Dr. Victor Rosenthal's Summarized CV:

Dr. Rosenthal is a specialist in Internal Medicine and Infectious Diseases in Buenos Aires. He holds an Infectious Diseases fellowship at the University of Wisconsin. He is a graduate in Clinical Effectiveness, from Harvard University. He is certified on Infection Control and Hospital Epidemiology.

Dr. Rosenthal is the founder and chairman of the International Nosocomial Infection Control Consortium (INICC), a nonprofit international research center which focuses on Healthcare-Associated Infections collaborating with more than 1000 researchers in more than 200 cities in 54 countries.

He is Coauthor of JCI guidelines to prevent CLAB. He is a Task Force Member and Reviewer of the Infection Control Guidelines for the World Health Organization (WHO), He has collaborated with edition of the Infection Control Guidelines of Argentina, Brazil, Colombia, Peru, Hong Kong, Taiwan, China and several other countries.

He is an editorial board member and scientific reviewer of several international peer reviewed journals, such as "Lancet", "American Journal of Infection Control (AJIC)"; "Infection Control and Hospital Epidemiology" (ICHE) ;and several others.

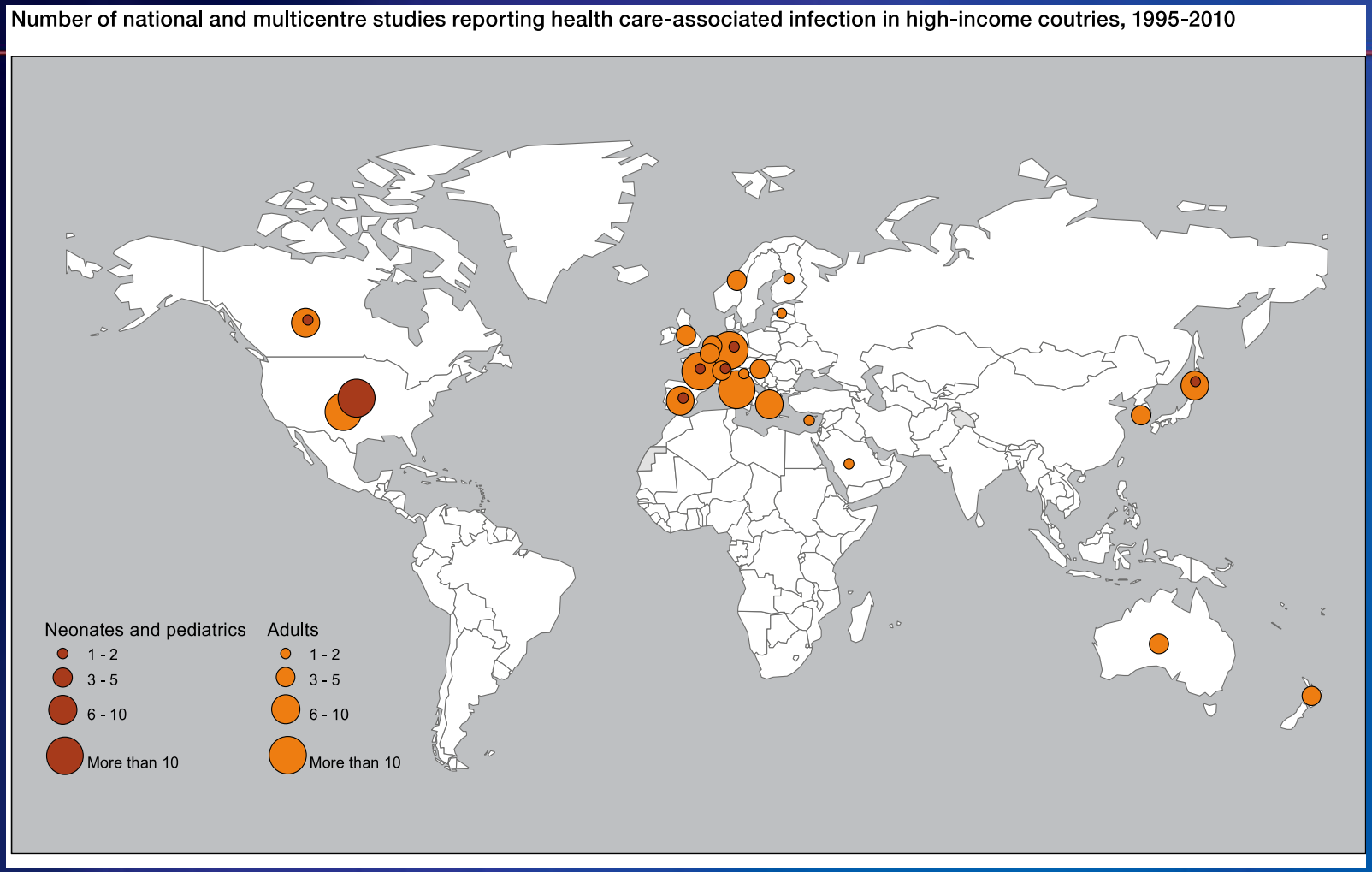
Being an author of more than 350 scientific publications and book chapters worldwide, Dr. Rosenthal has received several awards granted at different international scientific meetings, including APIC, IFIC, Pan American Meetings, and others.

7th GCC Conference on Infection Prevention & Control
Kuwait
December 1st to 3rd 2013

"Burden of Health Care Acquired Infections Internationally: Findings of INICC"

Dr. Victor D. Rosenthal, MD, MSC, CIC
INICC Founder and Chairman
victor_rosenthal@inicc.org

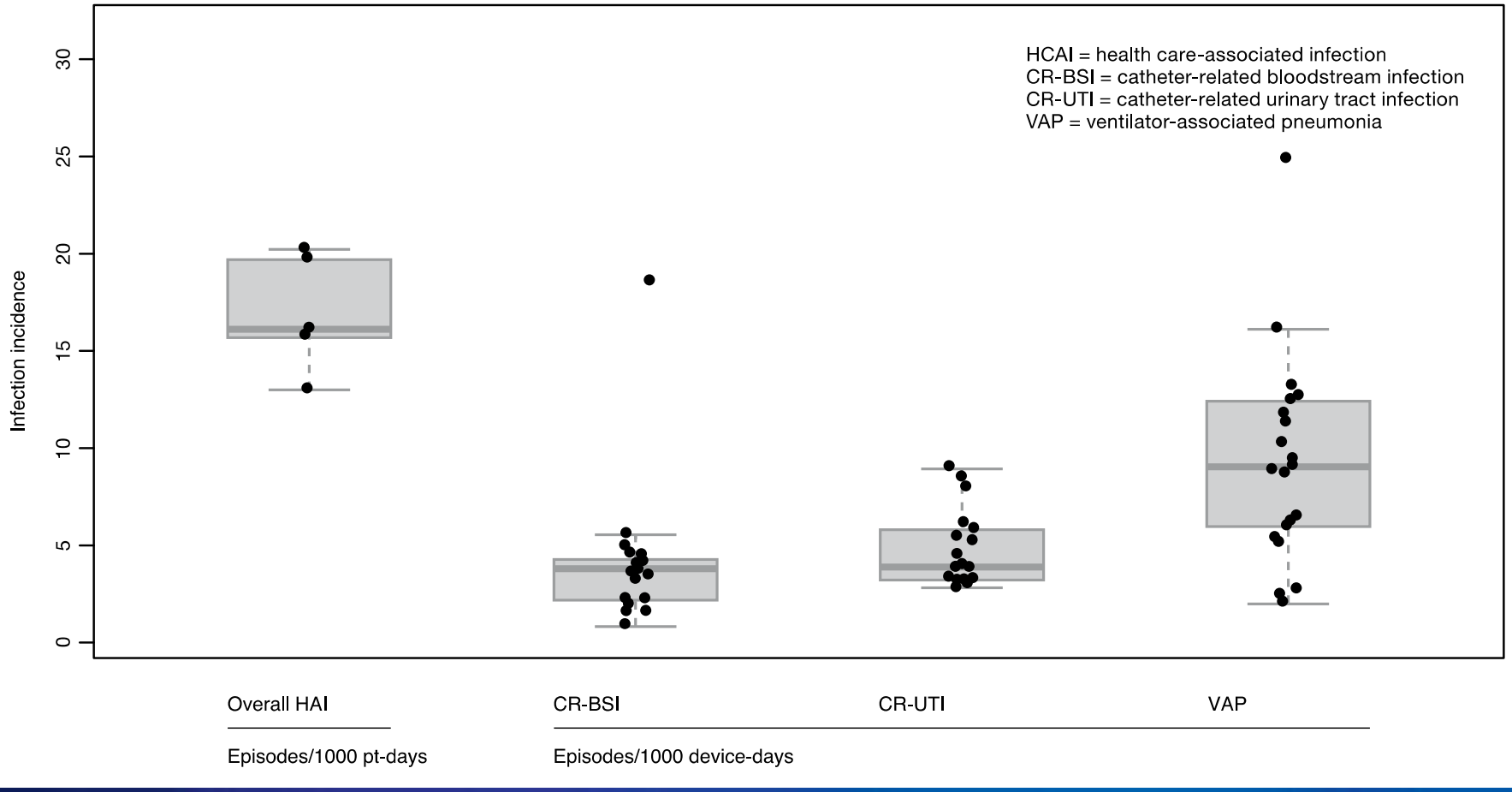
The burden of endemic health care-associated infection in High-Income countries



Benedetta Allegranzi et al. Report on the Burden of Endemic Health Care-Associated Infection Worldwide. A systematic review of the literature. © World Health Organization 2011

The burden of endemic health care-associated infection in High-Income countries

Incidence of overall health care-associated infection and device-associated infection in high-risk adult patients in high-income countries, 1995-2010



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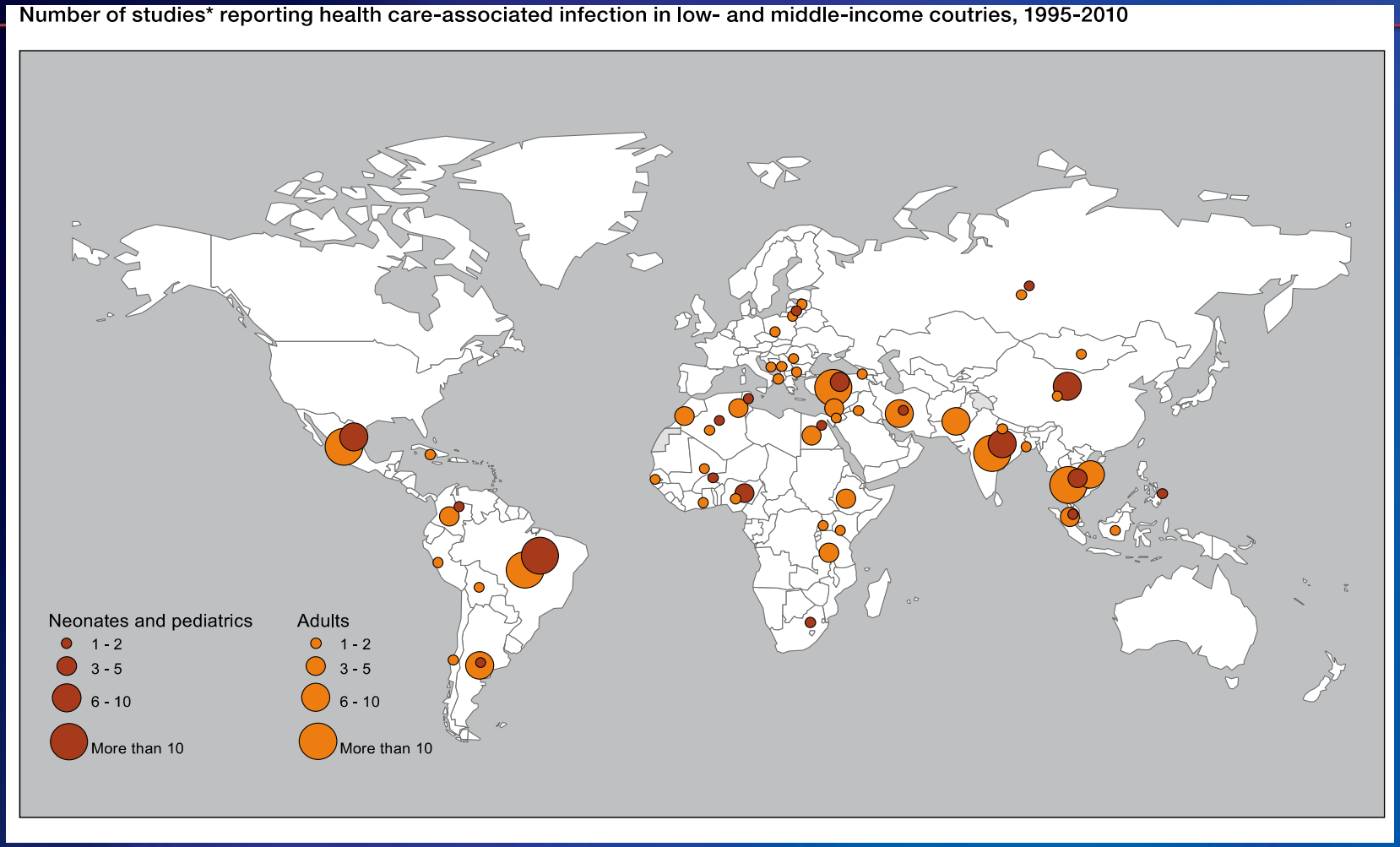
The burden of endemic health care-associated infection in low- and middle-income countries



