – Responsibilities for Strategy and Implementation

	Strategy Development	Strategy Focus	Surveillance and Implementation	Research Programme	Guideline Development	Quality Standards
USA	CDC Division of Healthcare and Quality Promotion	Patient safety Reduction in HAI Antimicrobial resistance	Centers for Disease Control (CDC)	Part of Public Health Action Plan to Combat Antimicrobial Resistance	CDC	Joint Commission on Accreditation of Healthcare Organisations National Committee for Quality Assurance
Australia	Australian Council for Safety and Quality in Health ACSQH	Patient safety Reduction in HAI Antimicrobial resistance	Joint Expert Technical Committee on Antibiotic Resistance National Surveillance	No specified programme. Funding from general healthcare research programme.	Department of Health and Ageing	ACSQH
New Zealand	Ministry of Health	Patient safety Reduction in HAI Antimicrobial resistance		Funding available from general healthcare research programme	Ministry of Health	Standards New Zealand
Belgium	Ministry of Social Affairs Public Health and Environment	Patient safety Reduction in HAI Antimicrobial resistance	Scientific Institute of Public Health – Louis Pasteur (SIH) Robert Koch Institute (RKI)	Funding from general healthcare research programme Involved in EU and DG SANCO programmes.	SIH RKI Belgian Group for the Study, Screening and Prevention of Hospital Infections	Quality Decree of the Flemish Community
Denmark	Ministry of Health	Patient safety Reduction in HAI Antimicrobial resistance	National Centre for Hospital Hygiene Statens Serum Institute (NCHH)	DANMAP Antimicrobial Programme. Involved in EU and DG SANCO programmes	NCHH	Danish Standards Institution

	Strategy Development	Strategy Focus	Surveillance and Implementation	Research Programme	Guideline Development	Quality Standards
France	Ministere de l'Emploi et de la Solidarite, Secretariat d'Etat a la Sante National Institute for Public Health (RNSP/IVS)	Patient safety Reduction in HAI Antimicrobial resistance	National Committee for Infection Control Comite Technique Infection Nosocomiales (CTIN)	Ministry of Health Involved in EU and DG SANCO programmes	CTIN RNSP/IVS French National Agency for Accreditation and Evaluation (ANAES)	ANAES
Germany	Ministry of Health, Bundesministerium fuer Gesundheit	Patient safety Reduction in HAI Antimicrobial resistance	Robert Koch Institute Commission for Hospital Hygiene and Infection Prevention National Reference Centre for Hospital Hygiene	Funding from general healthcare research programme. Involved in EU and DG SANCO programmes	Robert Koch Institute	None
Netherlands	Ministry of Health, Welfare and Sport	Patient safety Reduction in HAI Antimicrobial resistance	State Inspectorate of Health National Institute for Public Health and Environment	Funding from general healthcare research programme Involved in EU and DG SANCO funded programmes	Working Party on the Prevention of Infection	Currently under development by the Inspectorate of Healthcare
Spain	Ministerio de Sanidad y Consumo	Patient safety Reduction in HAI Antimicrobial resistance	Comision INOZ (Basque) Committee of Experts in Nosocomial Infection (CENI)(Catalonia). National Reference Laboratory	Funding from general healthcare research programme Involved in EU and DG SANCO funded programmes	INOZ CENI	Benchmarks exist but there are no formal quality standards associated with HAI

Quality Standards

There is a growing trend towards placing surveillance data and rates of nosocomial infection in the public domain. This trend is partly driven by the development and focus on governance issues in healthcare. Quality standards linked to hospital accreditation processes exist in the USA, Australia, New Zealand, Belgium, Denmark and France and include standards relating to the management and control of HAI. The Netherlands is in the process of developing quality standards for HAI and the Spanish Ministry of Health uses a set of benchmarks based on EPINE surveillance data.

Guidelines

The development of National Guidelines features as a part of each of the selected countries strategy to reduce the incidence of preventable HAI and to provide guidance for hospital infection control committees and healthcare professionals. The numbers of guidelines in each country is variable, but include key issues such as:

- Prevention of infections associated with specific sites and medical devices e.g., central venous catheters;
- Prevention and control of multi-drug resistant organisms;
- Prevention of exposure to bloodborne pathogens;
- Sterilisation of instruments and equipment and
- Waste management.

All guidelines are linked to evidence from relevant literature but are predominantly developed by appropriate groups of clinical experts on the basis of consensus.

Roles and Responsibilities of Specialist Professionals

All the selected countries (with the exception of Spain) identified that there were official profiles for the roles of Infection Control Doctor (ICD) and Infection Control Nurse (ICN). These profiles are described in a range of administrative instruments including national/state law, accreditation criteria, national guidelines and standards. The role of ICD is undertaken by a range of medical professionals and includes medical microbiologists, hospital epidemiologists and infectious disease specialists. In some countries profiles for the responsibilities of technical professionals are also included. The ratio of infection control professionals (ICP) to hospital beds is also identified in some counties (Table 6) although these ratios are rarely met.

Table 6 – Recommended Ratio of Infection Control Professionals to Acute Hospital Beds

	USA	Belgium	France	Germany	Netherlands
ICD		1:1000	1:800	1:450	1:1000
ICN	1:250	2.5:1000	1:400	1:300	1:250

The primary responsibilities of ICP in can be summarised in the following activities:

- Conduct local surveillance activities and contribute to national surveillance systems where appropriate;
- Provide a local source of clinical advice and expertise for the prevention of HAI and the care of patients with HAI;

- Manage and investigate outbreaks of HAI;
- Implement national guidelines and standards and provide appropriate data for hospital accreditation purposes;
- Provide a programme of local infection prevention and control education and training.

What can be learnt from other countries and current initiatives?

It is clear from our review that ICP are involved in sharing experiences and data that might assist in reducing the threats of antimicrobial resistance, through direct contact, academic meetings and international research and surveillance collaborations. Not surprisingly there are more similarities between the countries selected for this review than there are differences. **In general, the overall prevalence of HAI is similar and the strategic responses are driven by corresponding imperatives.** The following points highlight key areas of collaboration and identify where approaches being taken by other countries might be worth investigating in greater depth than was possible in this review.

1. In general terms those countries reviewed faced similar challenges in reducing rates and the accompanying cost of HAI. There is a common imperative to improve patient safety and minimise the infection risks associated with modern healthcare.
2. The outcomes of EU initiatives to develop standardised protocols for targeted surveillance of specific organisms and infections in high risk environments will provide data that is more able to be compared.
3. The experience of the Danish and the Dutch indicate that the consistent and strict application of guidelines for the prevention of MRSA infections, that include components concerning, screening, surveillance of resistance patterns, isolation and antimicrobial prescribing can be successful in preventing the organism from becoming endemic in healthcare facilities. The economic costs of this strategy are unclear.
4. Few countries have an accurate understanding of the current economic impact of HAI or the cost and impact of approaches to prevention. Economic analyses need to be conducted using methods that make comparisons useful.
5. The setting of infection control standards and the declaration of rates of HAI within national accreditation processes for healthcare facilities is an emerging trend.
6. The USA CDC DHPQ campaign 'Seven Healthcare Safety Challenges' represents a significant national government initiative to set targets for reducing the risks of HAI over a five year period.

7. The existence of the EU DG SANCO funded HELICS initiative has provided a collaborative forum within Europe for the exchange of data between national agencies responsible for surveillance and policy development. It provides the opportunity to further develop collaborative and consistent approaches to the problems of preventing and controlling HAI.
8. The USA CDC DHPQ 'Prevention Epicenters' represents a significant national government initiative to coordinate relevant research for developing the evidence base and assessing the cost of infection prevention and control.
9. ICD and ICN are central to the local implementation of national strategy and guidance and play a major role in the collection and feedback of surveillance data for local and national use. The recommended ratios of infection prevention practitioners (medical and nursing) are based on the results of research conducted in the USA in the early 1980s and anecdotally are rarely met in practice.

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National Audit Office

Study Title

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Technical Report

22 September 2003

Richard Wells Research Centre
Thames Valley University
32-38 Uxbridge Road, Ealing
London W5 2BS
e: robert.pratt@tvu.ac.uk
URL: <http://www.richardwellsresearch.com>



Introduction

The National Audit Office (NAO) is undertaking a Value for Money study to evaluate improvements that the National Health Service has made in the management and control of Hospital-acquired Infections (HAI) as part of a follow-up to their report in February 2000 on *The Management and Control of Hospital-acquired Infections in Acute NHS Hospitals*. * As a component of this study, NAO wishes to compare infection prevention and control practices and the extent and costs of HAI in England with comparable countries. This report provides an insight into these issues in selected countries in North America, Australasia and the European Union.

* available online at: http://www.nao.gov.uk/publications/nao_reports/9900230es.pdf

Investigators

Robert J. Pratt, Professor of Nursing ¹	Project Director
Heather P. Loveday, Principal Lecturer (Research) ¹	Lead Investigator
Carol M. Pellowe, Principal Lecturer (Research) ¹	
Peter Harper, Senior Lecturer (Research) ¹	
Simon Jones, Senior Research Assistant ¹	
Professor Barry Cookson, Medical Microbiologist ²	Specialist Adviser
Susan Macqueen, Infection Control Nurse ³	Specialist Adviser

4. Richard Wells Research Centre, Thames Valley University
5. Health Protection Agency (Laboratory of Healthcare Infections)
6. Great Ormond Street Hospital for Sick Children, London

Methodology

▪ Focus

This review focused on the occurrence, cost and strategic response to HAI in a range of comparable countries ('select countries') with western healthcare systems, mature infection control structures and arrangements, and established networks of infection control professionals.

