

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

Journal of Hospital Infection

journal homepage: [www.elsevierhealth.com/journals/jhin](http://www.elsevierhealth.com/journals/jhin)

# Prevalence survey of healthcare-associated infections in Argentina; comparison with England, Wales, Northern Ireland and South Africa

R. Durlach<sup>a,b,\*</sup>, G. McIlvenny<sup>c</sup>, R.G. Newcombe<sup>d</sup>, G. Reid<sup>c</sup>, L. Doherty<sup>e</sup>,  
C. Freuler<sup>a</sup>, V. Rodríguez<sup>a</sup>, A.G. Duse<sup>f</sup>, E.T.M. Smyth<sup>c,g</sup>

<sup>a</sup>Hospital Alemán, Buenos Aires, Argentina

<sup>b</sup>Instituto Técnico de Acreditación de Establecimientos de Salud (ITAES), Buenos Aires, Argentina

<sup>c</sup>Northern Ireland Healthcare-Associated Infection Surveillance Centre (HISC), The Belfast HSC Trust, Belfast, UK

<sup>d</sup>Department of Primary Care and Public Health, Clinical Epidemiology Interdisciplinary Research Group, Cardiff University, Cardiff, UK

<sup>e</sup>Department of Health, Social Services and Public Safety, Belfast, UK

<sup>f</sup>Department of Clinical Microbiology and Infectious Diseases, NHLS and Wits School of Pathology, Gauteng, South Africa

<sup>g</sup>Infection Prevention and Control, The Belfast HSC Trust, Belfast, UK

## ARTICLE INFO

### Article history:

Received 24 May 2011

Accepted 2 December 2011

by J.A. Child

Available online xxx

### Keywords:

Healthcare-associated  
infections  
Meticillin-resistant  
*Staphylococcus aureus*  
Nosocomial infection  
Prevalence  
Surveillance

## SUMMARY

**Background:** Prevalence surveillance methodology is the systematic observation of the occurrence and distribution of healthcare-associated infections (HCAIs) so that appropriate actions can be taken.

**Aim:** The objectives of a prevalence survey with an international validated methodology were to determine the prevalence of HCAIs for the first time in Argentina, and to provide data which could be used for international benchmarking.

**Methods:** In 2008, an HCAI prevalence survey was carried out in 39 hospitals in seven of 23 provinces in Argentina, with methodology identical to that employed by the Hospital Infection Society in the third prevalence survey of HCAIs in acute hospitals in the British Isles. Data collected were processed and analysed at the Northern Ireland Healthcare-Associated Infection Surveillance Centre at Belfast.

**Findings:** A total of 4249 patients were surveyed; 480 of these had at least one HCAI, resulting in a prevalence of 11.3% of patients. Male prevalence was 13.6% and female 9.0%. The most common HCAIs were pneumonia (3.3%), urinary tract infection (3.1%), surgical site infection (2.9%), primary bloodstream infection (1.5%), and soft tissue infections (1.2%). Among the 1027 patients who underwent surgery, the prevalence of surgical site infection was 10.2%. The prevalence of meticillin-resistant *Staphylococcus aureus* was 1.1%, accounting for 10.0% of all HCAI isolates. The results for Argentina show higher HCAI rates compared with corresponding findings for England, Wales, Northern Ireland and South Africa.

**Conclusion:** This survey will contribute to the prioritization of resources and help to inform Departments of Health and hospitals in the continuing effort to reduce HCAIs.

© 2011 The Healthcare Infection Society. Published by Elsevier Ltd. All rights reserved.

\* Corresponding author. Address: Avenida Pueyrredón 1640, Buenos Aires C1118AAT, Argentina. Tel.: +54 91135617002.

E-mail address: [ricardodurlach@yahoo.com](mailto:ricardodurlach@yahoo.com) (R. Durlach).

## Introduction

Surveillance is the systematic, ongoing observation of the occurrence and distribution of disease in a population and the events or conditions that increase or decrease the risk of disease. It is important to recognize that surveillance encompasses analysis of data and dissemination of results so that appropriate actions can be taken.