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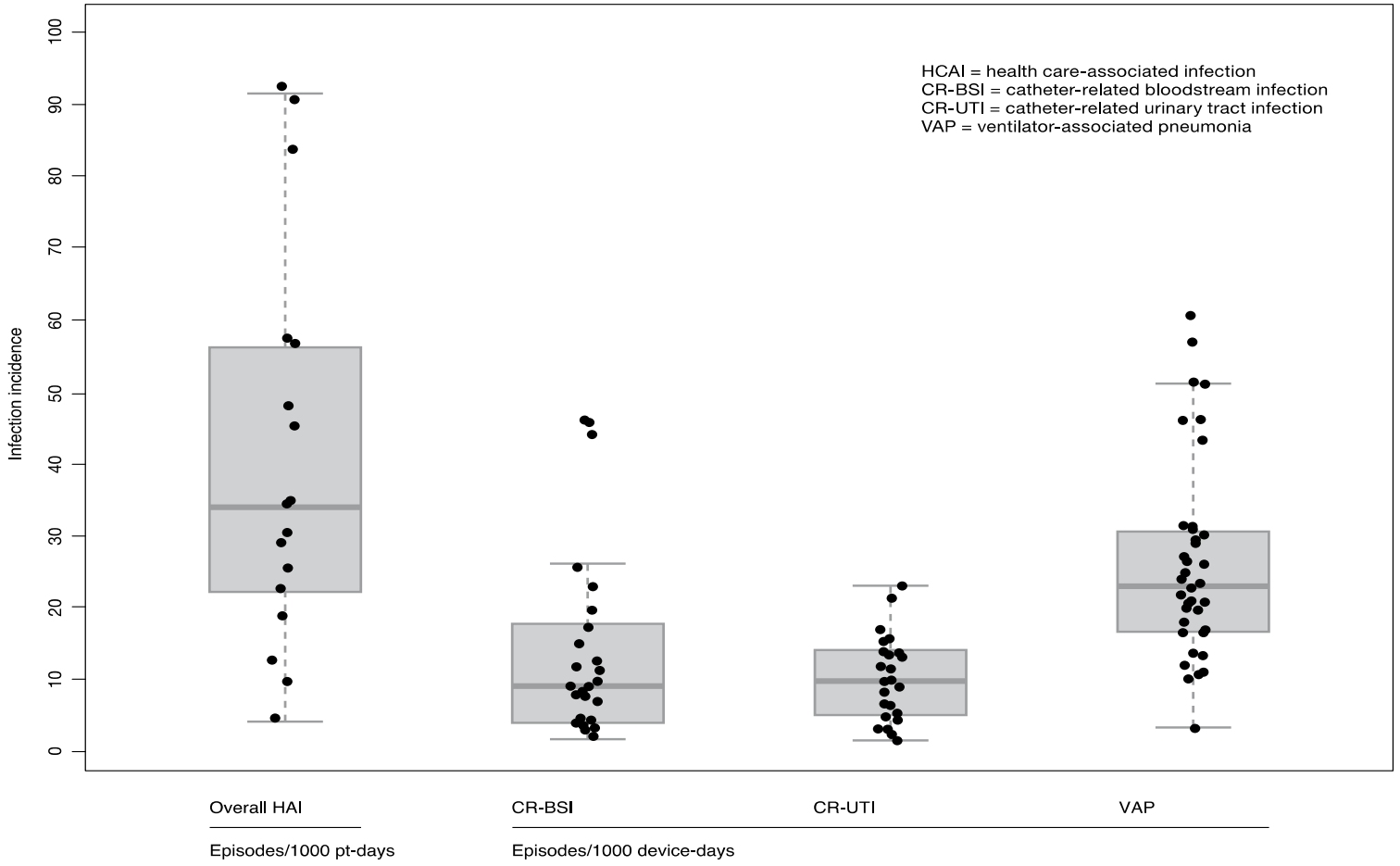
The burden of endemic health care-associated infection in low- and middle-income countries

Incidence of overall health care-associated infection and device-associated infection in high-risk patients in low- and middle-income countries, 1995-2010



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INVITED ARTICLE HEALTHCARE EPIDEMIOLOGY

Robert A. Weinstein, Section Editor

Central Line–Associated Bloodstream Infections in Limited-Resources Countries: A Review of the Literature

Victor D. Rosenthal

Bernal Medical Center, Infection Control and Infectious Diseases Department, Buenos Aires, Argentina

Central line–associated bloodstream infections (CLABSIs) are considered a significant cause of mortality in hospitalized patients; however, the incidence of CLABSIs in limited-resources countries has not been explored analytically. Likewise, the appropriate interventions to prevent, control, and reduce CLABSIs have yet to be analyzed thoroughly. This review demonstrates that CLABSIs are associated with significant extra mortality, with an odds ratio ranging from 2.8 to 9.5. The results of 6 sequential prospective interventional studies showed that hand hygiene and educational programs were related to a significant reduction in CLABSI rates. CLABSI rates in limited-resources countries are higher than US National Healthcare Safety Network benchmark rates and have a significant impact on mortality. Studies showing successful interventions for a reduction in CLABSIs are few. Subsequently, it can be inferred that additional epidemiological studies need to be conducted to achieve an appreciation of the effects of CLABSIs and to develop more-definitive approaches for CLABSI prevention in the form of practical, low-cost, low-technology measures that are feasible to implement in limited-resources countries.

Rosenthal, V. D. (2009). "Central line-associated bloodstream infections in limited-resource countries: a review of the literature." Clinical infectious diseases : an official publication of the Infectious Diseases Society of America 49(12): 1899-1907.

Pooled cumulative incidence densities for CLABSI in adult ICU patients, In limited resources countries- Review of the literature

Source	Country/Countries	Study Period	CLABSI per 1,000 CL days
Systematic review of the literature (1)	Limited resources countries	1995-2010	12.2

1. *Rosenthal, V. D. (2009). "Central line-associated bloodstream infections in limited-resource countries: a review of the literature." Clinical infectious diseases: an official publication of the Infectious Diseases Society of America **49**(12): 1899-1907.*

Central Line–Associated Bloodstream Infections in Limited-Resources Countries: A Review of the Literature

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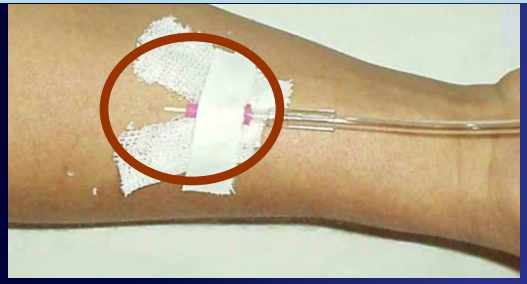
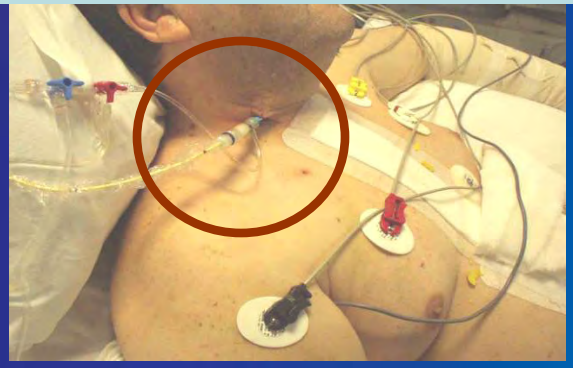
Clinical Infectious Diseases 2009; 49:000–000

Peripheral catheter with no sterile catheter dressing



Central line with no sterile dressing



CL insertion without maximal barriers

Three ways stop cock (open connector)

Multiple use vials with inserted needles

Single use vials, used multiple times


25 7 2008


25 7 2008

COMPARING HAI RATES OF USA AND EUROPE WITH INTERNATIONAL DATA:

WHO PAPERS

Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis

Benedetta Allegranzi, Sepideh Bagheri Nejad, Christophe Combescure, Wilco Graafmans, Hoda Attar, Liam Donaldson, Didier Pittet

Lancet 2011; 377: 228–41
Published Online December 10, 2010
DOI:10.1016/S0140-6736(10)61458-4
See Comment page 185

First Global Patient Safety Challenge, WHO Patient Safety, Geneva, Switzerland (B Allegranzi MD, S Bagheri Nejad MD, W Graafmans PhD, H Attar PhD, L Donaldson MD, Prof D Pittet MD); Division of Clinical Epidemiology, University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland (C Combescure PhD); Infection Control Programme, and WHO Collaborating Centre on Patient Safety (Infection Control and Improving Practices), University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland (Prof D Pittet); and National Patient Safety Agency, London, UK (L Donaldson)

Correspondence to: Prof Didier Pittet, Infection

Summary

Background Health-care-associated infection is the most frequent result of unsafe patient care worldwide, but few data are available from the developing world. We aimed to assess the epidemiology of endemic health-care-associated infection in developing countries.

Methods We searched electronic databases and reference lists of relevant papers for articles published 1995–2008. Studies containing full or partial data from developing countries related to infection prevalence or incidence—including overall health-care-associated infection and major infection sites, and their microbiological cause—were selected. We classified studies as low-quality or high-quality according to predefined criteria. Data were pooled for analysis.

Findings Of 271 selected articles, 220 were included in the final analysis. Limited data were retrieved from some regions and many countries were not represented. 118 (54%) studies were low quality. In general, infection frequencies reported in high-quality studies were greater than those from low-quality studies. Prevalence of health-care-associated infection (pooled prevalence in high-quality studies, 15·5 per 100 patients [95% CI 12·6–18·9]) was much higher than proportions reported from Europe and the USA. Pooled overall health-care-associated infection density in adult intensive-care units was 47·9 per 1000 patient-days (95% CI 36·7–59·1), at least three times as high as densities reported from the USA. Surgical-site infection was the leading infection in hospitals (pooled cumulative incidence 5·6 per 100 surgical procedures), strikingly higher than proportions recorded in developed countries. Gram-negative bacilli represented the most common nosocomial isolates. Apart from meticillin resistance, noted in 158 of 290 (54%) *Staphylococcus aureus* isolates (in eight studies), very few articles reported antimicrobial resistance.

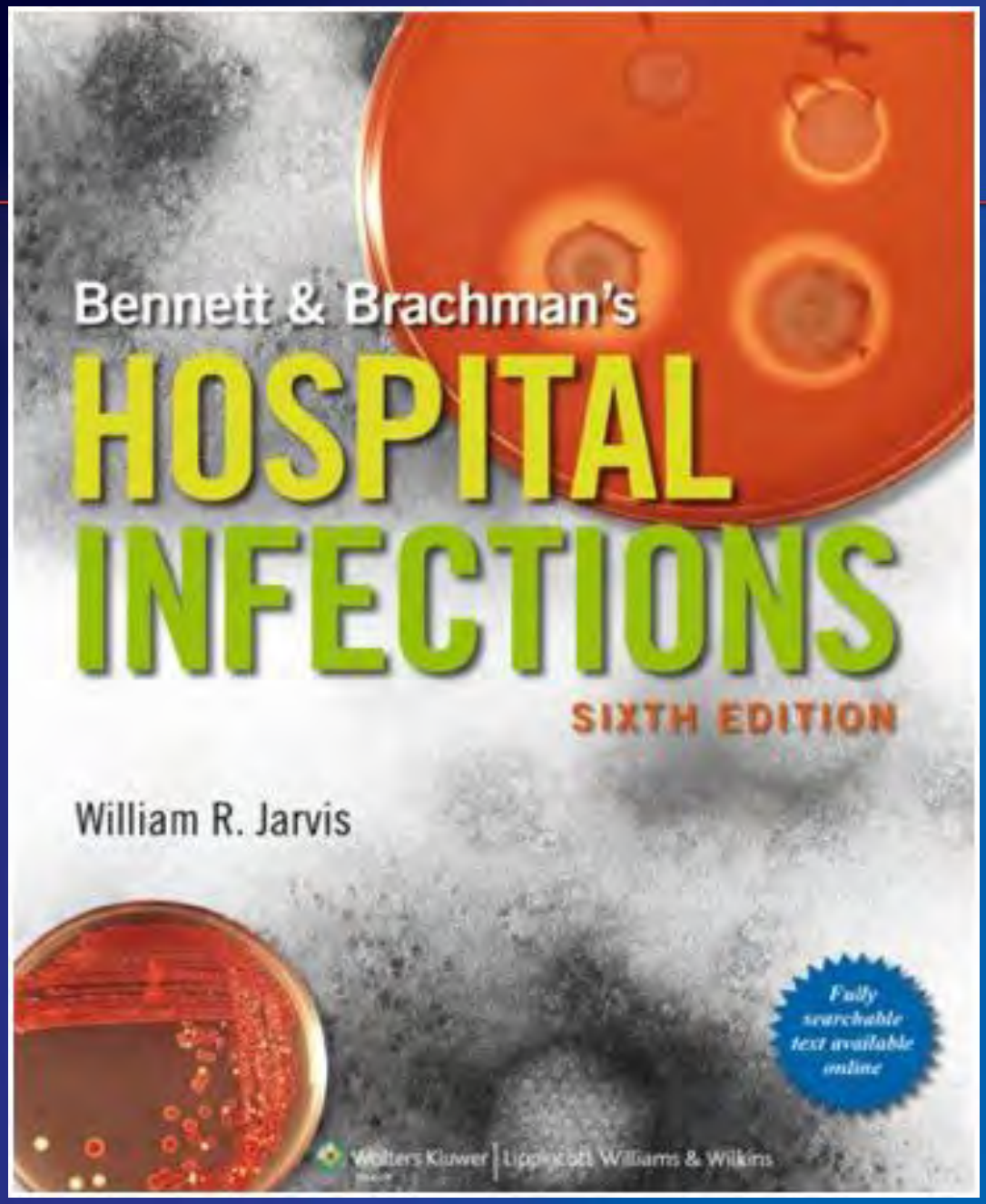
Interpretation The burden of health-care-associated infection in developing countries is high. Our findings indicate a need to improve surveillance and infection-control practices.