▪ Select Countries

The following countries in North America, Australasia and in the European Union (EU)* were included in this review:

- United States of America
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- Spain

* EU countries are members
of the HELICS DG SANCO
Project

▪ Review Issues

The following issues informed the review questions:

I Extent and Costs of HAI

- **Extent of HAI:** the national or regional/state prevalence of HAI; types.
- **Cost:** estimated costs of HAI and the mechanisms used to determine these costs.

II Strategies and Policies focused on reducing the risk of HAI

- **Strategies:** current national, regional or state strategies for reducing the risk of HAI.
- **Policies:** current national, regional or state policies that influence infection prevention and control strategies.
 - **training:** presence and content of education and training objectives defined within strategies
 - **research:** current national, regional or state funded infection prevention and control research programmes.
 - **practitioners:** specific roles and responsibilities of specialist infection prevention and control practitioners identified within strategies.

III Guidelines and Standards

- **Guidelines:** the development and current availability of national, regional or state guidelines for preventing and controlling HAI.
- **Quality Standards:** the use of national, regional or state infection prevention and control quality standards (controls assurance standards).

Approach to Data Collection

Data relevant to the review issues in select countries was collected and analysed. Three methods were used to obtain this information:

- a formal review of the international literature using electronic searches of appropriate databases;
- a review of relevant web-based databases maintained by national governments, departments of health and professional bodies in select countries;
- a targeted e-mail survey of key government departments, professional organisations, learned societies and relevant networks in select countries.

▪ Electronic Databases

Searches for interrogating Medline and EMBASE databases were constructed using MeSH, thesaurus and free text terms to cover the fields of infection prevention and control policy and strategy and the extent and economic costs of HAI in countries selected for the review. An economic filter created by the Centre for the Dissemination of Reviews of Effectiveness at the University of

York was included in the economic search. Search terms included: infection control; cross infection; bacteraemia; surgical wound infection; catheters, indwelling; catheterization, central venous. The searches were limited to the period 1998-2003 and to English language and studies were retrieved if they had a national or regional focus and were explicitly related to the review issues.

Search Results (Electronic Databases)

Very few studies identified by the Medline and EMBASE searches met the criteria for inclusion into the review as they only reported local prevalence or cost data.

	Medline	Embase
Policy and Prevalence	58 citations identified	607 citations identified
Economic	383 citations identified	473 citations identified
Retrieved	9	17

Due to the small number of European papers identified, an author search was conducted, using the co-ordinators of the HELICS DG SANCO collaboration. This yielded a further 10 publications that provided specific surveillance data.

Eurosurveillance

Eurosurveillance (A monthly publication) and *Eurosurveillance Weekly* (a weekly electronic bulletin) are funded by the European Commission with the aim to promote the diffusion and exchange of information on communicable diseases; both are available on line at <http://www.eurosurveillance.org/index-02.asp>. The volumes for 1998-2003 were searched using the MeSH terms: hospital acquired infection, nosocomial infection, surgical site infection, MRSA, antimicrobial resistance, bacteraemia AND prevalence, incidence.

	1998	1999	2000	2001	2002	2003
<i>Eurosurveillance</i>	86	93	89	87	87	43
Downloaded articles	2	0	6	3	3	0

▪ Web-based Databases

Relevant web-based databases, maintained by national governments, departments of health and professional bodies were searched for information explicitly relevant to any of our review issues.

EU Countries

The HELICS DG SANCO website <http://helics.univ-lyon1.fr> was used as the source for the search of European organisations responsible for policy direction, surveillance and guideline development. The websites identified for each of the countries included in the review were then searched for information related to the review issues. Only information available in English language was retrieved. In addition to the database the HELICS II Report and Appendices were downloaded and used to provide data on the surveillance structures and policies underpinning the selected countries healthcare-associated infection programme.

United States of America

The Centers for Disease Control and Prevention (CDC) website <http://www.cdc.gov/> and CDC-associated websites, e.g., the Division of Healthcare Quality Promotion (DHQP) <http://www.cdc.gov/ncidod/hip/>, the Healthcare Infection Control Practices Advisory Committee (HICPAC) <http://www.cdc.gov/ncidod/hip/HICPAC/> and the National Centre for Infectious Diseases <http://www.cdc.gov/ncidod/index.htm> were the principal USA websites we reviewed. Additionally, the websites for the Society of Healthcare Epidemiologists of America (SHEA) <http://www.shea-online.org/> and the Association for Professionals in Infection Control and Epidemiology Inc. (APIC) <http://www.apic.org/> were reviewed.

Finally, we reviewed the websites for the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) <http://www.jcaho.org/>, the federal Occupational Safety and Health Administration (OSHA) that covers healthcare facilities <http://www.osha.gov/SLTC/healthcarefacilities/index.html> and NCQA, the National Committee for Quality Assurance at <http://www.ncqa.org/Main/programs.htm> which is responsible for the accreditation and certification information for health maintenance organizations (HMOs).

Australasia

We reviewed the website of the Australian Infection Control Association <http://www.aica.org.au>, Commonwealth Department for Health and Aged Care <http://www.health.gov.au>, Queensland Government Health Department (Queensland Health) <http://www.health.qld.gov.au>, the Australian council on Healthcare Standards <http://www.achs.org.au> and the Australian Council for Safety and Quality in Health Care <http://www.safetyandquality.org>. In addition, we reviewed the report on hospital-acquired infections in New Zealand from the Auditor General's Office <http://www.oag.govt.nz>

▪ E-mail Surveys

We developed a survey instrument designed to elicit country-specific data for each of our review issues (Appendix 1). Key personnel* in each of the select countries were e-mailed a survey form which they completed and returned by e-mail. Our response rate was 100 per cent despite this survey being conducted during the period of the SARS outbreak when respondents were extremely busy.

Following a preliminary analysis of the completed questionnaires, a country report was written and returned to each respondent for comment and additional information.

Country Respondents

The following key personnel* responded to the e-mail survey:

Country	Respondent	Country Organization
USA	Teresa Horan MPH	Chief, Performance Measurement Section, Healthcare Outcome Branch, Division of Healthcare Quality Promotion, National Center for Infectious Diseases, Centers for Disease Control and Prevention thoran@cdc.gov
Australia	Ms. Dolly Olesen Dr. Michael Whitby	Australian Infection Control Association (AICA); Queensland Health (Government of Queensland) Dolly_Olesen@health.qld.gov.au WhitbyM@health.qld.gov.au
New Zealand	Collin Morris Deborah Mills Bill Gebbie	Office of the Auditor General, Government of New Zealand Bill.Gebbie@oag.govt.nz
Belgium	Dr. Carl Suetens	Head of National Programme for the Surveillance of Nosocomial Infections, Scientific Institute of Public Health, Department of Epidemiology Carl.Suetens@ihe.be
Denmark	Dr. Ole B. Jepsen	Staten Serum Institut (National Serum Institute), National Center for Antimicrobial Resistance and Infection Control OBJ@ssi.dk
France	Prof. Jacques Fabry	Laboratoire d'épidémiologie et de Santé Publique, Université Claude Bernard and Hospices Civils de Lyon jfabry@rockefeller.univ-lyon1.fr
Germany	Prof. Petra Gastmeier	Institute for Medical Microbiology and Hospital Epidemiology, Hannover Medical School Gastmeier.Petra@mh-hannover.de
The Netherlands	Dr. Annette de Boer	National Institute of Public Health and the Environment (RIVM), Centre for Infectious Diseases Epidemiology Annette.de.Boer@rivm.nl
Spain	Dr. Jose Rossello-Urgell	Servicio de Medicina Preventiva y Epidemiología, Hôpital Universitario Vall d'Hebron mp6jr@cs.vhebron.es

Analysis

A descriptive text-based and comparative analysis of data from the literature, web sites and email respondents was conducted using an analytical framework derived from the review issues.

Results

Following analysis, the following detailed reports were compiled for each select country.

Comparison of International Practices in the Management and Control of Hospital-acquired Infections

I Extent and Costs of Healthcare-Associated Infections

Extent

United States of America

Is information on the national, regional or state prevalence of HAI available?

Prevalence data is collected in the USA by the National Nosocomial Infections Surveillance (NNIS) System. This is a cooperative effort that began in 1970 between the Centers for Disease Control and Prevention (CDC) and participating hospitals to create a national nosocomial infections database. Today, the NNIS database is able to describe the epidemiology of nosocomial infections and antimicrobial resistance trends and produce nosocomial infection rates to use for comparison purposes.⁽¹⁾ The purposes of NNIS are to establish national risk-adjusted benchmarks for hospital-acquired infection rates and device use ratios by using uniform case definitions and data collection methods and computerized data entry and analysis.⁽²⁾

How are prevalence data collected? NNIS data are collected uniformly by trained infection control professionals (ICPs) using standardized protocols (surveillance components) that target inpatients at high risk of infection and are reported routinely to CDC where they are aggregated into the NNIS database. To promote the use of standardized data collection and analysis methods, ICPs receive 28 hours of training at CDC and are invited to attend a biennial conference.⁽¹⁻³⁾

What surveillance components are used? There are four surveillance components: adult and paediatric intensive care unit (ICU), high-risk nursery (HRN), surgical patient, and antimicrobial use and resistance (AUR) (Table 1).

The components may be used singly or simultaneously, but once selected they must be used for a minimum of 1 calendar month. All infections are categorized into major and specific infection sites using standard CDC definitions that include laboratory and clinical criteria.

Who can participate in the NNIS System? Participation in the NNIS System is voluntary and involves only acute care general hospitals in the United States. Long term care facilities, such as rehabilitation, mental health, and nursing homes are not included in the NNIS System. By law, CDC assures participating hospitals that any information that would permit identification of any individual or institution will be held in strict confidence.⁽¹⁾ At the beginning of 2000, approximately 315 hospitals were participating in the NNIS System.