In November 2007 the Northern Ireland Healthcare-Associated Infection Surveillance Centre (HISC) was invited to participate in a collaborative research initiative with the Argentine Accreditation Institute for Healthcare Institutions (Instituto Técnico de Acreditación de Establecimientos de Salud, ITAES) to conduct a nationwide healthcare-associated infection (HCAI) prevalence survey. Prevalence surveys of HCAIs provide data on hospitalized patients, at one particular point in time, and are generally easy to conduct and are cost-effective.<sup>1</sup>

In April 2008 ITAES performed a prevalence survey with methodology identical to that employed by the Hospital Infection Society (HIS) in the Third Prevalence Survey of HCAIs in Acute Hospitals in the British Isles.<sup>2,3</sup> Data collected were processed and analysed at HISC. Definitions of HCAIs were those developed by the National Healthcare Safety Network (NHSN), formerly the National Nosocomial Infection Surveillance (NNIS) System, Centers for Disease Control and Prevention (CDC, Atlanta, Georgia, USA; 'Patient safety component protocols', [http://www.cdc.gov/ncidod/dhqp/nhsn\\_documents.html](http://www.cdc.gov/ncidod/dhqp/nhsn_documents.html)).<sup>4</sup>

The objectives of the survey were to determine prevalence rates of HCAIs, provide data which could be used for international benchmarking, and that will assist in the prioritization of resources to prevent and reduce the occurrence of HCAIs.

## Methods

From April 2008 to July 2008, an HCAI prevalence survey was carried out in 39 hospitals in seven of 23 provinces in Argentina. The survey was organized by ITAES and the Hospital Alemán infection prevention and control staff. The invitation to participate was sent to selected hospitals with a recognized infection prevention and control team (IPCT), a developed clinical microbiology laboratory and an infectious disease (ID) specialist who accepted to lead the survey at their institution. This person ensured the collaboration of clinical staff and hospital management. The hospital IPCT was responsible for the collection and recording of survey data. The study protocol together with the data collection questionnaire and the definitions of infection used in the 2006 Third Prevalence Survey of Healthcare Associated Infections in acute hospitals, were translated into Spanish to be used as a training tool and study protocol (M. Del Castillo et al. Manual del Sistema VIGILAR 2008; <http://www.ITAES.org.ar>).<sup>5</sup>

The questionnaire consisted of four sections on a one-page, double-sided A4 sheet. The first section included the survey date and hospital details; the second dealt with demographic details and HCAI-related risk factors; the final section recorded details of all HCAIs including those in which meticillin-resistant *Staphylococcus aureus* (MRSA) was implicated as the causative organism. The majority of questions were answered by marking an 'X' in a box. A number of questions required numerical codes or dates. In order to establish whether patients met the criteria for HCAI, staff were directed to use documentation including

medical records, nursing notes, temperature charts, X-rays, laboratory reports, and to seek additional evidence from ward staff where appropriate. All participant institutions collected data on individually serialized questionnaires which were designed using an optical mark reader (OMR) system (Formic 4; Formic Ltd, London, UK). The questionnaires were scanned and analysed at HISC, Belfast, Northern Ireland.

The infections documented were all active HCAIs present in a patient at the time of survey, including those requiring antimicrobial treatment. Public and private hospitals with acute adult inpatients and an active IPCT were eligible to participate in the survey. Excluded from this survey were specialist paediatric hospitals, hospitals with fewer than 50 inpatient beds, and those providing non-acute services and day cases. Data collection was performed in a single day for each ward or unit.<sup>2</sup> Permission to access medical notes was sought from medical directors of each participating facility. The local coordinator's role was to explain the aims and objectives of the survey, support the data collection teams and answer queries regarding definitions, methodology and logistics during the survey. Completed questionnaires were returned to the central coordinator's office in Buenos Aires City, checked, and finally sent to HISC in Northern Ireland for processing. Feedback of data to individual hospitals was by means of individual reports. The results obtained were compared with those of the HIS survey and with the South Africa study.

## Statistical methods

Confidence intervals (CIs) for HCAI prevalence were calculated using the score method.<sup>6</sup> Odds ratios (ORs) were reported for each risk factor relative to a reference category, with 95% CIs calculated using the method of Miettinen and Nurminen.<sup>7</sup>

## Results

The prevalence survey included 4249 patients of whom 1207 had undergone a surgical procedure. There was a very slight preponderance of females (50.9%). The mean age of patients surveyed was 55 years (median: 57; range: 13–107). The mean age was slightly higher for males (56 years) than for females (53 years).