Funding World Health Organization.

	Number of ICUs	CR-BSI (95% CI)	Catheter-days	CR-UTI (95% CI)	Urinary catheter-days	VAP (95% CI)	Ventilator-days
Developed countries							
NNIS (1995–2003), USA*[98]	85–133†	5·0‡	1356 490	5·3‡	1356 490	5·8‡	115 900
NHSN (2006–2008), USA*[99]	89–182†	2·1‡	699 300	3·4‡	546 824	2·9‡	383 068
KISS (1997–2003), Germany[100]	309	1·8‡	1993 541	..	..	8·0‡	1177 137
KISS (2004–2009), Germany[101]	514–583†	1·3‡	4002 108	2·0‡	4757 133	5·1‡	2391 381
Developing countries							
INICC (2002–2007), 18 developing countries*§[73]	60	8·9‡	132 061	6·6‡	1030	19·8‡	1802
Argentina (1998–2004; current systematic review)[80–83]	15	24·7 (7·4–42·0)	9458	17·2 (13·4–21·1)	19 013	48·0 (42·0–54·0)	5777
Turkey (1999–2005; current systematic review)[86,87,89,90]	16	11·0 (2·2–24·3)	23 503	10·8 (4·2–17·4)	36 343	26·0 (20·0–32·0)	39 504
Current systematic review (1995–2008)[80–83,85,86,68,72–74,76,79,81,83,86,87,89,90]	226	11·3 (9·0–13·6)	373 848	9·8 (7·7–11·8)	427 831	22·9 (19·1–26·6)	263 027

Data are overall (pooled mean) infection episodes per 1000 device-days. ICUs=intensive-care units. CR-BSI=catheter-related bloodstream infection. CR-UTI=catheter-related urinary-tract infection. VAP=ventilator-associated pneumonia. NNIS=National Nosocomial Infection Surveillance. NHSN=National Healthcare Safety Network. KISS=Krankenhaus Infektions Surveillance System. INICC=International Nosocomial Infection Control Consortium. *Medical or surgical ICUs in major teaching hospitals. †Range reported because number of ICUs included in data pooling varied according to the type of device-associated infection. ‡95% CI not reported. §Argentina, Brazil, Colombia, Costa Rica, Cuba, El Salvador, India, Kosovo, Lebanon, Macedonia, Mexico, Morocco, Nigeria, Peru, Philippines, Turkey, Uruguay.

Table 2: **Comparison of device-associated infection densities in adult ICUs from developed and developing countries, 1995–2008**


Bennett & Brachman's
HOSPITAL INFECTIONS
SIXTH EDITION
William R. Jarvis
Fully searchable text available online
Wolters Kluwer | Lippincott Williams & Wilkins

Percentage of HAIs

Country	Type of Study/Unit	HAI Rate (%)	Year
Albania	Adult ICUs	31.6	2008
Albania	Surgical ICUs	22.0	2008
Argentina (INICC Study)	Multicenter adult ICU	27.0	2003
Bangladesh	Adult ICUs	30	2011
Brazil	Multicenter newborn ICU	28.1	2004
Brazil	Newborn ICU	50.7	2002
Brazil(INICC Study)	Multicenter adult ICU	29.6	2006
Bulgaria	Newborn ICU	1.9	2011
Chile	Hospitalwide	14.0	2001
China	Hospitalwide	3.04	2005
China	Newborn ICU	11.6	2007
Colombia	Newborn ICU	5.3	2005
Colombia (INICC Study)	Multicenter adult ICU	12.2	2006
Costa Rica (INICC Study)	Adult ICU	4.8	2009
Croatia (INICC Study)	Adult ICU	7.0	2006
Cuba (INICC Study)	Multicenter adult ICU	22.4	2011
Egypt	Pediatrie ICU	23.0	2005
Egypt (INICC study)	Adult ICU	32.8	2012
Egypt (INICC study)	Pediatric ICU	24.5	2012
India	Pediatric ICU	19.3	2011
India (INICC Study)	Multicenter adult ICU	12.3	2005
Kosovo	Adult ICU	64.3	2008
Kosovo	Adult and New Born	17.4	2006
Kuwait	Adult MS ICU	10.6	2008
Lebanon (INICC study)	Adult ICU	9.8	2012
Macedonia (INICC study)	Adult ICU	2.1	2010

Percentage of HAIs

Country	Type of Study/Unit	HAI Rate (%)	Year
Mexico	Hospitalwide	21.0	2002
Mexico	Multicenter adult ICU	23.2	2000
Mexico (INICC Study)	Multicenter adult ICU	24.4	2006
Morocco (INICC Study)	Adult medical ICU	19.3	2005
Pakistan	Adult ICUs	39.7	2007
Peru (INICC Study)	Multicenter adult ICU	11.2	2005
Philippines (INICC Study)	Adult ICU	19.1	2006
Poland (INICC study)	Adult ICU	24.3	2012
Saudi Arabia	Multicenter hospitalwide	2.8	2004
Saudi Arabia	[illegible]	[illegible].0	2002
Saudi Arabia	[illegible]	[illegible].5	2002
Saudi Arabia	Adult ICU	19.8	2002
Saudi Arabia	Newborn ICU	35.8	2002
Serbia	Adult ICUs	40.8	2006
Tanzania	Multicenter hospitalwide	14.8	2003
Tanzania	Adult medical ICU	40.0	2003
Tunisia (INICC study)	Newborn and Pediatric	4.1	2010
Turkey	Adult ICU	12.5	2000
Turkey	Adult ICU	33.0	2003
Turkey	Adult ICU	51.8	2003
Turkey	Multicenter adult ICU	48.7	2004
Turkey	Neurology ICU	88.9	2005
Turkey	General pediatric wards	3.02	2012
Turkey	Intensive care unit	25.6	2011
Turkey	Intensive care unit	20.1	2011
Turkey	Newborn ICU	29.7	2010
Turkey	Adult ICU	16.6	2005
Turkey (INICC Study)	Multicenter adult ICU	20.5	2005
INICC 8 countries	Multicenter adult ICU	14.7	2005

Range: 2% to 88%

HAIs per 1000 Bed Days

Country	Setting	HAI per 1000 bed days	Year
Argentina (INICC Study)	Multicenter adult ICU	90.0	2003
Brazil	Multicenter adult ICU	30.6	2006
Brazil	Multicenter newborn ICU	24.9	2004
Brazil	Newborn ICU	62.0	2002
China	Newborn ICU	14.9	2007
Colombia (INICC Study)	Newborn ICU	6.2	2005
Colombia (INICC Study)	Multicenter adult ICU	18.2	2006
Costa Rica (INICC Study)	Adult ICU	13.9	2009
Croatia (INICC Study)	Adult ICU	25.6	2006
Cuba (INICC Study)	Multicenter adult ICU	30.6	2011
Egy			
Egy			
Egy			
Egypt (INICC Study)	Adult ICU	52.9	2012
Egypt (INICC Study)	Pediatric ICU	22.8	2012
India	Hospitalwide	36.2	2004
India	Pediatric ICU	21	2011
India (INICC Study)	Multicenter adult ICU	21.4	2005
INICC (INICC Study)	Multicenter adult ICU	22.5	2005
Kuwait	Adult MS ICU	20.6	2008
Lebanon (INICC study)	Adult ICU	11.85	2012
Lithuania	5 Pediatric ICUs	24.5	2009
Macedonia (INICC study)	Adult ICU	4.5	2010
Mexico (INICC Study)	Multicenter adult ICU	39.0	2006
Morocco (INICC Study)	Adult medical ICU	20.4	2005
Peru (INICC Study)	Multicenter adult ICU	25.3	2005
Philippines (INICC Study)	Adult ICU	27.5	2006
Poland (INICC Study)	Adult ICU	21.9	2012
Serbia	Adult ICUs	65.6	2006
Tunisia (INICC Study)	Pediatric and Newborn	6.88	2010
Turkey	Burn ICU	18.2	2009
Turkey	General Pediatric wards	3.17	2012
Turkey	ICU	21.6	2011
Turkey	Newborn ICU	17.3	2010
Turkey	Adult ICU	30.2	2012
Turkey (INICC Study)	Multicenter adult ICU	48.4	2005
Turkey (INICC Study)	Neurology ICU	84.2	2005

Range: 11 to 90 HAIs per 1000 Bed days

CLABSI per 1000 CL days

Country	ICU Type	CLABSI per 1000 CL days	Year
Argentina	Adult	11.4	2002
Argentina (INICC Study)	Adult	30.3	2004
Argentina (INICC Study)	Adult	2.7	2004
Brazil	NICU	17.3	2010
Brazil	PICU	10.2	2003
Brazil (INICC Study)	Adult	9.1	2008
Brazil (INICC Study)	Adult, PICU	34.0	2003
Brazil (INICC Study)	NICU	3.1	2007
China	NICU	18	2007
China (INICC Study)	Adult	3.1	2011
China (INICC Study)	Adult	7.66	2012
Colombia (INICC Study)	Adult	11.3	2006
Costa Rica (INICC Study)	Adult	4.65	2009
Croatia (INICC Study)	Adult	8.3	2006
Cuba (INICC Study)	Adult	2.0	2011
Egypt (INICC Study)	Adult	22.5	2011
Egypt (INICC Study)	PICU	18.8	2011
El Salvador (INICC Study)	PICU	10.1	2011
El Salvador (INICC Study)	NICU	16.1	2011
India	Adult, PICU, NICU	0.48	2010
India	NICU	27.0	2011
India (INICC Study)	Adult	7.9	2007
Iran	Adult	147.3	2004

CLABSI per 1000 CL days

Country	ICU Type	CLABSI per 1000 CL days	Year
Kuwait	Adult	5.5	2008
Lebanon (INICC Study)	Adult	5.2	2011
Lithuania	PICU	7.7	2009
Macedonia (INICC Study)	Adult	1.47	2010
Mexico (INICC Study)	Adult	23.1	2006
Morocco (INICC Study)	Adult	15.7	2009
Peru	PICU	18.1	2010
Peru (INICC			
Philippines (			
Philippines (INICC Study)	PICU	8.23	2011
Philippines (INICC Study)	NICU	20.8	2011
Poland (INICC Study)	Adult	4.01	2011
Saudi Arabia	NICU	8.2	2009
Tunisia	Adult	15.3	2006
Tunisia	Adult	14.8	2007
Tunisia (INICC Study)	PICU, NICU	8.65	2010
Turkey	Adult	11.8	2010
Turkey	Adult	2.8	2011
Turkey	NICU	3.8	2012
Turkey (INICC Study)	Adult	17.6	2007
INICC 15 countries	NICU	13.7	2011
INICC 18 countries	Adult, PICU,	9.2	2008
INICC 18 countries	NICU	14.8	2008
INICC 25 countries	Adult, PICU,	7.6	2010
INICC 25 countries	NICU	13.9	2010
INICC 36 countries	Adult, PICU,	6.8	2011
INICC 36 countries	NICU	12.2	2011
INICC 8 countries	Adult, PICU, NICU	18.5	2006