The NNIS System is not accepting new applications for membership at this time.⁽³⁾

How are data reported? The data from the NNIS System are reported annually in the in the *American Journal of Infection Control* and online as the NNIS Report located on the NNIS website

<http://www.cdc.gov/ncidod/hip/SURVEILL/NNIS.HTM>

Table 1: NNIS surveillance components ⁽³⁾

Component	Description
Adult and paediatric intensive care units (ICU)	Infection control professionals (ICPs) collect data on all sites of nosocomial infection in patients located in ICUs, and ICU-specific denominator data. Site-specific infection rates can be calculated by using as a denominator the number of patients at risk, patient days, and days of indwelling urinary catheterization, central vascular cannulation (central line), or ventilation.
High risk nurseries (HRN)	ICPs collect data on all sites of nosocomial infection in patients located in HRNs, and HRN-specific denominator data. Site-specific infection rates can be calculated by using as a denominator the number of patients at risk, patient-days, and days of umbilical catheter/central line use or ventilation for each of 4 birth-weight categories (1000 g, 1001 to 1500 g, 1501 to 2500 g, and >2500 g).
Surgical patient	ICPs select from the NNIS operative procedure list those procedures they wish to follow-up and monitor the patients undergoing those procedures for all infections or surgical-site infections (SSI) only. A record on every patient undergoing the selected procedure is generated that includes information on risk factors for SSI such as wound class, duration of operation, and American Society of Anesthesiology (ASA) score. Using a composite index for predicting the risk of SSI after operation, ICPs can calculate rates by the number of risk factors present.
Antimicrobial Use and Resistance (AUR)	The AUR component allows inter-hospital comparison of select antimicrobial use and antimicrobial resistance rates, which can be used in conjunction with the device-associated rates generated from the ICU component. Hospital choosing this component aggregate antimicrobial use and resistance data from at least three areas: one ICU or specialty care area (such as bone marrow transplant unit), all non-ICU inpatient areas combined, and all outpatient areas combined.
Hospital-wide surveillance	In January 1999, the hospital-wide component was eliminated from the NNIS system. This was done for several reasons. The hospital-wide component required considerable time and resources in most hospitals, particularly those that have a large patient population at high-risk, resulting in inaccurate and inadequate case-finding. More importantly, the hospital-wide component did not yield rates that were meaningful for national comparison purposes because they were not risk-adjusted

What do these data demonstrate? These and other review data suggest that between 5 and 10 percent of patients admitted to acute care hospitals acquire one or more infections ⁽⁴⁾ and that the risks for Hospital-acquired Infections (HAI) have steadily increased during recent decades (Table 2).^(5,6) HAI affect

approximately 2 million patients each year and result in approximately 90,000 deaths. ⁽⁷⁻⁹⁾

Table 2: HAI in the United States of America ^(5,6)

Variable	Year 1975	Year 1995
No. of admissions (x10 ⁻⁶)	37.7	35.9
No. of patient-days (x10 ⁻⁶)	299.0	190.0
Average length of stay (days)	7.9	5.3
No. of inpatient surgical procedures (x10 ⁻⁶)	18.3	13.3
No. of HAI (x10 ⁻⁶)	2.1	1.9
Incidence of HAI (no. per 1000 patient-days)	7.2	9.8

Four types of infection account for more than 80 percent of all HAI: urinary tract infections (UTIs), usually catheter-associated (CR-UTIs), surgical site infections (SSIs), bloodstream infections (BSIs) (usually associated with the use of an intravascular device – CR-BSI), and pneumonia (usually ventilator-associated, i.e., VAP).^(9,10) They can be ranked according to their frequencies, associated mortality rates, costs, and relative changes in frequency in recent years: ^(5,8)

- CR-UTIs are the most frequent, accounting for about 35 percent of HAI but carry the lowest costs and mortality;
- SSIs are second in frequency (about 20 percent) and third in costs;
- CR-BSIs and pneumonia are less common (about 15 percent each) but are associated with much higher costs, morbidity and mortality.

Trends

BSIs and Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are the most rapidly increasing in frequency with the current incidence of BSI being nearly three times the incidence in 1975.^(5,11) One fourth of nosocomial infections involve patients in intensive care units (ICU), and nearly 70 percent are due to microorganisms that are resistant to one or more antibiotics. ^(2,12)

The rates of both UTIs and SSIs have declined slightly over the last few years but this may be due to surveillance artefacts caused by decreases in the length of hospital stays and increasing numbers of infections that develop after discharge from the hospital.⁽⁴⁾ The incidence of SSIs and other HAI in ICU patients in NNIS-participating hospitals have been reduced during the last decade by over 10 percent.⁽²⁾

For further information on HAI in ICU, see:

<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4908a1.htm>

The value of NNIS as a model to prevent HAI

The elements of NNIS that are believed to be critical for HAI rate reduction ⁽²⁾ are:

1. voluntary participation and confidentiality for NNIS hospitals;
2. standard definitions and protocols <http://www.apic.org/pdf/cdcdefs.pdf>;

3. targeted, high-risk populations (e.g., intensive care and surgical patients);
4. site-specific, risk-adjusted infection rates comparable across institutions;
5. adequate numbers of trained ICPs;*
6. data dissemination to health-care providers; and
7. links between monitored rates and prevention efforts ⁽¹³⁻¹⁵⁾.

*The key to NNIS success is having trained ICPs who use monitoring data to design and implement prevention activities at healthcare facility level.

The evidence for rate reduction in NNIS hospitals are subject to at least three limitations:

1. improvements may be influenced by other national efforts to prevent infections, e.g., new research, prevention guidelines;
2. the shift in the US health-care system from hospital-based care to nonhospital settings;*
3. dependence on collecting most data from patient record review.

*NNIS has not yet conducted surveillance in nonhospital settings and acknowledges that efforts are needed in these locations to determine the extend of HAI rates and where to target prevention initiatives.

Australia

Is information on the national, regional or state prevalence of HAI available?

Australia does not have a national system of surveillance for HAI. Consequently, a 'general paucity of data makes it difficult to estimate the incidence and costs of these infections in Australia or to develop appropriate national control strategies.' ¹⁶

A national nosocomial prevalence survey was undertaken in 1984 and found that 6.3 percent of 28,643 hospitalized patients had a hospital-acquired infection (most commonly, a SSI, UTI or respiratory tract infection) with the highest rates in larger hospitals. ¹⁷ No similar study has been conducted since.

In April 2001 the Australian Infection Control Association (AICA) presented a draft report to the Commonwealth Department of Health and Aged Care (CDHA) entitled "National Surveillance of Healthcare Associated Infection in Australia."¹⁶ This comprehensive report discusses the prevalence and financial costs of all of the major HAI in Australia, and describes various surveillance systems. Estimates of the extent of HAI in Australia described in this report are extrapolated from other international prevalence data. These estimates suggest that the prevalence (and cost) of HAI in Australia is similar to those reported in the USA, UK and Canada.

Surveillance studies cited in the above report are now beginning to describe the local epidemiology of HAI in Australia. Many of these studies describe the

incidence of HAI in patients undergoing cardiovascular and orthopaedic surgery in a well defined grouping of hospitals, e.g., in ten public health hospitals in New South Wales, eleven Victorian hospitals. An interesting study of over 36.5 thousand surgical wounds in Tasmania described in this report demonstrated the benefits of a surveillance system. All reported infections were validated by an infection control nurse and during the initial two year surveillance period a significant reduction in infection rates was achieved. However, when the infection control nurse went on leave for 15 months and surveillance was temporarily discontinued, the infection rates increased to pre-surveillance levels. Once surveillance was re-established, a significant reduction in the infection rate was once again observed.

The Centre of Healthcare Related Infection Surveillance and Prevention (CHRISP) is a project of the Quality Improvement and Enhancement Program (QIEP) funded through Queensland Health that aims to continuously monitor the performance of health care facilities in regard to HAI.¹⁸ It collects state-wide anonymised (patient/hospital) data. We have not been able to establish the current status of this project as the website appears not to have been updated since 2001 and does not contain any project outcomes, i.e., surveillance data. Various other States have established (or are developing) individual programmes to facilitate State-wide co-ordination of surveillance of HAI, including surveillance of occupational exposures to bloodborne pathogens.

e/CAT, a data collection and analysis package developed by a team of infection control professionals to serve the needs of the infection control community is in use in many parts of Australia.¹⁹ The website however does not give details of the extent of its use and again does not publish surveillance data.

New Zealand

Is information on the national, regional or state prevalence of HAI available?

National surveillance data is limited, however, a recent study (2003) on the prevalence and estimates of the cumulative incidence of HAI among patients admitted to Auckland District Health Board Hospitals suggested a national HAI rate of 10%.²⁰ Incidence data relating to hospital-acquired bloodstream infections (BSI) has been collected nationally since the mid 1990s and a study published in 1998 found New Zealand's rate acceptable for a developed country with a comprehensive health service.²¹ Almost 80% of BSI occurred in areas with large hospitals offering complex services. The study recommended that a nationally coordinated programme be developed to monitor and compare BSI rates for comparable medical and surgical services in high-risk hospitals. Since the 1970s national surveillance of antimicrobial resistance has been undertaken by the Institute of Environmental Science and Research (ESR) on behalf of the Ministry of Health.²²

The Office of the Auditor General (OAG) report noted a need to develop comprehensive HAI surveillance and although the Ministry had accepted this

in principle, no time frame had been agreed. The ESR would undertake this. The OAG study also reported that most hospitals were undertaking periodic surveillance of infections post discharge from hospital but only three of the six DHB hospital services with tertiary hospitals were monitoring surgical site infections.

Belgium

Is information on the national, regional or state prevalence of HAI available?