Results of the survey are presented in Tables I–VII. The overall prevalence of infection was 11.30% (480/4249). There was a statistically significant higher prevalence of HCAIs among men (13.61%) compared with women (9.02%) (OR: 1.59; 95% CI: 1.31–1.93).

Critical care medicine was the consultant specialty with the highest HCAI prevalence (29.17%), which was significantly higher than the series as a whole (OR: 3.56; 95% CI: 2.59–4.88) (Table I).

Table II shows the prevalence of HCAIs affecting different body systems. For many of the 480 patients with HCAI, more than one body system was affected. Three categories of infections accounted for almost two-thirds of all the 605 infections by system, namely pneumonia (141, 23.3%), urinary tract infections (133, 22.0%) and surgical site infections (SSIs) (123, 20.3%). The prevalence of SSI was 2.89%; however, when the denominator was restricted to patients who had undergone surgery, i.e. 1207 patients who had had either surgery with no implant within the previous 30 days or surgery within previous year involving an implant, the SSI prevalence was 10.19% (95% CI: 8.61–12.03).

Table I

Prevalence of healthcare-associated infection (HCAI) in Argentinian series according to patient characteristics and speciality

	No. of patients	No. of patients with HCAI	Prevalence of HCAI (%)	OR (95% CI)	95% CI	P-value <sup>a</sup>
All patients	4249	480	11.30		10.38–12.28	
Sex						<0.001
Male	2079	283	13.61	1.59 (1.31–1.93)	12.21–15.15	
Female	2162	195	9.02	1	7.88–10.30	
Age group (years)						<0.001
<35	894	72	8.05	0.62 (0.46–0.84)	6.44–10.02	
35–64	1819	204	11.21	0.90 (0.72–1.13)	9.85–12.75	
65–84	1218	150	12.32	1	10.59–14.28	
≥85	247	43	17.41	1.50 (1.04–2.17)	13.19–22.63	
Consultant speciality group						<0.001
General medicine	1802	187	10.38	1.00	9.05–11.87	
General surgery	567	59	10.41	1.00 (0.74–1.32)	8.15–13.19	
Trauma and orthopaedics	358	44	12.29	1.21 (0.85–1.72)	9.28–16.10	
Obstetrics and gynaecology	379	9	2.37	0.21 (0.11–0.41)	1.25–4.45	
Cardiothoracic surgery	93	17	18.28	1.93 (1.12–3.32)	11.74–27.34	
Ophthalmology and ENT	24	2	8.33	0.79 (0.20–3.04)	2.32–25.85	
Neurosurgery	128	31	24.22	2.76 (1.80–4.24)	17.62–32.32	
Critical care medicine	240	70	29.17	3.56 (2.59–4.88)	23.78–35.21	
Others	17	3	17.65	1.85 (0.57–6.07)	6.19–41.03	

CI, confidence interval; OR, odds ratio; ENT, ear, nose and throat.

<sup>a</sup> Chi-squared test to assess whether the data give significant evidence that the prevalence of HCAI in this population depends on each of the three factors, gender, age, consultant speciality group.

Table III shows some results for three types of infection that were most closely related to device use. Urinary tract infections were predominantly catheter-related, whereas about half of the pneumonias and primary bloodstream infections were ventilator- and central line-related.

Table IV shows how secondary bloodstream infections, where the patient had a culture-confirmed bloodstream infection and a related HCAI at another site, are related to infection site. There is marked variation in the propensity to develop a secondary bloodstream infection, though numbers are small for some infection types.

Of the 4249 patients, 48 (1.13%) had an MRSA-associated infection. These constitute 10% of all patients with HCAs. MRSA was the causative organism in 58 infections in these 48 patients. MRSA was more common in males than females (OR: 1.22; 95% CI: 0.69–2.16), in line with the findings for all HCAs. Critical care medicine and some surgical specialties (neurosurgery, trauma and orthopaedics) accounted for the highest MRSA prevalence. The prevalence of MRSA in SSIs among surgical patients was 14/1207 (1.16%). MRSA was most prevalent in the <35-year age category (prevalence: 1.45; OR: 1.62).