Range: 2 to 147 CLABs per 1000 CL days

VAP per 1000 MV days

Country	ICU Type	VAP per 1000 MV days	Year
Albania	Adult, PICU, NICU	40.0	2008
Argentina (INICC Study)	Adult	46.3	2004
Brazil	NICU	3.2	2010
Brazil	PICU	18.7	2003
Brazil (INICC Study)	Adult	20.9	2008
Brazil (INICC Study)	Adult, PICU	26.0	2003
Brazil (INICC Study)	NICU	4.3	2007
China	NICU	63.3	2007
China (INICC Study)	Adult	20.8	2011
China (INICC Study)	Adult	10.46	2012
Colombia (INICC Study)	Adult	10.1	2006
Costa Rica (INICC Study)	Adult	29.9	2009
Croatia (INICC Study)	Adult	47.8	2006
Cuba (INICC Study)	Adult	52.5	2011
Egypt (INICC Study)	Adult	73.4	2011
Egypt (INICC Study)	PICU	31.8	2011
El Salvador (INICC Study)	PICU	12.1	2011
El Salvador (INICC Study)	NICU	9.9	2011
India	Adult, PICU, NICU	21.9	2010
India (INICC Study)	Adult	10.4	2007
Iran	Adult	275	2004

VAP per 1000 MV days

Country	ICU Type	VAP per 1000 MV days	Year
Kuwait	Adult	9.1	2008
Lebanon (INICC Study)	Adult	8.1	2011
Lithuania	PICU	28.8	2009
Macedonia (INICC Study)	Adult	6.58	2010
Mexico (INICC Study)	Adult	21.8	2006
Morocco (INICC Study)	Adult	43.2	2009
Peru	PICU	7.9	2010
Peru (INICC			008
Philippines (I			011
Philippines (INICC Study)	PICU	12.8	2011
Philippines (INICC Study)	NICU	0.44	2011
Poland (INICC Study)	Adult	18.2	2011
Tunisia	Adult	4.4	2006
Tunisia (INICC Study)	PICU, NICU	5.56	2010
Turkey	Adult	27.1	2010
Turkey	Adult	21.2	2011
Turkey	NICU	13.76	2012
Turkey (INICC Study)	Adult	26.5	2007
INICC 15 countries	NICU	9.7	2011
INICC 18 countries	Adult, PICU,	19.5	2008
INICC 18 countries	NICU	7.5	2008
INICC 25 countries	Adult, PICU,	13.6	2010
INICC 25 countries	NICU	9.5	2010
INICC 36 countries	Adult, PICU,	15.8	2011
INICC 36 countries	NICU	9.0	2011
INICC 8 countries	Adult, PICU, NICU	24.1	2006

Range: 3 to 275 VAP per 1000 MV days

CAUTI per 1000 UC days

Country	ICU Type	CAUTI per 1000 UC days	Year
Albania	Adult, PICU, NICU	41.0	2008
Argentina (INICC Study)	Adult	18.5	2004
Brazil	PICU	1.8	2003
Brazil (INICC Study)	Adult	9.6	2008
China (INICC Study)	Adult	6.4	2011
China (INICC Study)	Adult	1.3	2012
Colombia (INICC Study)	Adult	4.3	2006
Croatia (INICC Study)	Adult	6.0	2006
Cuba (INICC Study)	Adult	8.1	2011
Egypt (INICC Study)	Adult	34.2	2011
El Salvador (INICC Study)	PICU	5.8	2011
India	Adult, PICU, NICU	0.6	2010
India (INICC Study)	Adult	1.4	2007
Iran	Adult	137.5	2004

CAUTI per 1000 UC days

Country	ICU Type	CAUTI per 1000 UC days	Year
Kuwait	Adult	2.3	2008
Lebanon (INICC Study)	Adult	4.1	2011
Lithuania	PICU	3.4	2009
Macedonia (INICC Study)	Adult	0.45	2010
Mexico (INICC Study)	Adult	13.4	2006
Morocco (I			
Peru			
Peru (INICC Study)	Adult	5.1	2008
Philippines (INICC Study)	Adult	4.2	2011
Philippines (INICC Study)	PICU	0.0	2011
Poland (INICC Study)	Adult	4.8	2011
Tunisia (INICC Study)	PICU, NICU	0.0	2010
Turkey	Adult	9.6	2010
Turkey	Adult	11.9	2011
Turkey	Adult	19.02	2012
Turkey (INICC Study)	Adult	8.3	2007
INICC 18 countries	Adult, PICU,	6.5	2008
INICC 25 countries	Adult, PICU,	6.3	2010
INICC 36 countries	Adult, PICU,	6.3	2011
INICC 8 countries	Adult, PICU, NICU	8.9	2006

Range: 0.1 to 137 CAUTI per 1000 UC days

Pediatr Crit Care Med 2012 Vol. 13, No. 4

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Socioeconomic impact on device-associated infections in pediatric intensive care units of 16 limited-resource countries: International Nosocomial Infection Control Consortium findings

Victor D. Rosenthal, MD, MSc, CIC; William R. Jarvis; Siliom Jamulitrat; Cristiane Pavanello Rodrigues Silva; Bala Ramachandran; Lourdes Dueñas; Valdotas Gurskis; Gulden Ersoz; Maria Guadalupe Miranda Novales; Ilham Abu Khader; Khaldi Ammar; Nayde Barahona Guzmán; Josephine Anne Navoa-Ng; Zeinab Salah Sellem; Teodora Atencio Espinoza; Cheong Yuet Meng; Kushlani Jayatilleke; International Nosocomial Infection Control Members

Infection (2011) 39:439–450
DOI 10.1007/s15010-011-0136-2

CLINICAL AND EPIDEMIOLOGICAL STUDY

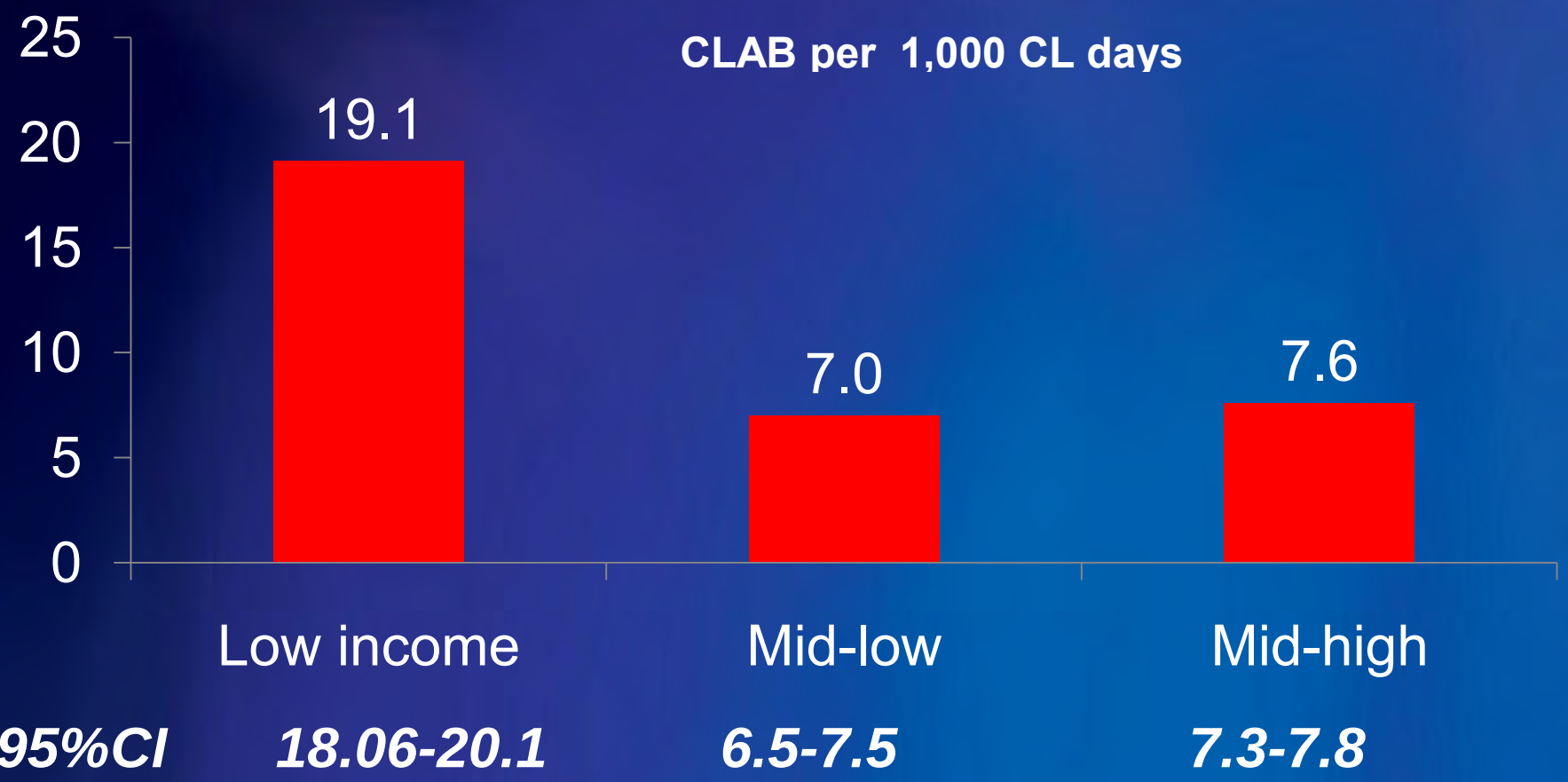
Socioeconomic impact on device-associated infections in limited-resource neonatal intensive care units: findings of the INICC

V. D. Rosenthal · P. Lynch · W. R. Jarvis · I. A. Khader · R. Richtmann · N. B. Jaballah · C. Aygun · W. Villamil-Gómez · L. Dueñas · T. Atencio-Espinoza · J. A. Navoa-Ng · M. Pawar · M. Sobreyra-Oropeza · A. Barkat · N. Mejía · C. Yuet-Meng · A. Apisarnthanarak · INICC members

World Bank classification of Countries Economic Strata. According to 2011 gross national income (GNI) per capita.

- The World Bank classifies countries into four economic strata according to 2011 gross national income (GNI) per capita.
- These groups are:
  - low income, $1,025 or less;
  - lower middle income, $1,026–4,035;
  - upper middle income, $4,036–12,475;
  - high income, $12,476 or more.
  - These economies represent 144 of 209 countries of the world (68.8%) and more than 75% of the world population.
- There is very limited information regarding association between socio economic level of the country (Low income, mid low income, and mid high income) and DAI rates, as well as association between type of hospital (Public, Academic, and Private) and DAI rates.
- The goal of this study is to show DAIs rates stratified by socio economic level of the country and type of hospital and to find statistical associations among them.

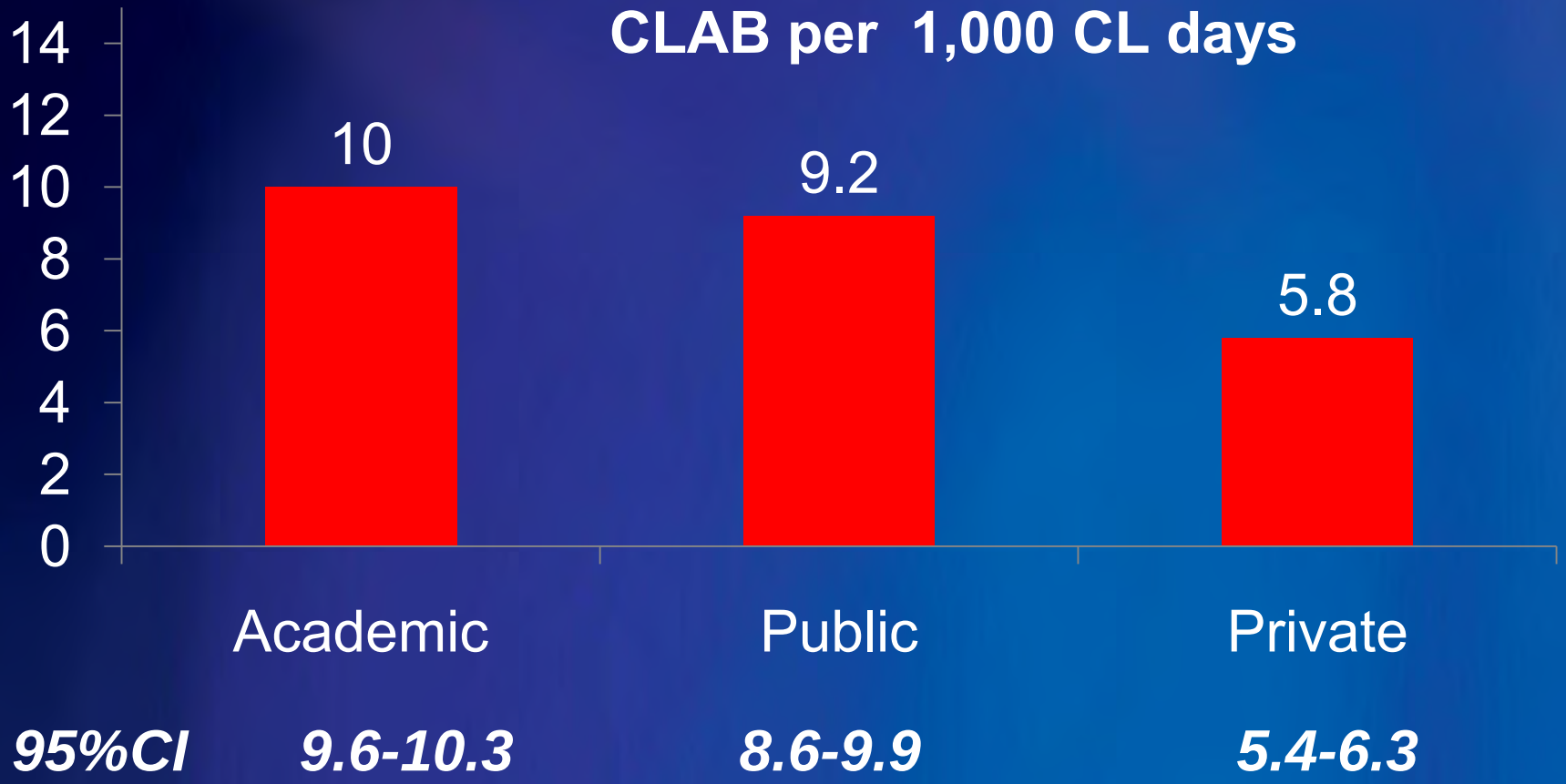
CLAB Rates Stratified Socio-Economic Level



	Low income	Mid-low	Mid-high
95%CI	***18.06-20.1***	***6.5-7.5***	***7.3-7.8***

Rosenthal VD, et al. Pediatric Critical Care 2012. Infection 2012.