The coordination of national surveillance programmes is undertaken by the Scientific Institute of Public Health-Louis Pasteur²³ and Belgian Group for the Study, Screening, and Prevention of Hospital Infections (GDEPIH/GOSPIZ) using a methodology last published in 1990.²³ The surveillance programme has four components: infections acquired in intensive care units (ICU) focused on ventilator-associated pneumonia (VAP) per 1000 patient days and catheter-related blood stream infection (CRBSI) per 1000 patient days; hospital wide nosocomial blood stream infection (BSI); multi-drug resistant *staphylococcus aureus* (MRSA); and surgical site infection (SSI).²⁴

How are data collected?

Data are collected quarterly with the exception of MRSA which is six monthly. Participation is voluntary and currently 110-120 hospitals participate in the ICU and BSI modules and 60 hospitals collect and provide data for a minimum, period of three months for the SSI module. Data collection is conducted by hospital based healthcare professionals and analysis involves the infection control team (ICT), primarily infection control doctors (ICD), infection control nurses (ICN), and microbiologists.²⁴ Data are validated internally and externally.

How are data reported?

Confidential feedback is provided to participating hospitals. The Flemish region requires the disclosure of NI for hospital accreditation since 1999.²⁵

What do these data demonstrate?

Data reports the incidence of BSI as 7.05 BSI episodes per 10000 patient days with a greater incidence in ICU of 38.5 per 10000 patient days. Nearly a quarter (23.5%), of BSI are catheter related.⁴ Data from ICU surveillance indicates that 2.4% of patients in ICU are diagnosed with bacteraemia, the device adjusted BSI rate was 3.0/1000 catheter days and varied according to surgical intervention.²⁶ Ventilator-associated pneumonia accounts for 4.7% of VAP in patients in ICU for longer than 48 hours, with a rate of 19.0/1000 ventilator days.²⁷ In 36 acute hospitals reporting data the median prevalence of MRSA increased between 1989 and 1991 from 9.5% to 13.7%, with a mean prevalence rate of 14%.²⁸

Denmark

Is information on the national, regional or state prevalence of HAI available?

The coordination of national surveillance programmes is undertaken by the National Centre for Hospital Hygiene (NCHH), Statens Serum Institute (SSI) using an adaptation of CDC definitions for NI surveillance and methodology last updated in 1997. The surveillance programme has two components: national multi-drug resistant *staphylococcus aureus* (MRSA) surveillance, which includes surgical wounds, bloodstream, urinary catheter, vascular catheter and respiratory tract; and nosocomial infection surveillance. National prevalence surveys are conducted at three yearly intervals on approximately 25% of acute beds.²⁴

Prevalence information is presented to the Ministry of Health at three year intervals.

How are data collected?

Prevalence data are collected in accordance with strict guidelines, using data forms provided by the NCHH. National protocols are used locally by multidisciplinary healthcare professionals to collect data. Analysis is undertaken by members of the ICT, primarily ICD, ICN and microbiologists and validated internally at the NCHH.

How are data reported?

Data is reported by SSI using electronic (www.ssi.dk) and traditional publishing routes and confidential feedback is provided to participating hospitals. Data are also made available to the media and public through the quarterly NCHH Newsletter (also available online). Data is available in Danish with some limited summaries in English.

What do these data demonstrate?

Data available from a 20 year comparison of surveillance data shows overall prevalence rates of nosocomial infection reducing from 12.1% in 1979 to 8% in 1999.²⁹ Surgical site infections have remained constant over the same period at 2% in 1979 and 2.5% in 1999.²⁹ Over the same period BSI rates although separated into bacteraemia and septicaemia for the 1999 comparison have remained constant at a combined rate of 0.4%.²⁹ Prevalence rates of urinary tract infections fell from 5.5% in 1979 to 2.1% in 1999.²⁹ In the period 1998-2001 numbers of MRSA infections have almost doubled from a very low base of 54 cases to 105 cases.³⁰ The recent increases in MRSA cases is not due to strains imported from outside Denmark.³¹

France

Is information on the national, regional or state prevalence of HAI available?

The coordination of national/regional surveillance of nosocomial infection programmes is undertaken by the Ministry of Health (Nosocomial Infection Unit) and a committee of experts drawn from the five regions known as the Comité Technique National Nosocomiales (CTIN) using an adaptation of CDC definitions for NI surveillance and methodology established in 1992.²⁴ Activity is centred in five regional coordinating centres (CCLIN) also created in 1992 and located in university teaching hospitals in Bordeaux, Rennes, Lyon, Paris and Strasbourg. There are seven components in the French inter-regional nosocomial surveillance programme: hospital wide MRSA commenced in regions between 1993 and 1999; SSI surveillance (INCISO) per 100 operations commenced between 1995 and 1997; hospital-wide BSI per 1000 patient days and per 100 patient admissions commenced in 1994; UTI infections commenced in 1997; a maternity component focuses on rates per 100 caesarian sections and per 100 normal deliveries, and on infections in newborn infants. The ICU component is complex and covers acquired infections (REACAT) colonisation per 1000 catheter days (arterial and central venous) and bacteraemia per 1000 patient days; general nosocomial infections and those related to device use.²⁴ Since 1996, national prevalence surveys have been planned at five yearly intervals.

How are data collected?

Data for the national prevalence survey is collected using a standardised protocol and coordinated by CCLIN South West in Bordeaux. Inter-regional data is collected using standardised protocols and participation is voluntary for a minimum period of three months of data collection. Currently 84 units and 72 hospitals participate in the MRSA component: 506 units submit data for SSI; 134 hospitals participate in bacteraemia surveillance; and 198 units submit data for ICU related infections. Data collection is conducted by hospital based healthcare professionals and analysis involves the (ICT), primarily ICD, ICN, and microbiologists.²⁴ Data is validated internally.

How are data reported?

Confidential feedback is provided to participating hospitals. Data is published by the electronic (<http://cclin-sudest.univ-lyon1.fr>) and traditional publishing routes in the Journal of Hospital Infection and other journals.

What do these data demonstrate?

Results of the 1996 prevalence survey identify that 22% of ICU patients develop an infection, the most frequent urinary tract and respiratory tract infections. Preliminary findings from the 2001 survey indicate that the overall prevalence of patients with NI is 6.9%. Surgical site infections comprise 10.5% of NI in both the 1996 and 2001 survey.^{32,33} Other data suggests that 2% of surgical procedures result in an SSI.³⁶ Urinary tract infections account for 40% of all NI, with symptomatic infections accounting for over half of the total (24%).³³ Methicillin resistant *Staphylococcus aureus* accounts for 64% of

all staphylococcal infections with vancomycin resistance being encountered in 0.5% of infections.³⁴

Germany

Is information on the national, regional or state prevalence of HAI available?

The coordination of national surveillance of nosocomial infection programmes is undertaken by the Robert Koch Institute and the National Reference Centre for the Surveillance of Nosocomial Infections, using an adaptation of CDC definitions for NI surveillance adopted in 1997 with the general methodology for surveillance being updated and published in 1998.²⁴ The first and only national prevalence survey was carried out in 1994 with a few local surveys being conducted in some hospitals since that time. There are four components in the surveillance programme Krankenhaus-Infektions-Surveillance-System known as KISS. The two major components were established in 1997 and are the ICU component focused on VAP, CRBSI and UTI associated with urinary catheterisation and the SSI component. Two smaller components, focusing on neonatal intensive care established in 1999 and bone marrow transplant patients established in 2001, also exist.²⁴

How are data collected?

Ny means of KESS, a computer programme developed especially for KISS data entry. KISS data is collected using a standardised protocol and coordinated by the National Reference Centre for the Surveillance of Nosocomial Infections. Participation is voluntary for a minimum period of three months of data collection. Currently 189 units participate in the ICU component and 158 units participate in the SSI component. Data collection is conducted by hospital based healthcare professionals and analysis involves the (ICT), primarily ICD, ICN, and microbiologists.²⁴

How are these data reported?

No information retrieved

What do these data demonstrate?

Recent surveillance data indicates an overall prevalence rate for nosocomial infection as 4%.³⁵ The prevalence of blood stream infection is 8.3% with 2.1% being ICU related. The incidence of catheter associated BSI is reported as 2.2 BSI per 1000 central venous catheter days.³⁶ Data from ICU surveillance also indicates an incidence of 0.31 MRSA infections per 1000 patient days with an overall increase in MRSA. Resistant organisms are associated with 19.2% of *Staphylococcus aureus* pneumonia and 25.5% of *Staphylococcus aureus* primary bloodstream infections.³⁶

The Netherlands

Is information on the national, regional or state prevalence of HAI available?

The coordination of national surveillance of nosocomial infection programmes is undertaken by the National Institute of Quality Improvement in Health Care CBO and the National Institute of Public Health and Environment (RIVM) using an adaptation of CDC definitions for NI surveillance adopted in 1993 with the general methodology for surveillance being updated and published in 1998.²⁴ The PREZIES project has 3 surveillance components: ICU including VAP per 1000 ventilator days, BSI and sepsis per 1000 catheter days and UTI per 1000 urinary catheter days; SSI per 100 operations (specific); and catheter associated sepsis per 1000 catheter days. In addition there is a pilot component focused on pneumonia.²⁴

How are data collected?

PREZIES data is collected using a standardised protocol and coordinated by RIVM. Participation is voluntary for a minimum period of three months of data collection. Currently 16 hospitals participate in the ICU component, 10 hospitals in the catheter associated sepsis component and 70 hospitals participate in the SSI component. Data collection is conducted by hospital based healthcare professionals and analysis involves the (ICT), primarily ICD, ICN, and microbiologists.²⁴ Data is externally validated.

How are these data reported?

The results of PREZIES surveillance is published in scientific articles and RIVM reports available on line at www.rivm.nl In addition RIVM and the National Institute of Quality Improvement in Health Care CBO publish their data online at www.prezies.nl Short articles are published online in a joint monthly bulletin at www.infectieziektenbulletin.nl

What do these data demonstrate?