Table II

Prevalence of various types of healthcare-associated infection (HCAI)

Infection type	No. of infections	Prevalence of HCAI (%) by infection type	95% CI	Percentage of total HCAs
Gastrointestinal system	8	0.19	0.10–0.37	1.32
Urinary tract	133	3.13	2.65–3.70	21.98
Surgical site	123	2.89	2.43–3.44	20.33
Restricted to 1207 surgical patients		10.19	8.61–12.03	
Pneumonia	141	3.32	2.82–3.90	23.31
Skin and soft tissue	51	1.20	0.91–1.57	8.43
Primary bloodstream	62	1.46	1.14–1.87	10.25
Lower respiratory tract (not pneumonia)	16	0.38	0.23–0.61	2.64
Eyes, ENT or mouth	5	0.12	0.05–0.28	0.83
Bone and joint	26	0.61	0.42–0.90	4.30
Systemic	15	0.35	0.21–0.58	2.48
Cardiovascular system	7	0.16	0.08–0.34	1.16
Reproductive tract	4	0.09	0.04–0.24	0.66
Central nervous system	14	0.33	0.20–0.55	2.31

ENT, ear, nose and throat.

**Table III**  
Device-associated infections (DAIs)

Infection type	No. of infections	No. of DAIs	Prevalence of DAIs (%)	95% CI	% of DAIs
Urinary tract	133	115 catheter-related	2.71	2.26–3.24	86.5
Pneumonia	141	64 ventilator-associated	1.51	1.18–1.92	45.4
Primary bloodstream	62	35 central line-related	0.82	0.59–1.14	56.5

CI, confidence interval.

At the time of survey, 1926 out of 4249 patients (45.3%) were on antimicrobial therapy, with more than 1496 (35.2%) receiving intravenous antimicrobials. Of the 480 patients with HCAI, 421 (87.7%) were receiving antimicrobials at the time of the survey and 355 (74.0%) were receiving them intravenously. Risk factors for all HCAs are shown in Table V and risk factors specific to primary bloodstream infections are presented in Table VI.

Table VII presents a comparison of HCAI prevalence rates between Argentina, England, Northern Ireland, Wales, Republic of Ireland and South Africa (See online Figure 1).

## Discussion

The healthcare system in Argentina comprises 3000 public (funded by the province or national government) and private (either profit or non-profit) hospitals. Seven hundred hospitals had an intensive care unit with a total of 6500 beds. The number of active infection control programmes in all of Argentina is unknown. In this study we have included all categories of hospitals. Our study was carried out in 39 institutions representing 1.3% of all Argentine hospitals. The institutions surveyed all had intensive care units (representing 5.5% of all hospitals with an intensive care unit), a fully functioning infection prevention and control team and a clinical microbiology laboratory with conditions to identify micro-organisms into species classification.

HCAs are a major threat to patient safety, with surveillance the cornerstone of infection prevention and control. The primary aim of this survey was to assess the prevalence of HCAs in acute hospitals. Our second aim was to develop a methodology, utilizing NHSN definitions, which could be used for future surveys.

Although the same protocol and questionnaires as those used in the 2006 Four Country Prevalence Survey from British Isles were used in our study, differences in sampling strategy and case mix make our prevalence rates difficult to benchmark.<sup>4,5</sup>

Argentina previously had no information about countrywide HCAI prevalence and this survey contributes an important starting point for the monitoring of HCAs.

The overall prevalence of HCAI in Argentina was 11.30%, substantially higher than the 2006 Four Country Prevalence Survey from British Isles that showed an overall prevalence of 7.59%.<sup>2</sup> However, 47 hospitals (25%) in the 2006 Four Country Prevalence Study had an overall prevalence of  $\geq 10\%$ .<sup>2</sup>

The reasons for a higher burden of HCAs in Argentina than the British Isles are difficult to determine given the available evidence. The main determinants for a higher HCAI prevalence may be: environmental factors, hygiene conditions, infrastructure, equipment, relationship between healthcare staff and patients, paucity of knowledge and application of basic infection-control measures. In addition, the infrastructure and essential activities of infection control and effective good practice in Argentine hospitals are not the same as in developed countries.