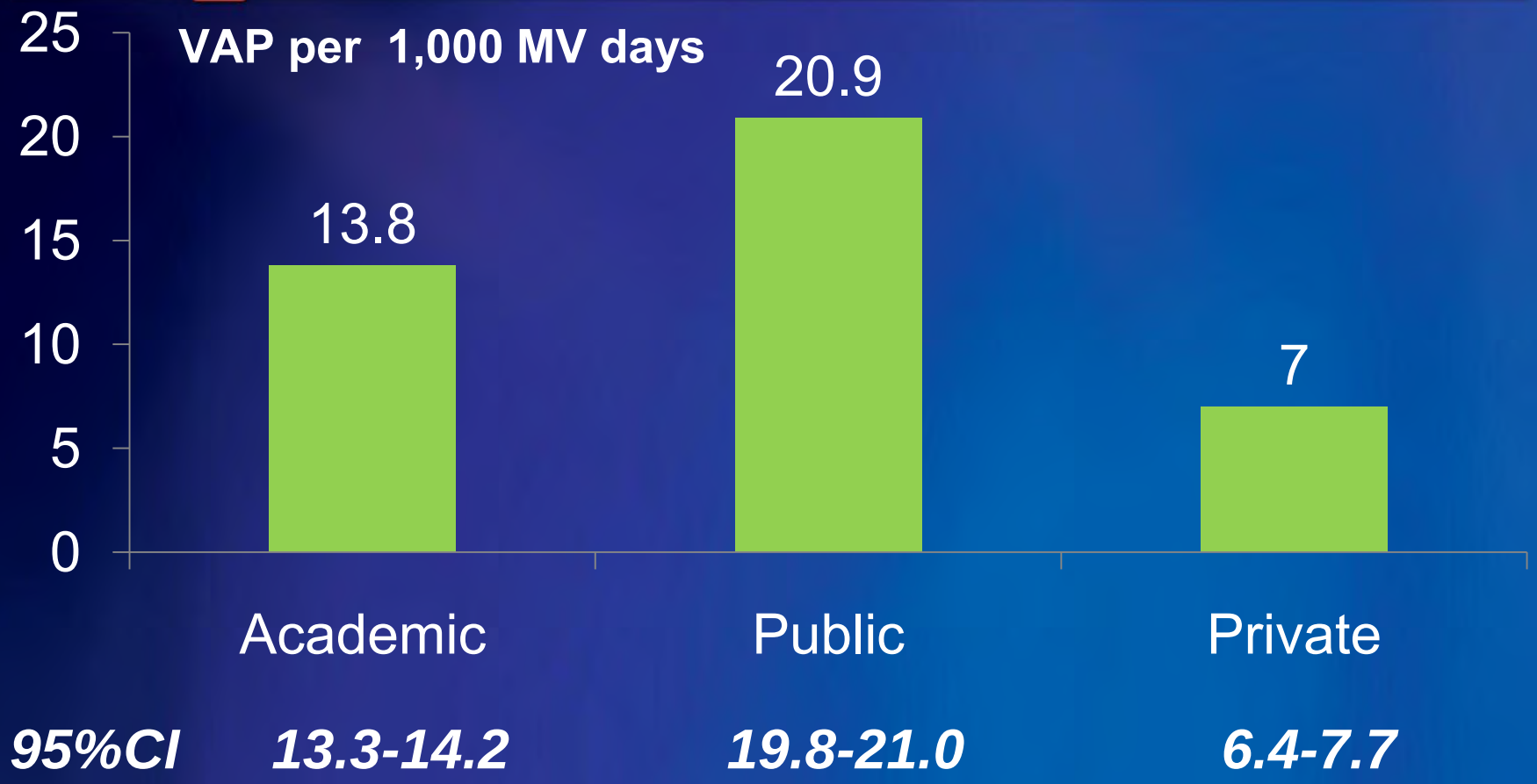
CLAB Rates Stratified By Hospital Type



	Academic	Public	Private
95%CI	*9.6-10.3*	*8.6-9.9*	*5.4-6.3*

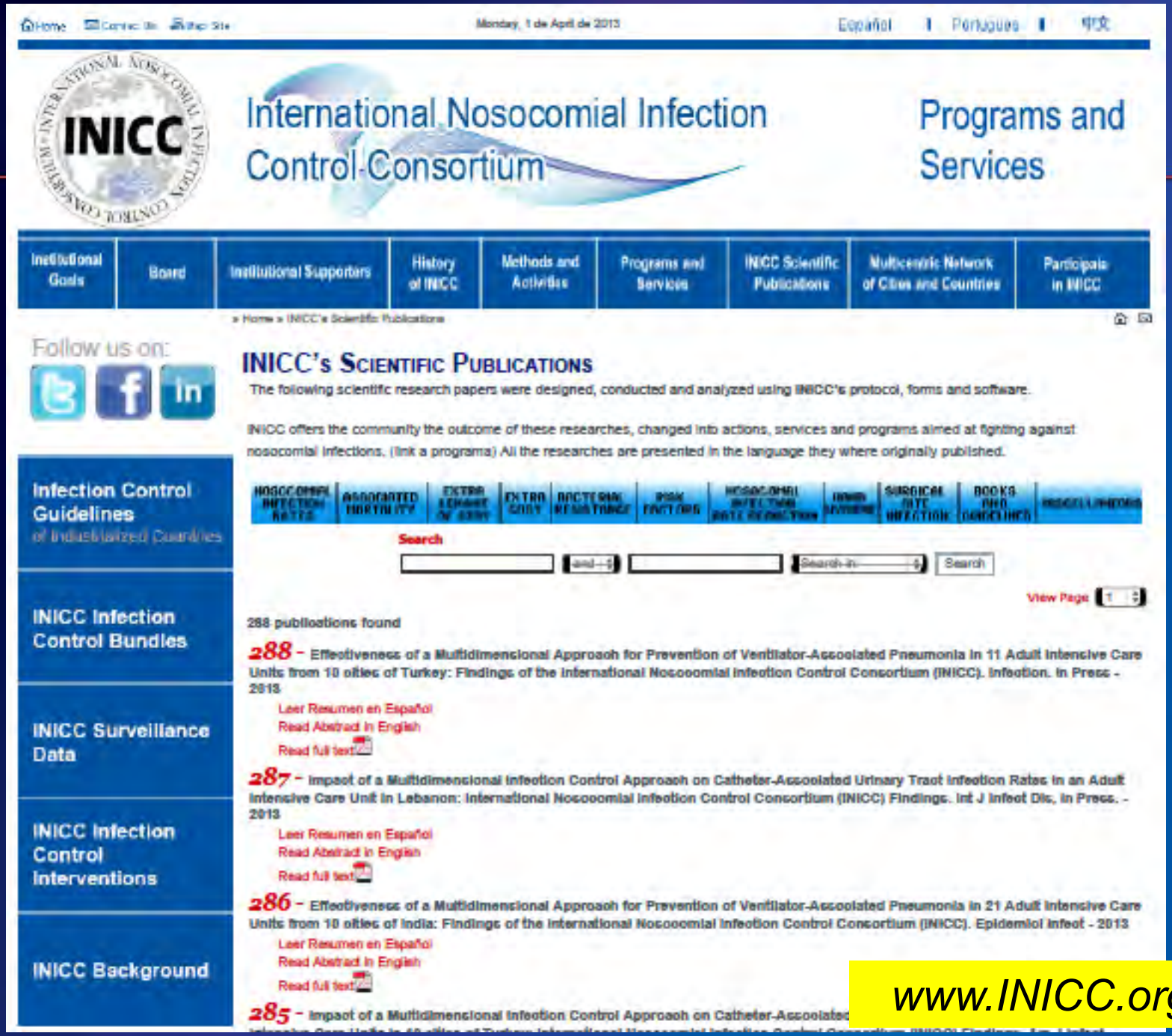
Rosenthal VD, et al. Pediatric Critical Care 2012. Infection 2012.

VAP Rates Stratified By Hospital Type



	Academic	Public	Private
95%CI	*13.3-14.2*	*19.8-21.0*	*6.4-7.7*

Rosenthal VD, et al. Pediatric Critical Care 2012. Infection 2012.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Monday, 1 de April de 2013
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INICC

International Nosocomial Infection Control Consortium

1000 Hospitals of 200 CITIES of 54 COUNTRIES of 4 CONTINENTS

List of 54 countries participating in INICC

Latin America	Europe	Asia	África
1. Argentina	1. Bulgaria	1. China	1. Botswana
2. Bolivia	2. Cyprus	2. India	2. Egypt
3. Brazil	3. Czech Republic	3. Indonesia	3. Morocco
4. Chile	4. Greece	4. Jordan	4. Niger
5. Colombia	5. Kosovo	5. Kuwait	5. Tunisia
6. Costa Rica	6. Lithuania	6. Lebanon	6. Sudan
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8. Dominican Republic	8. Poland	8. Mongolia	
9. Ecuador	9. Romania	9. Pakistan	
10. El Salvador	10. Serbia	10. Philippines	
11. Guatemala.	11. Slovakia	11. Singapore	
12. Honduras	12. Turkey	12. Sri Lanka	
13. México	13. Ukraine	13. Saudi Arabia	
14. Panamá		14. Taiwan	
15. Peru		15. Thailand	
16. Puerto Rico		16. United Arab Emirates	
17. Venezuela		17. Vietnam	
18. Uruguay			

Papers published by INICC by specific Country of Latin America

Device-associated nosocomial i
rates in intensive care units in
Mexican public hospitals

Ector Jaime Ramírez Barba,[a] Victor Daniel Rosenthal,[b] Francisco Higuera,[c] Martha Sobreyra Oropeza,[d] Hector Torres Hernández,[e] Martha Sánchez López,[f] Elia Lara Lona,[a] Pablo Duarte,[b] Javier Ruiz,[b] Raul Rojas Hernandez,[a] Amalia Chavez,[a] Irma Perez Cerrato,[f] Gloria Elena Ramirez Ramirez,[a] and Nasia Safdar[g]
México City and Guanajuato, Mexico; Buenos Aires, Argentina; and Madison, Wisconsin

Background: Routine surveillance of nosocomial infections has become an integral part of infection control and quality assurance in US hospitals.
Methods: As part of the International Nosocomial Infection Control Consortium, we performed a prospective nosocomial infection surveillance cohort study in 5 adult intensive care units of 4 Mexican public hospitals using the Centers for Disease Control and Prevention National Nosocomial Infections Surveillance system definitions. Site-specific nosocomial infection rates were calculated.
Results: The overall nosocomial infection rate was 24.4 % (257/1055) and 39.0 (257/659) per 1000 patient days. The most common infection was catheter-associated bloodstream infection, 57.98 % (149/257), followed by ventilator-associated pneumonia, 20.23% (52/257), and catheter-associated urinary tract infection, 21.79% (56/257). The overall rate of catheter-associated bloodstream infections was 23.1 per 1000 device-days (149/6450); ventilator-associated pneumonia rate was 21.8 per 1000 device-days (52/2390); and catheter-associated urinary tract infection rate was 15.4 per 1000 device-days (56/4184).
Conclusion: Our rates are similar to other hospitals of Latin America and higher than US hospitals. (Am J Infect Control 2006;■:■–■)

Vol. 28 No. 8 Infection Control and Hospital Epidemiology

Device-Associated Nosocomial Infect
in Intensive Care Units of Argentina

[redacted]