The incidence of nosocomial infection in the Netherlands is calculated to be 6.3 per 1000 patient days³⁷ and 42 per 1000 patient days in ICU.³⁸ Surgical site infection has a prevalence of 3.4% and there 1000-1500 *Staphylococcus aureus* bacteraemias per year resulting in mortality of 20% of cases.³⁷ Methicillin resistant *Staphylococcus aureus* accounts for less than 1% of bacteraemias. The overall incidence of MRSA is <0.5%.³⁷

Spain

Is information on the national, regional or state prevalence of HAI available?

The coordination of national surveillance of nosocomial infection programmes is undertaken at regional level by the Comision INOZ for the Basque region and the Comite d'Experts del Departement d Sanitat for Catalonia using an adaptation of CDC definitions for NI surveillance adopted in 1993.²⁴ Between 1990 and 1999 prevalence data was collected annually as part of the EPINE project, this was replaced in 1999 with the PREVINE project which provides

cumulative incidence data. PREVINE has one surveillance component which covers cumulative incidence, incidence density and device associated incidence of NI.²⁴

How are data collected?

No information retrieved.

How are data reported?

No information retrieved

What do these data demonstrate?

Data from EPINE over the eight year period between 1990-1998 shows an overall prevalence of NI of 8.3%.³⁹ Methicillin-resistant *Staphylococcus aureus* rose from 4.7% to 40.2% in the same period. Between 1997-1999 prevalence remained static at 7%. There has been a recorded decrease in the occurrence of UTI and SSI but an increase in lower respiratory tract infections and bacteraemias.⁴⁰ With the exception of ICU there has been an observed overall decrease in NI.

Costs

United States of America

Is information on the costs of HAI available?

Previous (1980-82) estimates of the cost of HAI to US healthcare systems were thought to be between \$5-10 million per year,⁴¹ however, more recent data suggests that HAI add \$4.5 to \$5.7 billion per year to the costs of patient care in the USA.^{4,7-9} Further information on measuring the economic costs of antimicrobial resistance in hospital settings⁴² and the use of economic modelling to determine the hospital costs associated with nosocomial infections⁴³ is being explored.

Australia

Is information on the costs of HAI available?

The Australian Infection Control Association (AICA) undertook a scoping study, which describes costs of HAI. Details of this study form part of the AICA report previously described.¹⁹ The cost data in this report is detailed but out of date. Figures for 1988 are quoted: “nosocomial infections were estimated to affect 6.3% of hospitalised patients in Australia, with an annual cost of \$180 million. Surgical site infections were estimated to affect 4.6% of patients undergoing surgery, with an annual cost of \$60 million per year”. The estimated total cost of health-care associated blood stream infections ranges up to \$686 million per year.

New Zealand

Is information on the costs of HAI available?

No national studies have been undertaken but a recent study in Auckland estimated national costs in medical and surgical patients alone to be in the region of US\$137 million.⁴⁴ The costs of treating HAI in adult medical and surgical patients in two Auckland DHB hospitals was estimated to be US\$ 19 million.⁴⁵

The OAG study reported that one hospital had produced a business case seeking additional infection control personnel.⁴⁵ It estimated that almost \$4 million could be saved each year through an investment of \$170,000. Based on a conservative estimate of hospital-acquired infection rates, the hospital estimated that it would save (in bed occupancy costs) at least 15 times what it would spend on additional infection control resources. Another hospital estimated that it spends \$261,000 annually on dealing with surgical site infections. The report recommends a model be developed to determine the appropriate level of infection control, which takes account of all the relevant factors.

Belgium

Is information on the costs of HAI available?

In 1991 and 1995 the Belgian National Programme for Surveillance of Hospital Infections collected data on perioperative antibiotic prophylaxis in 72 acute care hospitals. This study estimated that annual drug cost savings of 194 million Bf (US\$ 6.1 million) could be made if national recommendations were followed closely.⁴⁶

Denmark

Is information on the costs of HAI available?

The costs of hospital acquired infections have been calculated and compared with data from the United Kingdom (available in Danish only). It is felt the costs of HAI in Denmark are similar to recently describe estimated costs in the United Kingdom (see Ref. 15 in Executive Summary). In Denmark, SSI were calculated to carry a cost of 400 million DKr. (Danish Krone) while other HAI were calculated to cost 600 million DKr. (Personal communication: e-mail respondent - OB Jepsen).

France

Is information on the costs of HAI available?

No data retrieved.

Germany

Is information on the costs of HAI available?

No data retrieved.

The Netherlands

Is information on the costs of HAI available?

Costs of the strict policy of MRSA eradication reported that 2,265 bed days were lost over a 10 year period with a loss of at least 250 elective surgical cases. The cost of keeping one medical centre free from MRSA over a 10 year period were estimated at 2,800,000 Euros.⁴⁷

Spain

Is information on the costs of HAI available?

No data retrieved.

Comparison of International Practices in the Management and Control of Hospital-acquired Infections

II Strategy and policy related to reducing the risk of hospital-acquired infections

United States of America

Are there national, regional or state strategies for preventing HAI ?

As part of their mission, the Division of Healthcare Quality Promotion (DHQP) at the Centers for Disease Control and Prevention (CDC) is responsible for (amongst other activities):

- identifying effective interventions that prevent Hospital-acquired Infections/antimicrobial resistance, related adverse events, and medical errors among patients and healthcare personnel;
- promoting the nationwide implementation of these interventions; and
- evaluating the impact of their implementation across the spectrum of healthcare delivery sites.

<http://www.cdc.gov/ncidod/hip/mission.htm>

An important element of the national strategy for decreasing the risks of HAI <<http://www.cdc.gov/ncidod/hip/challenges.htm>> are summarised in the 'Seven Healthcare Safety Challenges' campaign in which they intend to accomplish the following within the next five years:

1. Reduce catheter-associated adverse events by 50% among patients in healthcare settings
2. Reduce targeted surgical adverse events by 50%
3. Reduce hospitalizations and mortality from respiratory tract infections among long-term care patients by 50%
4. Reduce targeted antimicrobial-resistant bacterial infections by 50% by:
 - preventing infections
 - diagnosing and treating infections appropriately
 - optimizing antimicrobial use, and
 - preventing transmission in healthcare settings
5. Eliminate laboratory errors leading to adverse patient outcomes
6. Eliminate occupational needlestick injuries among healthcare personnel
7. Achieve 100% adherence to ACIP (Advisory Committee on Immunization Practices) guidelines for immunization of healthcare personnel

Are there key healthcare policies that influence these strategies?

In addition to the above strategy, an interagency task force, co-chaired by CDC, the Food and Drug Administration (FDA) and the National Institutes of Health (NIH) has mapped the US government's policy response to the rising threat of antimicrobial resistance (AR), including the implementation of appropriate antibiotic use policies. There are four major components to the 'Public Health Action Plan to Combat Antimicrobial Resistance' (Part 1: Domestic Issues): surveillance, prevention and control, research, and product development, all broken down into 84 action items (13 considered the highest priority – Table 2). The plan will be implemented incrementally as resources become available. The overall goal is to:

- develop and implement a coordinated national plan for AR surveillance;
- ensure availability of reliable drug susceptibility data for surveillance;
- monitor patterns of antimicrobial drug use;
- monitor AR in agricultural settings to ensure a safe food supply.

Table 2: Top priorities of the four major sections of the Public Health Action Plan to Combat Antimicrobial Resistance:

<http://www.cdc.gov/drugresistance/actionplan/2001report/index.htm>

Surveillance. CDC will work with state health departments and other task force members to design and implement a plan that will define national, regional, state and local antimicrobial resistance surveillance responsibilities so that these entities are coordinated and use similar methodology. Additionally, FDA, USDA and CDC plan to develop systems that can monitor patterns of antimicrobial drug use in human medicine, in agriculture and in consumer products.

Prevention and control. HHS and partners will launch a national public education campaign to reduce the overuse and misuse of antimicrobial drugs and to improve antibiotic use in health care systems. Along with professional societies and other stakeholders, CDC already has started to prepare clinical guidelines for health professionals on how best to use antimicrobials. Additionally, FDA has initiated consultations with stakeholders to refine its proposed framework for assessing the human health impact of antimicrobials that may be used in food-producing animals. CDC, too, has been supporting pilot projects to identify effective strategies to promote appropriate antimicrobial drug use and reduce infection rates in clinical practice.

Research. NIH will lead a team of agencies that will provide the research community with new information and technologies, including genetic blueprints for various microbes, to identify targets for desperately needed new diagnostics, treatments and vaccines that could assist in preventing the emergence and spread of resistant pathogens. NIH plans to develop clinical studies to test new antimicrobials and novel approaches to treating and preventing infections caused by resistant pathogens. NIH continues to encourage and facilitate new rapid diagnostic methods and will pursue their

development and evaluate their ultimate impact in the context of antimicrobial resistance.

Product Development. To identify and publicize priority health needs for new products that prevent resistance or treat resistant infections, HHS plans to create an Interagency Antimicrobial Product Development Working Group. Once formed, this group also will consult with stakeholders and economic consultants to identify incentives that encourage this kind of product development.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

DHQP has established a consortium of **Prevention EpiCenters** to carry out a research programme focused on reducing the risks of HAI. The programme objectives are to establish an ongoing consortium of academically-based research centers to conduct research and demonstrations projects that will:

- Enhance our understanding of the cost-effectiveness and prevention effectiveness of interventions to prevent Hospital-acquired Infections and other adverse healthcare events, including those due to medical errors.
- Promote improved information system capacity for monitoring, tracking, and assessing healthcare-associated infections, other adverse health events, and medical errors, and integrate quality improvement activities in healthcare organizations across the spectrum of delivery sites.
- Promote development of an epidemiology infrastructure across the spectrum of healthcare delivery sites.
- Use the Prevention Epicenters consortium to conduct research and development activities to further DHQP program goals for surveillance and prevention.