A similar prevalence survey, using the same methodology and definitions, was performed in South Africa.<sup>8</sup> This was limited to six healthcare facilities (four in the public sector and two in the private sector) and only four main types of HCAs (urinary tract infections, SSIs, primary bloodstream infections and pneumonias) were surveyed. The services offered by the six facilities included medicine, surgery, trauma, intensive care, obstetrics/gynaecology and paediatrics. In the South African study the combined prevalence for the four surveyed infections was 9.7% (Table VII). Differences in the distribution

**Table IV**  
Secondary bloodstream infections (SBSIs)<sup>a</sup> related to infections and prevalence of healthcare-associated infection (HCAI)

Infection type	Total no. of infections	No. of SBSIs	% of infections with SBSIs	95% CI
Gastrointestinal system	8	2	25	7–59
Urinary tract	133	6	4.5	2–9.5
Surgical site	123	3	2.4	0.8–6.9
Pneumonia	141	11	7.8	4.4–13.4
Skin and soft tissue	51	2	4	1–13
Lower respiratory tract (not pneumonia)	16	0	0	0–19
Eyes, ENT or mouth	5	2	40	12–77
Bone and joint	26	2	8	2–24
Systemic	15	8	53	30–75
Cardiovascular system	7	5	71	36–92
Reproductive tract	4	1	25	5–70
Central nervous system	14	1	7	1–31

CI, confidence interval; ENT, ear, nose and throat.

<sup>a</sup> The patient had a culture-confirmed bloodstream infection and a related HCAI at another site.

**Table V**  
Risk factors for healthcare-associated infection (HCAI) among 4249 patients

Risk factor	Prevalence of HCAI (%) in patients with risk factor	Prevalence of HCAI (%) in patients without risk factor	OR (95% CI)	P-value
Current urinary catheter	23.82 (252/1058)	7.15 (228/3191)	4.06 (3.34–4.94)	<0.001
Urinary catheter in last 7 days	21.92 (167/762)	8.98 (313/3487)	2.85 (2.31–3.50)	<0.001
Current other bladder instrumentation	21.28 (10/47)	11.19 (470/4202)	2.14 (1.07–4.29)	NS
Other bladder instrumentation in last 7 days	20.00 (9/45)	11.20 (471/4204)	1.98 (0.96–4.08)	NS
Current peripheral IV catheter	9.87 (238/2411)	13.17 (242/1838)	0.72 (0.60–0.87)	0.003
Peripheral IV catheter in last 7 days	11.33 (177/1562)	11.28 (303/2687)	1.01 (0.83–1.22)	NS
Current central IV catheter	33.33 (199/597)	7.69 (281/3652)	6.54 (5.30–8.08)	<0.001
Central IV catheter in last 7 days	34.01 (118/347)	9.28 (362/3902)	5.04 (3.94–6.45)	<0.001
Current mechanical ventilation	43.72 (87/199)	9.70 (393/4050)	7.23 (5.37–9.74)	<0.001
Mechanical ventilation in last 7 days	32.04 (58/181)	10.37 (422/4068)	4.07 (2.94–5.65)	<0.001
Current parenteral nutrition	27.27 (30/110)	10.87 (450/4139)	3.07 (2.00–4.72)	<0.001
Parenteral nutrition in last 7 days	23.30 (24/103)	11.00 (456/4146)	2.46 (1.55–3.91)	<0.001
Any current antimicrobials	21.86 (421/1926)	2.54 (59/2323)	10.70 (8.12–14.2)	<0.001
Current IV antimicrobials	23.73 (335/1496)	5.27 (145/2753)	5.19 (4.22–6.38)	<0.001
Surgery in last 30 days (no implant)	16.15 (155/960)	9.88 (325/3289)	1.76 (1.43–2.16)	<0.001
Implant surgery in last year	28.79 (76/264)	10.14 (404/3985)	3.58 (2.69–4.76)	<0.001
Other invasive procedures	18.87 (100/530)	10.22 (380/3719)	2.04 (1.60–2.60)	<0.001

OR, odds ratio; CI, confidence interval; IV, intravenous; NS, non-significant.

of HCAs between the South African survey and the others may perhaps be accounted for by the fact that more than half of all public hospital admissions are HIV-related.