ABSTRACT
BACKGROUND: Nosocomial infections are an important public health problem in many developing countries, particularly in the intensive care unit (ICU) setting. No previous data are available on the incidence of device-associated nosocomial infections in different types of ICUs in Argentina.
METHODS: We performed a prospective nosocomial infection surveillance study during the first year of an infection control program in an Argentinean ICU. Nosocomial infections were identified using the Centers for Disease Control and Prevention National Nosocomial Infections Surveillance System definitions, and nosocomial infection rates were cal-
days: it was 14.2 per 1,000 device-days in coronary care units (CCUs). The rate of ventilator-associated pneumonia in medical-surgical ICUs was 40.5 per 1,000 device-days; it was 45.5 per 1,000 device-days in CCUs. The rate of symptomatic catheter-associated urinary tract infections in medical-surgical ICUs was 11.5 per 1,000 device-days; it was 12.3 per 1,000 device-days in CCUs.
CONCLUSIONS: The high rate of nosocomial infections in Argentinean ICUs found during our surveillance suggests that ongoing targeted surveillance and implementation of proven infection control strategies is needed in developing countries such as Argentina [Infect Control Hosp Epidemiol 2004;25:251–256]

ORIGINAL ARTICLE

evice-Associated Infection Rate and Mortalit
Units of 9 Colombian Hospitals: Findings of the International Nosocomial Infection Control Consortium

Carlos Alvarez Moreno, MD; Victor D. Rosenthal, MD; Nasda Olarte, MD; Wilmer Villamil Gomez, MD; Otto Sussmann, MD; Julio Garzon Agudelo, MD; Catherine Rojas, MD; Lelian Osorio, RN; Claudia Linares, RN; Alberto Valderrama, RN; Patricia Garrido Mercado, MD; Patrick Hennin Arrieta Reynale, MD; Guillermo Ruiz Vergara, MD; Alberto Marrugo Perez, MD; Beatriz Ingrein Mojica, RN; María del Pilar Torres Navarro, RN; Ana Sofia Alonso Romero, MD; Dubeth Henriquez, MD

OBJECTIVE. To perform active targeted prospective surveillance to measure device-associated infection (DAI) rates, attributable mortality due to DAI, and the microbiological and antibiotic resistance profiles of infecting pathogens at 18 intensive care units (ICUs) in 9 hospitals in Colombia, all of which are members of the International Infection Control Consortium.
METHODS. We conducted prospective surveillance of healthcare-associated infection in 9 hospitals by using the definitions of the US Centers for Disease Control and Prevention National Nosocomial Surveillance System (NNIS). DAI rates were calculated as the number of infections per 100 ICU patients and per 1,000 device-days.
RESULTS. During the 3-year study, 2,172 patients hospitalized in an ICU for an aggregate duration of 16,400 days acquired 266 DAIs, for an overall DAI rate of 12.2%, or 18.2 DAIs per 1,000 patient-days. Central venous catheter (CVC)–related bloodstream infection (BSI) (47.4% of DAIs; 11.3 cases per 1,000 catheter-days) was the most common DAI, followed by ventilator-associated pneumonia (VAP) (32.3% of DAIs; 10.6 cases per 1,000 ventilator-days) and catheter-associated urinary tract infection (CAUTI) (20.3% of DAIs; 4.3 cases per 1,000 catheter-days). Overall, 65.4% of all Staphylococcus aureus infections were caused by methicillin-resistant strains; 40.8% of Enterobacteriaceae isolates were resistant to ceftriaxone; and 28.3% were resistant to ceftazidime; and 40.8% of Pseudomonas aeruginosa isolates were resistant to fluoroquinolones, 30.8% were resistant to ceftazidime, 35.3% were resistant to piperacillin-tazobactam, and 39.0% were resistant to imipenem. The crude unadjusted attributable mortality was 16.9% among patients with VAP (relative risk [RR], 1.93; 95% confidence interval [CI], 1.24–3.00; $P = .002$); 18.5 among those with CVC-associated BSI (RR, 2.02; 95% CI, 1.42–2.87; $P < .001$); and 19.5% among those with CAUTI (RR, 1.98; 95% CI, 0.78–5.08; $P = .19$).
CONCLUSIONS. The rates of DAI in the Colombian ICUs were lower than those published in some reports from other Latin American countries and were higher than those reported in US ICUs by the NNIS. These data show the need for more-effective infection control interventions in Colombia.

Infect Control Hosp Epidemiol 2006; 27:349–356

Investigación original / Original research

Device-associated infection rates in intensive care units of Brazilian hospitals: findings of the International Nosocomial Infection Control Consortium

Reinaldo Salomao,[1] Victor D. Rosenthal,[2] Gorki Grimberg,[3] Simone Nouer,[4] Sergio Blecher,[1] Silvia Buchner-Ferreira,[2] Rosa Vianna,[4] and Maria Ângela Maretti-da-Silva[1]

Suggested citation Salomao R, Rosenthal VD, Grimberg G, Nouer S, Blecher S, Buchner-Ferreira S, et al. Device-associated infection rates in intensive care units of Brazilian hospitals: findings of the International Nosocomial Infection Control Consortium. Rev Panam Salud Publica. 2008;24(3):195–202.

Contents lists available at ScienceDirect
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Device-associated infection rates in adult intensive care units of Cuban university hospitals: International Nosocomial Infection Control Consortium (INICC) findings

H. Guanche-Garcell [a], O. Requejo-Pino [b], V.D. Rosenthal [c,*], C. Morales-Pérez [a], O. Delgado-González [b], D. Fernández-González [b]

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[b] *Gral. Calixto García University Hospital, Havana, Cuba*
[c] *International Nosocomial Infection Control Consortium, Buenos Aires, Argentina*

Original Article

Device-associated infection rates in intensive care units in El Salvador: International Nosocomial Infection Control Consortium (INICC) Findings

Lourdes Dueñas[1], Ana C. Bran de Casares [1], Victor D. Rosenthal [2], Lilian Jesús Machuca[1]

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!

Abstract
Introduction: This study aimed to determine the rate of device-associated, health care-associated infection (DA-HAI), the excess in length of stay, the mortality, and the hand hygiene compliance in a pediatric intensive care unit (PICU) and a neonatal ICU (NICU) in a hospital member of the International Infection Control Consortium (INICC) in El Salvador.
Methodology: A prospective cohort, active DA-HAI surveillance study was conducted on patients admitted in the pediatric and neonatal ICUs from January 2007 to November 2009. The protocol and methodology implemented were developed by INICC. Data were collected in the participating ICUs, and analyzed at INICC headquarters by proprietary software. DA-HAI rates were recorded by applying the definitions of the Centers for Disease Control and Prevention National Healthcare Safety Network.
Results: Of 1,145 patients hospitalized in the PICU for 9,517 days, 177 acquired DA-HAIs (overall rate 15.5%), and 18.6 DA-HAIs per 1,000 ICU-days. Furthermore, 1,270 patients hospitalized in the NICU for 30,663 days acquired 302 DA-HAIs (overall rate 23.8%), and 9.8 DA-HAIs per 1,000 ICU-days. The central line-associated bloodstream infection (CLA-BSI) rates in the NICU and PICU were 9.9 and 10.0 per 1,000 catheter-days respectively. The ventilator-associated pneumonia (VAP) rate was 16.1 per 1,000 ventilator-days in the NICU and 12.1 in the PICU.The catheter-associated urinary tract infection (CAUTI) rate was 5.8 per 1,000 catheter-days in the PICU.
Conclusions: DA-HAI rates in the PICU and NICU of our hospital were higher than international standards; infection control programs

Investigación original / Original research

Device-associated infection rates and mortality in intensive care units of Peruvian hospitals: findings of the International Nosocomial Infection Control Consortium

Luis E. Cuellar,[1] Eduardo Fernandez-Maldonado,[2] Victor D. Rosenthal,[3] Alex Castaneda-Sabogal,[4] Rosa Rosales,[1] Manuel J. Mayorga-Espichan,[2] Luis A. Camacho-Cosavalente,[3] and Luis I. Castillo-Bravo[1]

Suggested citation Cuellar LE, Fernandez-Maldonado E, Rosenthal VD, Castaneda-Sabogal A, Rosales R, Mayorga-Espichan MJ, et al. Device-associated infection rates and mortality in intensive care units of Peruvian hospitals: findings of the International Nosocomial Infection Control Consortium. Rev Panam Salud Publica. 2008;24(1):16–24.

Papers published by INICC by specific Country of Europe, Asia and Africa

Device-associated infections rate adult, pediatric, and neonatal int care units of hospitals in the Philippines: International Nosocomial Infection Control Consortium (INICC) findings

J. A. Navoa-Ng,[a] R. Berba,[b] Y. Arreza Galapia,[c] Victor Daniel Rosenthal,[d] V. D. Villanueva,[a] M. Corazon V. Tolentino,[a] G. A. Genulino,[b] R. J. Consunji,[b] and J. B. V. Mantaring III[b]
Quezon City and Manila, Philippines and Buenos Aires, Argentina

Background: This study investigated the rate of device-associated health care–associated infection (DA-HAI), microbiological profiles, bacterial resistance, length of stay (LOS), and mortality rate in 9 intensive care units (ICUs) of 3 hospital members of the International Nosocomial Infection Control Consortium (INICC) in the Philippines.

Methods: This was an open-label, prospective cohort, active DA-HAI surveillance study of adult, pediatric, and newborn patients admitted to 9 tertiary care ICUs in the Philippines between January 2005 and December 2009, implementing methodology developed by the INICC. Data collection was performed in the participating ICUs, and data were uploaded and analyzed at the INICC headquarters using proprietary software. DA-HAI rates were registered based on definitions promulgated by the Centers for Disease Control and Prevention's National Healthcare Safety Network.

Results: Over a 5-year period, 4952 patients hospitalized in ICUs for a total of 40,733 days acquired 199 DA-HAIs. For an overall rate of 4.9 infections per 1000 ICU-days. Ventilator-associated pneumonia posed the greatest risk (16.7 per 1000 ventilator-days in the adult ICUs, 12.8 per 1000 ventilator-days in the pediatric ICU, and 0.44 per 1000 ventilator-days in the neonatal ICUs), followed by central line–associated bloodstream infections (4.6 per 1000 catheter-days in the adult ICUs, 8.25 per 1000 ventilator-days in the pediatric ICU, and 9.6 per 1000 ventilator-days in the neonatal ICUs) and catheter-associated urinary tract infections (4.2 per 1000 catheter-days in the adult ICUs and 0.0 in the pediatric ICU).

Conclusion: DA-HAIs pose far greater threats to patient safety in Philippine ICUs than in US ICUs. The establishment of active infection control programs that involve infection surveillance and implement guidelines for prevention can improve patient safety and should become a priority.

Key Words: International Nosocomial Infection Control Consortium; hospital infection; nosocomial infection; health care–acquired infection; central line–associated bloodstream infection; bloodstream infection; bacteremia; ventilator-associated pneumonia; hospital-acquired pneumonia; catheter-associated urinary tract infection; developing country; limited-resource country; low-income country; intensive care unit; critical care; infection control; surveillance; incidence density; length of stay; mortality; microorganism profile; bacterial resistance.

Int J Infect Dis. 2011 Aug 14. [Epub ahead of print]

Device-associated infection rates in 398 intensive care units in Shangh International Nosocomial Infection Control Consortium (INICC) finding

Tao L, Hu B, **Rosenthal VD**, Gao X, He L.
Department of Respiratory Medicine, Huadong Hospital, Fudan University, Shanghai, China.

Abstract

OBJECTIVES: To determine device-associated healthcare-associated infection (DA-HAI) rates and the microorganism profile in 398 intensive care units (ICUs) of 70 hospitals in Shanghai, China.

METHODS: An open-label, prospective, cohort, active DA-HAI surveillance study was conducted on patients admitted to 398 tertiary-care ICUs in China from September 2004 to December 2009, implementing the methodology developed by the International Nosocomial Infection Control Consortium (INICC). The data were collected in the participating ICUs, and uploaded and analyzed at the INICC headquarters on proprietary software. DA-HAI rates were registered by applying the definitions of the US Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN). We analyzed the rates of DAI-HAI, ventilator-associated pneumonia (VAP), central line-associated bloodstream infection (CLABSI), and catheter-associated urinary tract infection (CAUTI), and their microorganism profiles.

RESULTS: During the 5 years and 4 months of the study, 391 527 patients hospitalized in an ICU for an aggregate of 3 245 244 days, acquired 20 866 DA-HAIs, an overall rate of 5.3% (95% confidence interval (CI) 5.3-5.4) and 6.4 (95% CI 6.3-6.5) infections per 1000 ICU-days. VAP posed the greatest risk (20.8 per 1000 ventilator-days, 95% CI 20.4-21.1), followed by CAUTI (6.4 per 1000 catheter-days, 95% CI 6.3-6.6) and CLABSI (3.1 per 1000 catheter-days, 95% CI 3.0-3.2). The most common isolated microorganism was Acinetobacter baumannii (19.1%), followed by Pseudomonas aeruginosa (17.2%), Klebsiella pneumoniae (11.9%), and Staphylococcus aureus (11.9%).