Program Description:

- The Prevention Epicenters are 7 academic medical centers that collaborate with DHQP under an ongoing cooperative agreement to perform research and prevention projects.
- Projects are directed by the Steering Committee, which consists of 2 representatives from each Epicenter and DHQP
- One or more core multicentre projects are carried out each year
- Each Epicenter works has one or more investigator-initiated single-center projects
- Additional special projects are performed as the need arises.

Expected Impact:

- Reduced rates of healthcare-associated adverse events through knowledge gained in Prevention Epicenter projects
- Improved monitoring for healthcare-associated adverse events, through research pointing to innovative surveillance methods (e.g., electronic data collection) that are more sensitive and less labor-intensive.

- Enhanced prevention of adverse events by developing and honing prevention methods at these major medical centers
- Extend healthcare surveillance beyond intensive care units and hospitals

Does the strategy identify any specific training & education objectives for the prevention of HAI?

CDC has developed and published online an educational initiative ('campaign') to support policy and practice aimed at reducing the incidence of MRSA infection in specific patient populations. This educational programme is available at: <http://www.cdc.gov/drugresistance/healthcare/default.htm>

This educational campaign:

- Focuses on preventing antimicrobial resistance in healthcare settings, such as hospitals and long-term care facilities;
- Promotes four strategies that clinicians can use to prevent antimicrobial resistance among different groups of patients:
 1. Prevent infection;
 2. Diagnose and treat infection effectively;
 3. Use antimicrobials wisely;
 4. Prevent transmission.
- Provides clinicians with tools for preventing antimicrobial resistance among specific patient populations:
 1. hospitalized adult patients;
 2. dialysis patients;
 3. surgical patients;
 4. hospitalized children;
 5. long-term care patients.
- Recommends action steps to prevent antimicrobial resistance based on guidelines, recommendations, and other research;
- Fosters partnerships to implement all campaign activities.

To support the campaign, CDC makes available a variety of web resources at: <http://www.cdc.gov/drugresistance/healthcare/webresources.htm>

A number of infection control training courses are available through various organizations, universities, and public health agencies in all States. In addition, both The Society for Healthcare Epidemiology of America, Inc. (SHEA) and the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) offer online e-learning courses and list relevant training opportunities in the United States on their web sites (<http://www.shea-online.org/> and <http://www.apic.org/>).

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

Infection control activities are defined in the accreditation standards of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

<http://www.jcaho.org/> , and the National Committee for Quality Assurance (NCQA), <http://www.ncqa.org/Main/programs.htm> responsible for the accreditation and certification information for health maintenance organizations (HMOs). In general, infection surveillance and prevention and control activities are undertaken by infection control (IC) professionals and hospital epidemiologists (HE) in those healthcare facilities large enough to have dedicated IC/HE personnel.

Australia

Are there national, regional or state strategies for preventing HAI?

The National Health & Medical Research Council (NHMRC) and the National Council on AIDS (ANCA) have released a joint publication *Infection Control in the Health Care Setting* (1996) which is currently under review.⁴⁸ This is based on a review of previous infection control guidelines and the need for national guidelines that cover a broad range of care settings. It includes Standard Precautions and additional precautions for circumstances where Standard Precautions may be insufficient, e.g., MRSA, *Mycobacterium tuberculosis*.

The Australian Council for Safety and Quality in Health (ACSQH) has produced a background paper to support a "national workshop to reduce healthcare associated infections". The paper is entitled "Reducing Health Care Associated Infections - A National Approach".⁴⁹ The paper provides a detailed background to the problem of HAI. It highlights that rates of HAI and antibiotic resistance are "too high" and identifies the complexity of the problem as a major factor in resolving this. It advocates a multi-disciplinary approach.

The stated primary purpose of the workshop was "to consult nationally with key stakeholders to:

- identify national priorities and strategies for improving patient safety by reducing health care associated infections, and;
- identify practical elements of a national approach to achieving this improvement to be led by the Safety and Quality Council in conjunction with other players."

The paper identifies the need to build on existing initiatives. The workshop took place on 12 April 2002 and a draft summary of the workshop outcomes has been released.⁵⁰

Following this workshop, ACSQH published in July 2003 a 'National Strategy to Address Health Care Associated Infections'⁵¹ – available at http://www.safetyandquality.org/articles/Publications/NationalStrategy_web.pdf This strategy make recommendations for:

- the development of national leadership to 'progress the national strategy and develop a workplan to reduce HAI;
- the adoption of national infection control guidelines;

- maintaining the currency of national infection control guidelines;
- developing an operational focussed template consistent with the national infection control guidelines that can be used by all facilities/services to address the day-to-day management of HAI;
- reviewing and updating on an annual basis the definitions and minimum data set required for HAI surveillance
- all jurisdictions agreeing a process of surveillance;
- all jurisdictions having in place policies translated into action plans to prevent and manage HAI, specifically including:
 - availability of guidelines
 - surveillance systems and operational policies, particularly focusing on antibiotic use, intravenous devices and hand hygiene;
- all jurisdictions reviewing available recourses at local level to ensure appropriate capacity to prevent and control HAI;
- developing web/CD-Rom based educational material supported by a number of focussed workshops;
- develop information packages (e.g., hand hygiene and the use of antibiotics) for consumers highlighting their potential role in addressing HAI.

ACSQH also publishes a paper outlining these initiatives entitled "State and Territory Activity in Health Care Associated infections" (2002).⁵² This includes standardised procedures and definitions for bacteraemia and occupational exposure, and a surveillance programme for surgical infections due to commence in 2002. In July 2003, the ACSQH published its National Strategy to Address HAI, which is available from <http://safetyandquality.org.au>

In 1999 the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) presented a detailed report titled, "The use of antibiotics in food producing animals: antibiotic resistance bacteria in animals and humans" to the CDHA.⁵³ In August 2000 the CDHA published its response to the recommendations in the JETACAR report, which included the establishment of an Expert Advisory Group on Antibiotics (EAGA).⁵⁴ The JETACAR report is widely referred to on Australian websites and appears to provide the basis for the national approach to antibiotic resistance.

Section 3 of the Australian Chief Medical Officer's Report 2001-2002 published by the CDHA addresses communicable diseases.⁵⁵ This is the only part of the report which addresses infection issue. The only HAI addressed in this document is antibiotic resistance. The report describes the implementation of the JETACAR recommendations during 2002-2003.

Are there key healthcare policies that influence these strategies?

Unable to identify from the literature, website interrogations and e-mail correspondent.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

The NHMRC publishes strategic priorities on a triennial basis. There is no research focussed on the prevention or control of infection in either the current or previous triennium.⁵⁶

The ACSQH paper outlining state initiatives entitled “State and Territory Activity in Health Care Associated Infections” contains brief references to projects some of which may be research.⁵²

Does the strategy identify any specific training & education objectives for the prevention of HAI?

The AICA website describes a plan to credential and accredit infection control practitioners and establish a national training programme for both specialist and undergraduate nurses.⁵⁷

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

National and State guidelines contain job descriptions for consultant nurse infection control practitioners and clinical nurse specialists^{58,59}

New Zealand

Are there national, regional or state strategies for preventing HAI?

The Ministry’s document *An Integrated Approach to Infectious Disease: Priorities for Action 2002-2006* identified hospital-acquired infections (and in particular those caused by organisms that are resistant to commonly used antibiotics) as one of the six highest priority categories of infectious disease.⁶⁰ The Ministry of Health collaborated with *Standards New Zealand* (the trading arm of the *Standards Council*, a Crown Entity operating under the Standards Act 1988) to develop an Infection Control Standard that sets out the basic principles and systems forming the foundation of effective infection control.

The OAG study noted that while most DHB’s annual and/or strategic plans provided information on priority areas, few included specific plans on infection control.⁴⁵

Are there key healthcare policies that influence these strategies?

The Ministry of Health worked with Standards New Zealand to develop and publish several health standards including the management of risk, waste and an audit workbook for hospitals.⁶¹ The Infection Control Standard was published in 2000 and by October 2004, providers of health services – including public hospitals – will have to demonstrate that they meet the Standard relating to infection control in order to be certified under the Health and Disability Services (Safety) Act 2001. The OAG report noted that the standard was being implemented but little use was being made of the audit tool.⁴⁵ However, good progress had been made on voluntary accreditation which entails quality assurance processes necessary for certification.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

We did not manage to identify any current research programmes.

Does the strategy identify any specific training & education objectives for the prevention of HAI?

Staff are expected to receive training and refresher courses in order to comply with the national standards. Almost two thirds of hospital services in the OAG study were assessing the effectiveness of training through follow-up audits.⁴⁵ However, infection control teams were considered to be undertaking too little audit of policy implementation.

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

All hospitals have established a multidisciplinary infection control team. The OAG report suggested the establishment of an infection control network to evaluate existing practices.⁴⁵ It also suggested that infection control teams be involved in the design and conduct of clinical audits

Belgium

Are there national, regional or state strategies for preventing HAI?

At a government level the strategy for the prevention of HAI is the responsibility of the Ministry of Social Affairs, Public Health and Environment with a Working Party on Hospital Hygiene and the Conseil d' Hygiene Superieur.²⁴ Respondents to the email survey identified no single document as a national strategy. However, strategic direction for preventing HAI is contained in a range of linked activities including legislation, surveillance programmes, guideline development and funding streams for specific components of activity. The implementation of government policy is undertaken by the Scientific Institute of Public Health – Louis Pasteur and the Robert Koch Institute.

Are there key healthcare policies that influence these strategies?

Legislation in the form of Royal Decrees, Ministerial Decrees and Circulars and the Quality Decree of the Flemish Community cover:

- the requirements and composition of Hospital Hygiene Committees;
- the roles and responsibilities of infection control doctors and nurses, including their education and training;
- the provision of central government funding for the provision of infection control staff on a ratio of staff to acute hospital beds;
- funding support for hospitals participating in the national surveillance scheme; and
- the declaration of hospital infections as a quality indicator for the accreditation of hospitals.²⁴

Are there any strategic national/regional/state funded infection prevention & control research programmes?