An important difference between this Argentine study and the 2006 Four Country Prevalence Survey is that we did not conduct extensive training and validation activities.<sup>2</sup> The limited training provided and the lack of validation were down to time constraints and resource issues both financial and staff. However, given these constraints, the Argentine survey closely followed the 2006 Four Country Prevalence Survey methodology and protocol. It is our intention to address training and validation in future studies.

National prevalence surveys of HCAs are increasingly common; recent reports include those from Germany (3.5%), Greece (9.3%), and Norway (5.4%).<sup>9–11</sup> Possible reasons for different prevalence of HCAs in other countries include the quality of established infection prevention and control programmes.

In Argentina, the prevalence of the commonest HCAs (urinary tract infections, pneumonia, SSIs and primary bloodstream infections) are higher than described in the 2006 Four Country Prevalence Survey.<sup>2</sup>

Statistically significant risk factors for all HCAs included instrument-related procedures, intravascular catheter,

**Table VI**  
Risk factors for primary bloodstream infection (PBSI) among 4249 patients

Risk factor	Prevalence of PBSI (%) in patients with risk factor	Prevalence of PBSI (%) in patients without risk factor	OR (95% CI)	P-value
Current urinary catheter	2.93 (31/1058)	0.97 (31/3191)	3.08 (1.87–5.06)	<0.001
Urinary catheter in last 7 days	2.89 (22/762)	1.15 (40/3487)	2.56 (1.52–4.31)	<0.001
Current other bladder instrumentation	0.00 (0/47)	1.46 (62/4249)	0 (0–5.48)	NS
Other bladder instrumentation in last 7 days	4.44 (2/45)	1.43 (60/4204)	3.21 (0.84–12.3)	NS
Current peripheral IV catheter	0.91 (22/2411)	2.18 (40/1838)	0.41 (0.25–0.70)	<0.001
Peripheral IV catheter in last 7 days	0.76 (12/1562)	1.86 (50/2687)	0.41 (0.22–0.76)	0.005
Current central IV catheter	6.37 (38/597)	0.66 (24/3652)	10.3 (6.15–17.2)	<0.001
Central IV catheter in last 7 days	8.65 (30/347)	0.82 (32/3902)	11.4 (6.90–19.0)	<0.001
Current mechanical ventilation	6.53 (13/199)	1.21 (49/4050)	5.71 (3.07–10.6)	<0.001
Mechanical ventilation in last 7 days	5.52 (10/181)	1.28 (52/4068)	4.52 (2.29–8.93)	<0.001
Current parenteral nutrition	9.10 (10/110)	1.26 (52/4139)	7.86 (3.93–15.7)	<0.001
Parenteral nutrition in last 7 days	8.74 (9/103)	1.28 (53/4146)	7.39 (3.60–15.2)	<0.001
Any current antimicrobials	3.01 (58/1926)	0.17 (4/2323)	18.0 (6.8–47.8)	<0.001
Current IV antimicrobials	3.54 (53/1496)	0.33 (9/2753)	11.2 (5.6–22.5)	<0.001
Surgery in last 30 days (no implant)	0.83 (8/960)	1.64 (54/3289)	0.50 (0.24–1.04)	NS
Implant surgery in last year	1.52 (4/264)	1.46 (58/3985)	1.04 (0.39–2.78)	NS
Other invasive procedures	3.21 (17/530)	1.21 (45/3719)	2.71 (1.55–4.73)	<0.001

OR, odds ratio; CI, confidence interval; IV, intravenous; NS, non-significant.

Table VII

Comparative healthcare-associated infection (HCAI) prevalence rates: Argentina, England, Northern Ireland, Wales, Republic of Ireland and South Africa

HCAI prevalence (%)	Argentina	England <sup>2</sup>	Northern Ireland <sup>2</sup>	Wales <sup>2</sup>	Republic of Ireland <sup>2</sup>	Republic of South Africa <sup>8</sup>
Overall	11.30	8.19	5.43	6.35	4.89	–
Primary bloodstream infection	1.46	0.62	0.38	0.56	0.49	5.01
Pneumonia	3.32	1.27	1.29	0.68	0.86	2.88
SSI – surgical patients only	10.19	4.65	3.69	5.35	4.56	3.00
Urinary tract infection	3.13	1.80	1.84	1.08	1.10	1.53
MRSA	1.13	1.28	0.85	0.87	0.49	–

SSI, surgical site infection; MRSA, methicillin-resistant *Staphylococcus aureus*.

mechanical ventilation, and parenteral nutrition. In primary bloodstream infections only surgery and bladder instrumentation were not statistically significant risk factors.