CONCLUSIONS: DA-HAIs in the ICUs of Shanghai pose a far greater threat to patient safety than in ICUs in the USA. This is particularly the case for the VAP rate, which is much higher than the rates found in developed countries. Active infection control programs that carry out infection surveillance and implement prevention guidelines can improve patient safety and must become a priority.

…spital Infection (2007) 67, 168–174
Available online at www.sciencedirect.com
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ce-associated nosocomial infection rates tensive care units of seven Indian cities. ings of the International Nosocomial tion Control Consortium (INICC)

ita [a], V.D. Rosenthal [b,*], Y. Mehta [c], M. Chakravarthy [d], odi [e], N. Sen [f], S. Sahu [g], R. Gopinath [h], C. Rodrigues [a], oor [c], V. Jawali [d], P. Chakraborty [e], J.P. Raj [f], D. Bindhani [g], indra [h], A. Hegde [a], M. Pawar [c], N. Venkatachalam [d], tterjee [e], N. Trehan [c], T. Singhal [a], N. Damani [i]

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f February 2007; accepted 13 July 2007

ORIGINAL ARTICLE

International Nosocomial Infection Control Consortium Findings of Device-Associated Infections Rate in an Intensive Care Unit of a Lebanese University Hospital

Kanj SS, Kanafani ZA, Sidani N, Alamuddin L, Zahreddine N, Rosenthal VD[1]

Faculty of Medicine, Internal Medicine Department, American University of Beirut Medical Center, Beirut, Lebanon, [1]International Nosocomial Infection Control Consortium, Buenos Aires, Argentina, Avenida Corrientes 4580, Piso 12, Dpto "D", Buenos Aires (C1195AAR), Argentina

ABSTRACT

Objectives: To determine the rates of device-associated healthcare-associated infections (DA-HAI), microbiological profile, bacterial resistance, length of stay (LOS), excess mortality and hand hygiene compliance in one intensive care unit (ICU) of a hospital member of the International Infection Control Consortium (INICC) in Beirut, Lebanon. **Materials and Methods:** An open label, prospective cohort, active DA-HAI surveillance study was conducted on adults admitted to a tertiary-care ICU in Lebanon from November 2007 to March 2010. The protocol and methodology implemented were developed by INICC. Data collection

Journal of Critical Care (2011) xx, xxx-xxx

Journal of Critical Care

NICC headquarters on proprietary Safety Network (NHSN) at the US l ventilator-associated pneumonia inary tract infection (CAUTI) rates, : A total of 666 patients hospitalized –12.3], and 11.8 (95% CI 9.1–15.0) r-days; the VAP rate was 8.1 (95%)00 catheter-days. LOS of patients se with VAP. Excess mortality was significantly different from patients nd hygiene compliance was 84.9% ere moderately high, below INICC and antibiotic policies are essential

Device-associated infection rates and extra length of stay in an intensive care unit of a university hospital in Wroclaw, Poland: International Nosocomial Infection Control Consortium's (INICC) findings

Andrzej Kübler[a], Wieslawa Duszynska[a], Victor D Rosenthal[b,*], Malgorzata Fleischer[a], Teresa Kaiser[a], Ewa Szewczyk[a], Barbara Barteczko-Grajek[a]

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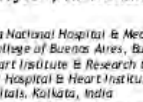
nfection, ventilator associated lium



International Archives of Medicine

Original research

Open Access

Health-care associated infections rates, length of stay, and bacterial resistance in an intensive care unit of Morocco: Findings of the International Nosocomial Infection Control Consortium (INICC)

Naoufel Madani[1], Victor D Rosenthal[2], Tarek Dendane[1], Khalid Abidi[1], Amine Ali Zeggwagh[1,3] and Redouane Abouqal*[1,3]

…We sought to determine the rate of healthcare-associated in… (HCAI), microbiological profile, bacterial resistance, length of stay … and excess mortality in 12 ICUs of the seven hospital members of … International Infection Control Consortium (INICC) of seven Indian … Prospective surveillance was introduced from July 2004 to March … 10 835 patients hospitalized for 52 518 days acquired 476 HCAIs, an … l rate of 4.4% and 9.06 HCAIs per 1000 ICU-days. The central venous … ter-related bloodstream infection (CVC-BSI) rate was 7.92 per 1000 … ter-days; the ventilator-associated pneumonia (VAP) rate was 10.46 … 000 ventilator-days; and the catheter-associated urinary tract

Journal of Hospital Infection (2006) ■, 1–7
Available online at www.sciencedirect.com
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Device-associated hospital-acquired infections rates in intensive care units of 12 Turkish hospitals. Findings of the International Nosocomial Infection Control Consortium (INICC)

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Received 7 December 2005; accepted 18 October 2006

Four INICC Annual Reports

Publication year	2006	2008	2010	2012
Number of Countries	8	18	25	36
Peer Review Journal	Annals of Internal Medicine	American Journal of Infection Control	American Journal of Infection Control	American Journal of Infection Control

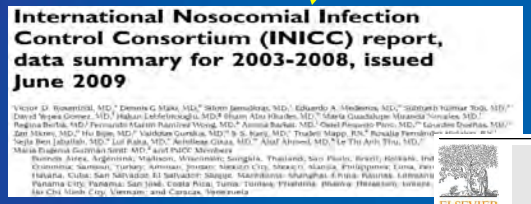

Annals of Internal Medicine

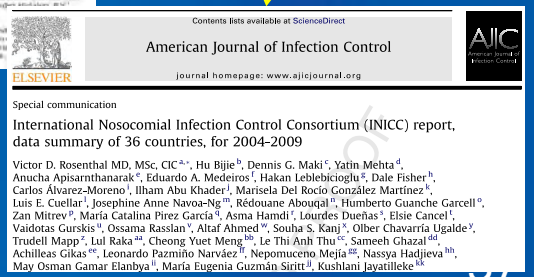
ARTICLE

Device-Associated Nosocomial Infections in 55 Intensive Care Units of 8 Developing Countries

Victor D. Rosenthal, MD; Dennis G. Maki, MD; Reinaldo Salomao, MD; Carlos Álvarez-Moreno, MD; Yatin Mehta, MD; Francisco Higuera, MD; Luis E. Cuellar, MD; Özay Akan Arikan, MD; Rédouane Abouqal, MD; and Hakan Leblebicioglu, MD, for the International Nosocomial Infection Control Consortium*


International Nosocomial Infection Control Consortium report, data summary for 2002-2007, issued January 2008


International Nosocomial Infection Control Consortium (INICC) report, data summary for 2003-2008, issued June 2009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Special communication

International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009

Victor D. Rosenthal MD, MSc, CIC[a,*], Hu Bijie[b], Dennis G. Maki[c], Yatin Mehta[d], Anucha Apisarnthanarak[e], Eduardo A. Medeiros[f], Hakan Leblebicioglu[g], Dale Fisher[h], Carlos Álvarez-Moreno[i], Ilham Abu Khader[j], Marisela Del Rocío González Martínez[k], Luis E. Cuellar[l], Josephine Anne Navoa-Ng[m], Rédouane Abouqal[n], Humberto Guanche Garcell[o], Zan Mitrev[p], María Catalina Pirez García[q], Asma Hamdi[r], Lourdes Dueñas[s], Elsie Cancel[t], Vaidotas Gurskis[u], Ossama Rasslan[v], Altaf Ahmed[w], Souha S. Kanj[x], Olber Chavarría Ugalde[y], Trudell Mapp[z], Lul Raka[aa], Cheong Yuet Meng[bb], Le Thi Anh Thu[cc], Sameeh Ghazal[dd], Achilleas Gikas[ee], Leonardo Pazmiño Narváez[ff], Nepomuceno Mejía[gg], Nassya Hadjieva[hh], May Osman Gamar Elanbya[ii], María Eugenia Guzmán Siritt[jj], Kushlani Jayatilleke[kk]

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Rosenthal, V. D., H. Bijie, et al. (2012). "International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009." American journal of infection control 40(5): 396-407.

INICC report – 36 countries- “2004 to 2009”.

- Period: January 2004 to December 2009 (6 years)
- Countries: 36 (Argentina, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Egypt, Greece, India, Jordan, Kosovo, Lebanon, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, Puerto Rico, El Salvador, Saudi Arabia, Singapore, Sri Lanka, Sudan, Thailand, Tunisia, Turkey, Venezuela, Vietnam, Uruguay)
- ICUs: 422
- Patients: 313,008
- Bed days: 2,194,897
- Central Line days: 1,078,448
- Ventilator days: 796,847
- Urinary catheter days: 1,049,541
- BSI (n): 7,603
- VAP (n): 12,395
- CAUTI (n): 6,595
- Total IAD: 26,593

Rosenthal, V. D., H. Bijie, et al. (2012). "International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009." American journal of infection control 40(5): 396-407

HAI rates INICC vs CDC-NHSN (USA)

	INICC 2004–2009 Pooled Mean (95% CI)	U.S. NHSN 2006-2008 Pooled Mean (95% CI)
Medical Cardiac ICU		
CLAB	6.2 (5.6 – 6.9)	2.0 (1.8 – 2.1)
CAUTI	3.7 (3.2 – 4.3)	4.8 (4.6 – 5.1)
VAP	10.8 (9.5 – 12.3)	2.1 (1.9 – 2.3)
Medical-surgical ICU		
CLAB	6.8 (6.6 – 7.1)	1.5 (1.4 – 1.6)
CAUTI	7.1 (6.9 – 7.4)	3.1 (3.0 – 3.3)
VAP	18.4 (17.9 – 18.8)	1.9 (1.8 – 2.1)
Pediatric ICU		
CLAB	4.6 (3.7 – 5.6)	3.0 (2.7 – 3.1)
CAUTI	4.7 (4.1 – 5.5)	4.2 (3.8 – 4.7)
VAP	6.5 (5.9 – 7.1)	1.8 (1.6 – 2.1)
Newborn ICU		
CLAB	11.9 (10.2 – 13.9)	1.5 (1.2 – 1.9)
VAP	10.1 (7.9 – 12.8)	0.8 (0.04 – 1.5)

Rosenthal, V. D., H. Bijie, et al. (2012). "International Nosocomial Infection Control Consortium (INICC) report, data summary of 36 countries, for 2004-2009." American journal of infection control 40(5): 396-407

Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis

Benedetta Allegranzi, Sepideh Bagheri Nejad, Christophe Combescure, Wilco Graafmans, Hania Attar, Liam Donaldson, Didier Pittet

Lancet 2011; 377: 228–41
Published Online December 10, 2010
DOI:10.1016/S0140-6736(10)61458-4
See Comment page 185

First Global Patient Safety Challenge, WHO Patient Safety, Geneva, Switzerland (B Allegranzi MD, S Bagheri Nejad MD, W Graafmans PhD, H Attar PhD, L Donaldson MD, Prof D Pittet MD); Division of Clinical Epidemiology, University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland (C Combescure PhD); Infection Control Programme, and WHO Collaborating Centre on Patient Safety (Infection Control and Improving Practices), University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland (Prof D Pittet); and National Patient Safety Agency, London, UK (L Donaldson)

Correspondence to: Prof Didier Pittet, Infection

Summary

Background Health-care-associated infection is the most frequent result of unsafe patient care worldwide, but few data are available from the developing world. We aimed to assess the epidemiology of endemic health-care-associated infection in developing countries.