Research is the remit of the Scientific Institute of Public Health – Louis Pasteur (IPH). The Institute is involved in ongoing epidemiological research related to nosocomial infection often in collaboration with professional organisations such as GDEPIH/GOSPIZ and the Association Belge d'Hygiene Hospitaliere (AHBB). Recent studies have focused on pneumonia and bacteraemia in intensive care units, surgical site infections and MRSA. They also participate in two European studies, the European Study of Surgical Antibiotic Policies (ESAP) and the European Antimicrobial Resistance Surveillance System (EARRS).²⁴

Does the strategy identify any specific training education objectives for the prevention of HAI?

Education and training of ICD and ICN exists and is primarily provided by Universities, IPH, GDEPIH/GOSPIZ, ABBH and the Flemish Catholic Nurses Association. The provision of formal training on nosocomial infection control rarely features in medical curricula but is sometimes included in nursing curricula. Local infection control staff are responsible for the provision of continuing education on an ad hoc basis.²⁴

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

The roles and responsibilities of ICN, ICD and regional infection control committees are set out in government legislation. The current ratio of practitioners to acute beds is 1:1000 for ICD and 2.5:1000 for ICN.

Demark

Are there national, regional or state strategies for preventing HAI ?

At a government level the strategy for the prevention of HAI is the responsibility of the Ministry of Health. Although respondents to the email survey identified no single document as a national strategy, they identified that the prevention and control of HAI is given a high priority within the national policy directives for the health service and hospitals.¹ The strategic direction for preventing HAI is contained in a range of linked activities that are the remit of the National Centre for Hospital Hygiene (NCHH). The Centre is responsible for strategy and policy development, surveillance, research, the development of guidelines for infection control and providing the necessary training of infection control nurses.²⁴ Policy is locally developed by the Departments of Microbiology in the five Danish regional areas.

There is a national programme for controlling antimicrobial resistance. The Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP) was started in 1995 and annual reports of antimicrobial resistance in animals and humans have been collected since 1996. In 2000 the consumption of antibiotic in humans was 33%, an increase of 13% on figures for 1997. Ninety percent of this figure was accounted for in primary care.³¹

Are there key healthcare policies that influence these strategies?

The early establishment of monitoring *Staphylococcus aureus* in 1957 has ensured that the problem of antimicrobial resistance has been largely controlled successfully to date. The proper use of urinary catheters, a restrictive approach to antibiotic usage and an emphasis on hand hygiene are key aspects of infection control policy.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

The overall strategic direction of research is to keep outbreaks in hospitals low, there does not appear to be a specific stream of funding for research into HAI. The National Centre for Hospital Hygiene participates in DANMAP and the European Study on Surgical Antimicrobial Prophylaxis (ESAP). It is also involved in projects investigating the diagnosis of pneumonia, the prevention of surgical site infections and is developing a research programme to address Norwalk virus.²⁴

Does the strategy identify any specific training & education objectives for the prevention of HAI?

Professional training exists for medical specialists but not for ICNs. The provision of formal training on nosocomial infection control features in medical and nursing curricula with local infection control staff being responsible for the provision of continuing education on regular basis in collaboration with NCHH at Statens Serum Institut.²⁴ Medical microbiologists are given a theoretical course of one month and have their practical training from tutors in clinics. The training course for ICN covers six-months theoretical and practical education.

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

There are official profiles for the role of specialist in Clinical Microbiology who undertakes the role of infection control doctor and Infection Control Nurses (ICN).²⁹

France

Are there national, regional or state strategies for preventing HAI ?

At a government level the strategy for the prevention of HAI is the responsibility of the Ministère de l'Emploi et de la Solidarité, Secrétariat d'Etat à la Santé and the National Institute for Public Health (RNSP/INVS).²⁴ A National Program for Infection Control was instigated from 1995-2000 but has not been extended. However, strategic direction for preventing HAI is contained in a range of linked activities including legislation, surveillance programmes and guideline development. The implementation of government policy is undertaken by the National Committee for Infection Control (CTIN) and the French National Agency for Accreditation and Evaluation (ANAES).²⁴

Legislation⁶² exists for seventeen aspects of hospital infection control this includes:

- Organisation of hospital hygiene ;
- Responsibilities of the various stakeholders ;
- Sterilization ;
- Disinfection ;
- Waste management ;
- Blood exposure incidents.

In addition, there are “100 recommandations pour le surveillance et la prévention des infections nosocomiales” that provide working guidance for infection control teams.⁶³ These include hand hygiene, isolation procedures, and prevention of bloodborne pathogens exposure.²⁴

Are there key healthcare policies that influence these strategies?

Email respondents identified no specific policies influencing infection control. However, the increase in awareness of healthcare safety issues following the public concern over HIV contaminated blood and a growing awareness of legal issues surrounding healthcare with the increased involvement of consumer organisations were seen as being influential.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

No specific funding was identified for infection prevention and control research, rather a number of disseminated funding streams. These are a special Ministry of Health fund for clinical research (PHRC) and another fund for microbiology research.²⁴ In addition, the Observatoire National de l'Epidemiologie de la Resistanced Bacterienne aux Antibiotiques (ONERBA) conducts research and surveillance activity associated with antibiotic resistance and prescribing.²⁴ The literature revealed a five year project (1999-2005) in the Alpes Maritime (GEPIE) focusing on the reduction in antimicrobial resistance in infants. This study has conducted an audit of educational outreach programmes and antibiotic prescribing during the first three years of the project. The French led the European Nosocomial Infection Surveillance project (EURONIS)¹ in the early 1990s and now lead the EU-DG SANCO-funded HELICS project.

Does the strategy identify any specific training & education objectives for the prevention of HAI?

The specialist training of Infection Control Doctors (ICD) is not standardised and depends on the individuals professional; background.²⁴ Respondents to the email survey identified that training of Infection Control Nurses (ICN) is a recent development. The provision of formal training on nosocomial infection control is sometimes included in medical curricula but is always included in nursing curricula. Local infection control staff are responsible for the provision of continuing education although this is generally focused on nursing personnel.²⁴

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

The roles and responsibilities of professionals are included in legislation concerning nosocomial infection and include medical, nursing and technical laboratory roles.⁶⁴ Staffing ratios of one ICD to 800 beds and 1 ICN to 400 beds are the official norm.²⁴

Germany

Are there national, regional or state strategies for preventing HAI ?

At a government level the strategy for the prevention of HAI is the responsibility of the Ministry of Health, Bundesministerium für Gesundheit.³⁵ Respondents to the email survey identified no single document as a national strategy but suggested that guidelines for prevention of hospital acquired infections include a strategy which is updated annually with the guidelines. However, strategic direction for preventing HAI is contained in a range of linked activities including legislation, surveillance programmes and guideline development. The implementation of government policy is undertaken by the Robert Koch Institute and the commission for hospital hygiene and infection prevention and the National Reference Centre for Hospital Hygiene (NRZ).²⁴

Are there key healthcare policies that influence these strategies?

New legislation was introduced in 2000 with some regulations concerning infection control in hospitals.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

There is a network for research focused on surveillance and prevention and the Spread of Infections and Resistance in ICU (SIR) which replaced the NIDEP 2-study Group which conducted research during 1994-99. The SIR network is funded by the Ministry of Education and Research. Several (at least six) Institutes are now participating in the SIR network which is being led and coordinated by Institute of Hygiene in Berlin. The Institute is also involved in ongoing epidemiological research related to nosocomial infection and also participates in the European Antimicrobial Resistance Surveillance System (EARRS).³⁵

Does the strategy identify any specific training & education objectives for the prevention of HAI?

Guidelines for prevention of hospital acquired infections are updated annually and contain requirements for the education and training of infection control nurses and hospital epidemiologists. The provision of formal training on nosocomial infection control is included in the majority of medical and nursing curricula. Local infection control staff are responsible for the provision of continuing education.²⁴

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

Although the roles and responsibilities of ICN, ICD and infection control committees are not set out in government legislation, various guidelines, e.g., those from the Robert Koch Institute recommend ratio of practitioners to acute beds is 1:450 for ICD and 1:300 for ICN but is rarely found in practice.²⁴

The Netherlands

Are there national, regional or state strategies for preventing HAI ?

There are four organisations identified as being involved in the prevention and control of HAI in the Netherlands. The Ministry of Health, Welfare and Sport (VWS) houses the State Inspectorate of Health which is charged with the supervision and monitoring of the health care and health status of the Dutch population. The implementation of government policy is the responsibility of CBO and RIVM. The strategic direction for preventing healthcare associated infection is set out in a Report of the Health Council from 1990 and is given high priority within the objectives set centrally and locally for health services and hospitals.^{24, 65}

Are there key healthcare policies that influence these strategies?

Measures issued by Dutch Inspectorate of Healthcare www.igz.nl are a major influence in the policies for the prevention and control of healthcare associated infection.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

Research is predominantly the remit of CBO and RIVM. The funding for research is included in general health care research funds: www.zonmw.nl and through funding of national surveillance system PREZIES www.prezies.nl by the Ministry of Health. Recent PREZIES projects focus on risk factors for SSI and the effect of post discharge surveillance. Other surveillance based research includes MRSA surveillance and Sentinel surveillance of laboratory results and resistance patterns and the effectiveness of antibiotic prophylaxis.

Does the strategy identify any specific training & education objectives for the prevention of HAI?