Patients who had an HCAI were older than those who did not, with mean ages 58 and 54 years respectively. The patients surveyed were divided into four age groups, and the prevalence of HCAI for each group was calculated. The distribution by age groups in Argentina of the surveyed population was: <35 years, 21.4%; 35–64 years, 43.5%; 65–84 years, 29.2%; and >85.5 years, 9%. Compared with the British series 9%, 26.9%, 45.9% and 17.9%, respectively, the Argentine caseload was very much younger, in line with the great difference in demographics between the underlying populations. Despite this age difference, the overall prevalence of infection was much higher in Argentina than in the British Isles. The prevalence in the Argentine series increased steadily from 8.05% in patients aged <35 years, 11.21% in patients aged 35–64 years, 12.32% in patients aged 65–84 years and 17.41% in patients aged ≥85 years; this parallels the trend in the British Isles series in which the same age groups had prevalence rates of 3.19%, 6.4%, 8.28% and 9.8% respectively.

There were significant differences in the presence of certain HCAI risk factors in Argentina compared with the 2006 UK Four Country survey.<sup>2</sup> More patients in Argentina had indwelling urinary catheters (24.9% vs 14.6%,  $P < 0.001$ ), central venous catheters (33.33 vs 19.9%,  $P < 0.001$ ), were mechanically ventilated (43.7% vs 29.1%,  $P < 0.001$ ), receiving parenteral nutrition (27.27% vs 24.9%,  $P < 0.01$ ) and were receiving antimicrobials (45.3% vs 18.8%,  $P < 0.001$ ).

MRSA-related HCAs were more prevalent in patients aged <35 years and in patients in critical care medicine.

It should be noted that in our survey the prevalence of SSI, in respect of patients who underwent surgery, is the highest of all system infections (10.19%) and was double that of the reference study (10.19% vs 4.65%).<sup>2</sup>

Ten percent of patients in our survey with HCAI had MRSA as the causative organism, whereas it was 13.7% in the 2006 Four Country Prevalence Survey.

In our study there was no statistically significant difference of MRSA-HCAI between males and females. In the 2006 Four Country Prevalence Survey, however, males were 1.5 times more likely to have an MRSA infection than females ( $P < 0.001$ ).<sup>2</sup>

In Argentina, the prevalence rate in critical care medicine was similar to that quoted in the 2006 Four Country Prevalence Survey. Surgical specialties, neurosurgery, trauma and orthopaedics accounted for twice the prevalence of HCAI.

The most prevalent infections in order of magnitude were consistent with other studies.<sup>12–14</sup>

The National Nosocomial Infections Surveillance Network of Argentina (VIHDA) in the year 2010 carried out a point prevalence study of HCAs in non-critical areas, in 61 hospitals, in 21 provinces. HCAI prevalence was 9%, 215 infected patients, out of the 2394 adults surveyed. The SSI prevalence was 9.1%, out of 497 operated patients, 45 became infected.<sup>15</sup>

In conclusion, this was the first HCAI prevalence survey performed in Argentina, and demonstrated a higher HCAI rate than that recorded in the 2006 Four Country Prevalence Survey.<sup>2</sup> This methodology and organization employed should be used as a template for future HCAI surveillance initiatives using standardized methodology and definitions, nationally, locally or at unit level. This survey has provided a baseline against which future prevalence surveys can be compared. In the absence of targeted incidence surveillance, we recommend consideration of repeat prevalence surveys as an effective means of measuring the impact of interventions over time.

Information obtained from this survey will contribute to the prioritization of resources and will help to inform the Ministry of Health, hospitals and other relevant stakeholders in the continuing effort to reduce the number of HCAs.

## Acknowledgements

This survey would not have been completed successfully and within schedule without the co-operation and support of the coordinators, microbiologists, IPCTs and other staff within the participating hospitals. Buenos Aires City: Hospital Alemán, Hospital Argerich, Hospital Austral, Hospital Británico, Hospital Italiano, Hospital Pirovano, Sanatorio Mater Dei, FLENI, Militar Central, Policlínico Docente, Alexander Fleming, Sanatorio Mitre, Dupuytren, Hospital Piñero, Clínica del Sol, San Juan de Dios de Haedo, Central de San Isidro, Hospital L Lucero, San Juan de Dios de La Plata, Hospital Español. Buenos Aires Province: Sanatorio Juncal, Hospital Gandulfo, Hospital Eva Perón, Hospital Paroissien, Hospital Posadas, Hospital Evita, Hospital Cordero, Hospital Zatti. Entre Ríos Province: Adventista San Martín. Sante Fe Province: Sanatorio Santa Fe, Sanatorio Parque, Cardiovascular, Hospital Provincial. Neuquen Province: Clínica Pasteur, Hospital Cipoletti. Tucuman Province: Centro de Salud, Hospital Avellaneda, Sanatorio Rivadavia. Corrientes Province: Hospital Escuela Universitario.

## Conflict of interest statement

None declared.

## Funding sources

None.

## Supplementary material

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jhin.2011.12.001

## References

1. Humphreys H, Smyth ETM. Prevalence surveys of healthcare-associated infections: what do they tell us, if anything? *Clin Microbiol Infect* 2006;12:2–4.
2. Smyth ETM, McIlvenny G, Enstone J, et al. Four Country Healthcare Associated Infection Prevalence Survey 2006: overview of the results. *J Hosp Infect* 2008;69:230–248.
3. Humphreys H, Newcombe RG, Enstone J, et al. Four Country Healthcare Associated Infection Prevalence Survey 2006: risk factor analysis. *J Hosp Infect* 2008;69:249–257.
4. Emori TG, Culver DH, Horan TC, et al. National nosocomial infections surveillance system (NNIS): description of surveillance methods. *Am J Infect Control* 1991;19:19–35.
5. Hospital Infection Society. *Third Prevalence Survey of Healthcare Associated Infections in Acute Hospitals Manual*. Protocol version 1.2. London: HIS; 2006.
6. Wilson EB. Probable inference, the law of succession, and statistical inference. *J Am Statist Assoc* 1927;22:209–212.
7. Miettinen O, Nurminen M. Comparative analysis of two rates. *Statist Med* 1985;4:213–226.
8. Duse AG, Doherty L, McIlvenny G, Rahman A, Smyth ETM. *Healthcare Associated Infection (HCAI) Prevalence Survey: the South African Pilot*. Sixteenth Annual Scientific Meeting of the Society of Healthcare Epidemiology of America, Chicago, IL, USA, 2006.
9. Gastmeier P, Kampf G, Wischniewski N, et al. Prevalence of nosocomial infections in representative German hospitals. *J Hosp Infect* 1998;38:37–49.
10. Gikas A, Padiaditis J, Papadakis JA, et al. Prevalence study of hospital-acquired infections in fourteen Greek hospitals: planning from the local to the national surveillance level. *J Hosp Infect* 2002;50:269–275.
11. Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections in hospitals in Norway 2002 and 2003. *J Hosp Infect* 2005;60:40–45.
12. Emmerson AM, Enstone JE, Griffin M, Kelsey MC, Smyth ETM. The Second National Prevalence Survey of infection in hospitals – overview of the results. *J Hosp Infect* 1996;32:175–190.
13. Fitzpatrick F, McIlvenny G, Oza A, et al. Hospital Infection Society Prevalence Survey of Healthcare Associated Infection 2006: comparison of results between Northern Ireland and the Republic of Ireland. *J Hosp Infect* 2008;69:265–273.
14. Edwards JR, Peterson KD, Andrus ML, et al. National Healthcare Safety Network (NHSN) Report, data summary for 2006, issued June 2007. *Am J Infect Control* 2007;35:290–301.
15. Lossa G, Giordano Lerena R, Arcidiacono D, et al. Point Prevalence of Health Care Associated Infections in Non Critical Areas in the National Nosocomial Infections Surveillance Network of Argentina (VIHDA). *Rev Argent Salud Pública* 2011;2:12–18.