The Health Council identify in general terms the education and training requirements for ICD and ICN. The provision of formal training on nosocomial infection control is included in the majority of medical and nursing curricula but only as a minor topic. Local infection control staff are responsible for the provision of continuing education for other hospital staff.²⁴

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

The Health Council identify the roles and responsibilities of ICD and ICN in general terms. These have been elaborated more recently in criteria set by the Inspectorate of Healthcare.⁶⁶ The current recommended ratio of practitioners to acute beds is 1:1000 for ICD (Medical Microbiologist) and 1:250 for ICN.²⁴

Spain

Are there national, regional or state strategies for preventing HAI ?

At a government level the strategy for the prevention of HAI is the responsibility of the Ministerio de Sanidad y Consumo.²⁴ Respondents to the email survey identified no single document as a national strategy and indicated that Catalonia, Galicia, Euskadi and Andalucia, have specific approaches to the issue. However, strategic direction for preventing HAI is contained in a range of linked activities including legislation, surveillance programmes and guideline development.^{24,67} The implementation of government policy is undertaken by the National Reference Laboratory in Madrid, and the respective governments of the Autonomous Communities, Commission INOZ (Basque) and the Committee of Experts in Nosocomial Infection (Catalonia).¹

Are there key healthcare policies that influence these strategies?

Email respondents identified no strategic policies influencing this area.

Are there any strategic national/regional/state funded infection prevention & control research programmes?

National research networks have been established recently funded by the Ministry of Health, Instituto de Salud Carlos III. Research activity is focused in the National Laboratory Reference Centre and some of the major hospitals in Madrid and Barcelona. Projects are predominantly surveillance based and are focused on multi-resistant organisms and the prevention of bacteraemia.

Does the strategy identify any specific training & education objectives for the prevention of HAI?

There are currently no official recommendations for the training of ICN or ICN. The provision of formal training on nosocomial infection control features in medical curricula and nursing curricula. Local infection control staff are responsible for the provision of continuing education on an ad hoc basis and professional organisations provide some continuing education.²⁴

Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI?

There are no official definitions of the roles and responsibilities of ICD and ICN.²⁴

Comparison of International Practices in the Management and Control of Hospital-acquired Infections

III Guidelines and Standards

United States of America

Are there national, regional or state infection prevention & control guidelines?

CDC has a long history of producing infection prevention and control guidelines, including:

- Environmental infection control in healthcare facilities (2003);
- Hand hygiene in healthcare settings (2002);
- Intravascular device-related infections (2002);
- Surgical site infections (1999);
- Isolation precautions (1994);
- Nosocomial pneumonia (1994);
- Catheter-associated urinary tract infections (1981).

Additional disease-specific guidance, e.g., HIV disease, tuberculosis, are also available online from CDC.

These guidelines are evidence-linked consensus guidelines developed by expert opinion and published in peer reviewed journals and available online at <http://www.cdc.gov/ncidod/hip/Guide/guide.htm> They are widely acknowledged as the most authoritative guidance currently available and are adapted and used by many different countries.

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Quality standards for infection prevention and control are encompassed within the standards for hospital accreditation and certification by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) <http://www.jcaho.org/> and the National Committee for Quality Assurance (NCQA), <http://www.ncqa.org/Main/programs.htm> responsible for the accreditation and certification information for health maintenance organizations (HMOs).

Additionally, there are standards associated with federal health and safety requirements published by the Occupational Safety and Health Administration (OSHA) that covers healthcare facilities. These are available online at: <http://www.osha.gov/SLTC/healthcarefacilities/index.html>

Australia

Are there national, regional or state infection prevention & control guidelines?

The Australian Department of Health and Ageing have published their 3rd draft of "Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting" (September 2002), which is endorsed by the Communicable Diseases Network of Australia.⁶⁸ These are comprehensive guidelines covering principles of infection control, quality management, effective working practices and the management of infectious diseases in general and in specific settings. The Queensland Government published a similar set of Infection Control Guidelines in 2001.⁶⁹ In July 2003, ACSQHC published National Infection Control Guidelines⁵¹ available at: http://www.safetyandquality.org/articles/Publications/NationalStrategy_web.pdf

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Appendix 3 of the CDHA guidelines referred to above makes reference to the "Australian / New Zealand Standards". "Standards New Zealand" publishes infection control standards <http://shop.standards.co.nz> which may be the document referred to but we have not been able to verify this.⁷⁰

A search of the Australian Council on Healthcare Standards website www.achs.org.au revealed no information on infection, infection control or HAI.

New Zealand

Are there national, regional or state infection prevention & control guidelines?

The Ministry of Health published draft guidelines to control MRSA infection in 2002.⁷¹ No other infection prevention guidelines were identified on the Ministry of health website. The OAG report noted the possibility of DHBs collaborating on policy development and suggests the Ministry establish a working group to review overseas practice.⁴⁵

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Standards New Zealand has published an infection prevention and control health standards including an audit workbook on infection control in hospitals.⁷⁰ Organisations subject to the Health & Disability Services (Safety) Act are required to demonstrate their compliance with the Infection Control Standard.

Belgium

Are there national, regional or state infection prevention & control guidelines?

Guidelines are developed centrally by government and also by IPH, the Robert Koch Institute and GDEPIH/GOSPIZ. They cover:

- the prevention of infections associated with specific site and medical devices;
- control of multi-drug resistant organisms,
- the prevention of exposure to bloodborne pathogens;
- sterilisation of instruments; and
- waste management.

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

The Flemish Community has a quality standard that requires hospitals to declare the rate of healthcare associated infection as part of the hospital accreditation process.

Denmark

Are there national, regional or state infection prevention & control guidelines?

Guidelines are issued and updated by NCHH and made available to hospitals without charge. They form the basis of local protocols and continuing education programmes and provide guidance, advice and quality standards related to the management and control of infection in healthcare settings.^{24;}

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

There are 12 formal infection control standards addressing the hospital management and infection control procedures. They cover issues of:

- procedures in primary care;
- hand-washing practice;
- use of intravascular catheters;
- surveillance and investigation of outbreaks;
- prevention of surgical site infections;
- infection prophylaxis in single use urinary incontinence devices;
- indwelling catheters in the urinary tract;
- laundering and handling of textiles for multiple use;
- acquisition and maintenance of technical and medical devices;
- food including transport and serving;
- procedures in dental clinics.

The standards are based on the ISO 900 concept and made in collaboration with Danish Standard Institution and are currently being translated into English

France

Are there national, regional or state infection prevention & control guidelines?

National guidelines ⁷² are produced by a wide range of government and professional organisations including:

- Ministère de l'Emploi et de la Solidarité, Secrétariat d'Etat à la Santé
- National Institute for Public Health (RNSP/IVS)
- CTIN
- ANAES
- ONERBA

At a regional level the five regional coordinating centres (CCLIN) are responsible for developing local protocols.

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

The French National Agency for Accreditation and Evaluation issue a set of accreditation criteria include an important section on nosocomial infection. ⁷³

Germany

Are there national, regional or state infection prevention & control guidelines?

The Robert Koch Institute is responsible for the development of national guidelines. They also include recommendations for prevention of pneumonia, sepsis, urinary tract infections and other device related infections.

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Email respondents identified only a few quality standards, e.g., water quality in hospital, sterilization and disinfection performance standards.

The Netherlands

Are there national, regional or state infection prevention & control guidelines?

Guidelines are produced by the Working Party on Infection Prevention (WIP) and are available electronically at www.wip.nl. There are currently 26 sets of guidelines directed at preventing infection in hospitals. Guidelines are presented to the National Health Council for review and are considered by the Health Care Inspectorate to be professional standards. WIP aims to revise guidelines every 5 years. ²⁴

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Email respondents identified that standards are currently under development, and will be based on the results of a nationwide review of infection prevention practices being completed by the Inspectorate of Healthcare.

Spain

Are there national, regional or state infection prevention & control guidelines?

Guidelines are developed by the Autonomous Government offices and professional organisations.

Are there national, regional or state infection prevention & control quality standards (controls assurance standards)?

Email respondents identified that standards existed in part and were based on the results of National Prevalence Survey data and used by the Spanish Ministry of Health as a benchmark.

END OF TECHNICAL REPORT 28/09/2003 RJP:HL:cp/ph/sj/TVU/RWR

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Appendix 1 – Email Survey Instrument

email survey

ON BEHALF OF
UNITED KINGDOM GOVERNMENT
NATIONAL AUDIT OFFICE

27 April 2003

Comparison of International Practices in the Management and Control of Healthcare-associated Infections

Extent and Costs

No.	Question	Yes	No	If Yes , where can we access further information ? [e.g., websites, hard copy documentation, key personnel]
1	Is information on the national, regional or state prevalence of HAI available ?			
2	Do you have any data on the costs of HAI in general and/or costs related to particular events or the use of particular medical devices ?			

Strategy & Policy

No.	Question	Yes	No	If Yes , where can we access further information ? [e.g., websites, hard copy documentation, key personnel]
3	Are there national, regional or state strategies for preventing HAI ?			
4	Are there key healthcare policies that influence these strategies ?			
5	Are there any strategic national/regional/state funded infection prevention & control research programmes ?			
6	Does the strategy identify any specific training & education objectives for the prevention of HAI?			
7	Does the strategy identify the specific roles & responsibilities of specialist professionals in preventing HAI ?			

Guidelines & Standards

No.	Question	Yes	No	If Yes , where can we access further information ? [e.g., websites, hard copy documentation, key personnel]
8	Are there national, regional or state infection prevention & control guidelines ?			
9	Are there national, regional or state infection prevention & control quality standards (controls assurance standards) ?			

Lessons We Can Learn From You

No.	Question	Yes	No	If Yes , please provide further advice ?
10	Can you identify key activities or factors that have helped you reduce the occurrence of HAI in your own country, region or state ?			

*SJRP/hl
15Apr2003*

Please return this form by email attachment to

[**robert.pratt@tvu.ac.uk**](mailto:robert.pratt@tvu.ac.uk)

Thank you

Your and Name/Organisation	Contact Details (incl. e-mail)