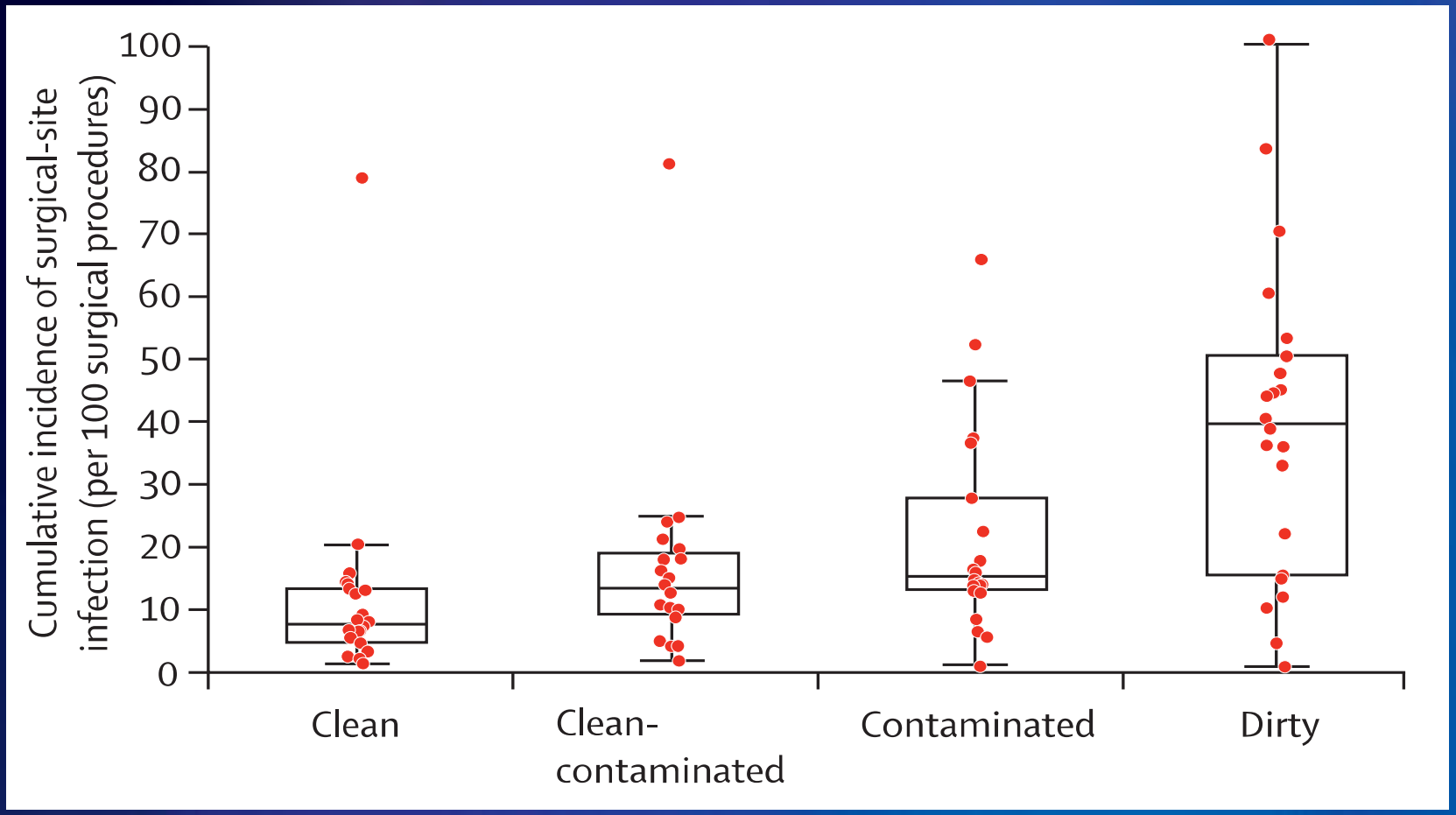
Methods We searched electronic databases and reference lists of relevant papers for articles published 1995–2008. Studies containing full or partial data from developing countries related to infection prevalence or incidence—including overall health-care-associated infection and major infection sites, and their microbiological cause—were selected. We classified studies as low-quality or high-quality according to predefined criteria. Data were pooled for analysis.

Findings Of 271 selected articles, 220 were included in the final analysis. Limited data were retrieved from some regions and many countries were not represented. 118 (54%) studies were low quality. In general, infection frequencies reported in high-quality studies were greater than those from low-quality studies. Prevalence of health-care-associated infection (pooled prevalence in high-quality studies, 15·5 per 100 patients [95% CI 12·6–18·9]) was much higher than proportions reported from Europe and the USA. Pooled overall health-care-associated infection density in adult intensive-care units was 47·9 per 1000 patient-days (95% CI 36·7–59·1), at least three times as high as densities reported from the USA. Surgical-site infection was the leading infection in hospitals (pooled cumulative incidence 5·6 per 100 surgical procedures), strikingly higher than proportions recorded in developed countries. Gram-negative bacilli represented the most common nosocomial isolates. Apart from meticillin resistance, noted in 158 of 290 (54%) *Staphylococcus aureus* isolates (in eight studies), very few articles reported antimicrobial resistance.

Interpretation The burden of health-care-associated infection in developing countries is high. Our findings indicate a need to improve surveillance and infection-control practices.

Funding World Health Organization.

The burden of endemic health care-associated infection in low- and middle-income countries



Lancet 2011; 377: 228–41

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JUNE 2013, VOL. 34, NO. 6

ORIGINAL ARTICLE

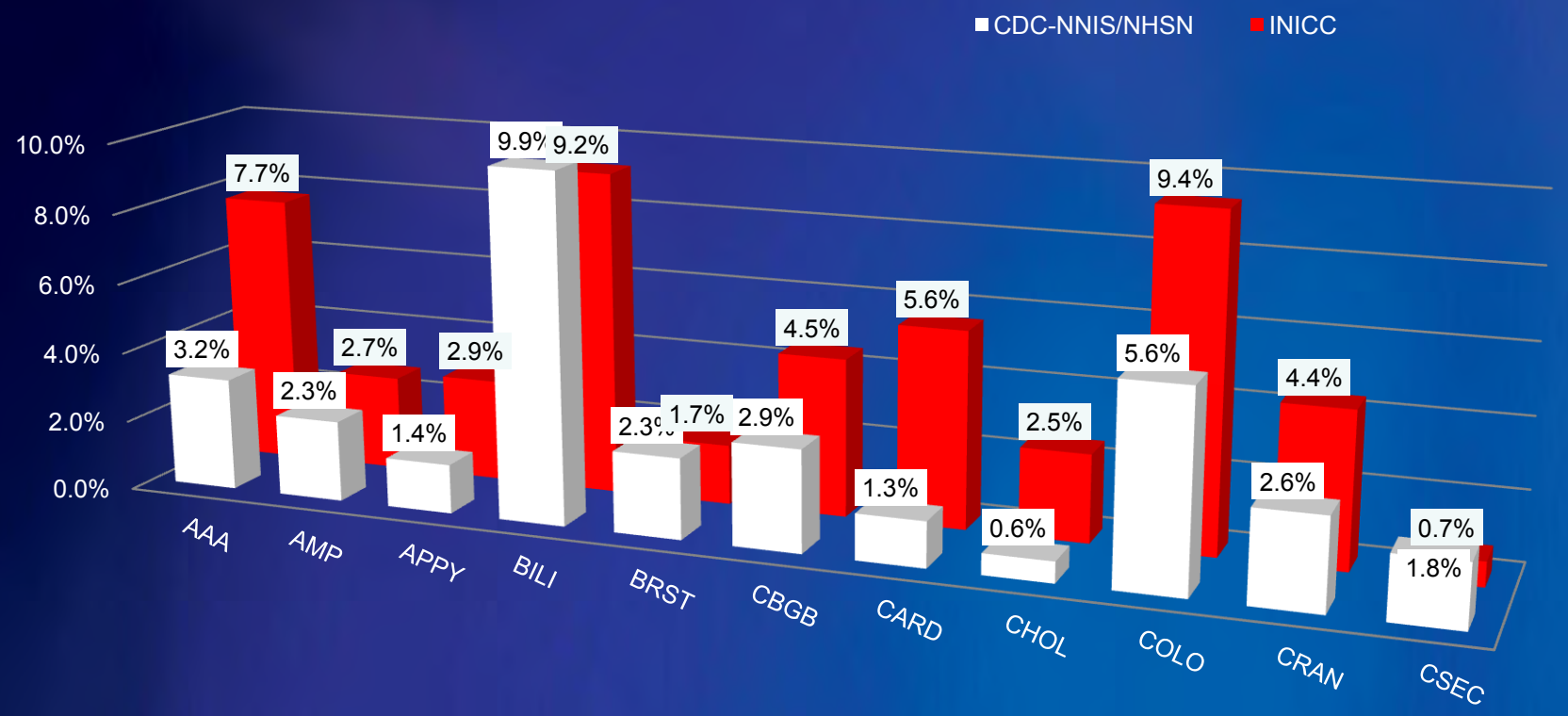
Surgical Site Infections, International Nosocomial Infection Control Consortium Report, Data Summary of 30 Countries, 2005–2010

Victor D. Rosenthal, MD;[1] Rosana Richtmann, MD;[2] Sanjeev Singh, MD;[3] Anucha Apisarnthanarak, MD;[4] Andrzej Kübler, MD;[5] Nguyen Viet-Hung, MD;[6] Fernando M. Ramírez-Wong, MD;[7] Jorge H. Portillo-Gallo, MD;[8] Jessica Toscani, MD;[9] Achilleas Gikas, MD;[10] Lourdes Dueñas, MD;[11] Amani El-Kholy, MD;[12] Sameeh Ghazal, MD;[13] Dale Fisher, MD;[14] Zan Mitrev, MD;[15] May Osman Gamar-Elanbya, MD;[16,17] Souha S. Kanj, MD;[18] Yolanda Arreza-Galapia, MD;[19] Hakan Leblebicioglu, MD;[20] Soňa Hlinková, MD;[21,22] Badaruddin A. Memon, MD;[23] Humberto Guanche-Garcell, MD;[24] Vaidotas Gurskis, MD;[25] Carlos Álvarez-Moreno, MD;[26] Amina Barkat, MD;[27] Nepomuceno Mejía, MD;[28] Magda Rojas-Bonilla, MD;[29] Goran Ristic, MD;[30] Lul Raka, MD;[31] Cheong Yuet-Meng, MD[32] on behalf of the International Nosocomial Infection Control Consortium[a]

RESULTS:

- The collected data amounted to 260,973 surgical procedures.
- Most of INICC SSI rates were 2 to 5 times statistically significantly higher in international hospitals than in USA (CDC) report, such as the following:

SSI rates: Comparing CDC-NHSN (USA) and International data (INICC)

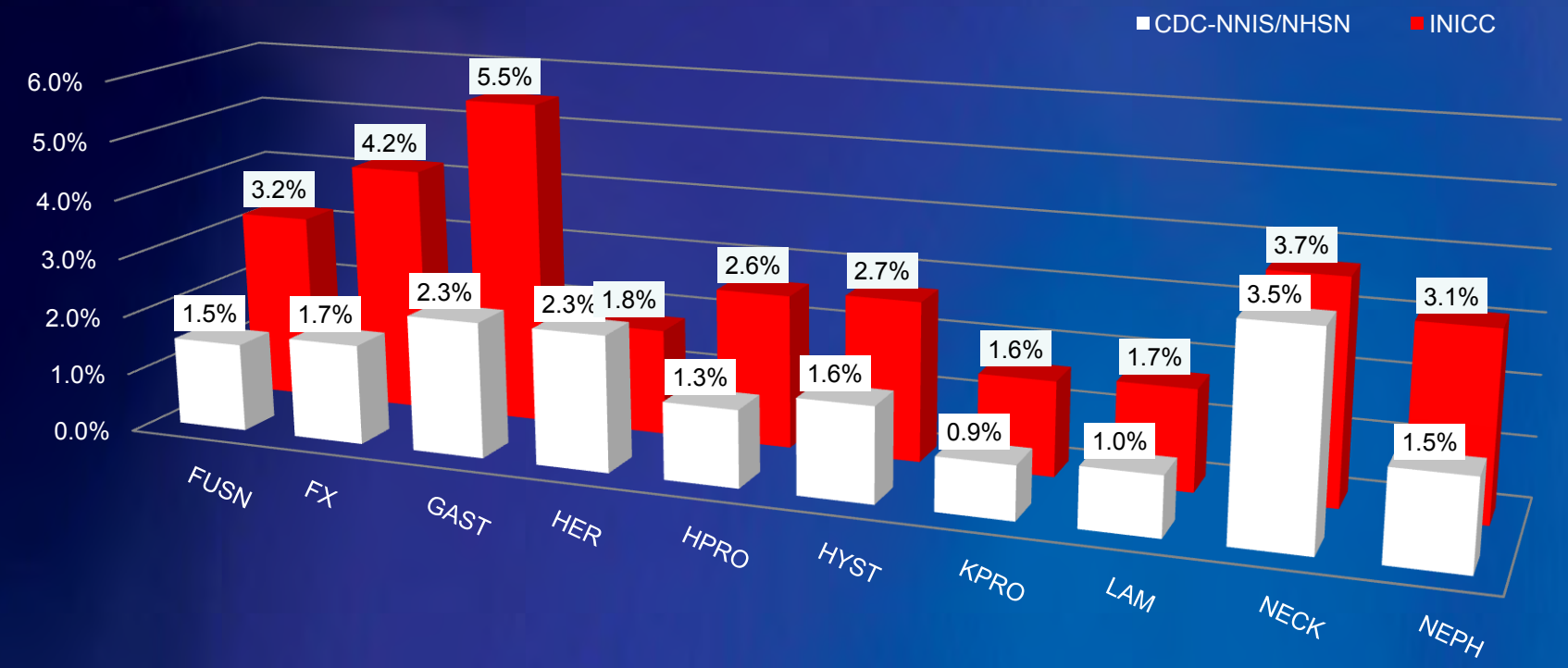


AAA: Abdominal Aortic Aneurysm Repair
AMP: Limb Amputation
APPY: Appendectomy
BILI: Bile duct, liver or pancreatic surgery

CBGC: CABG-Chest only
CARD: Cardiac surgery
CHOL: Cholecystectomy
COLO: Colon Surgery

CRAN: Craniotomy
CSEC: Cesarean section

SSI rates: Comparing CDC-NHSN (USA) and International data (INICC)

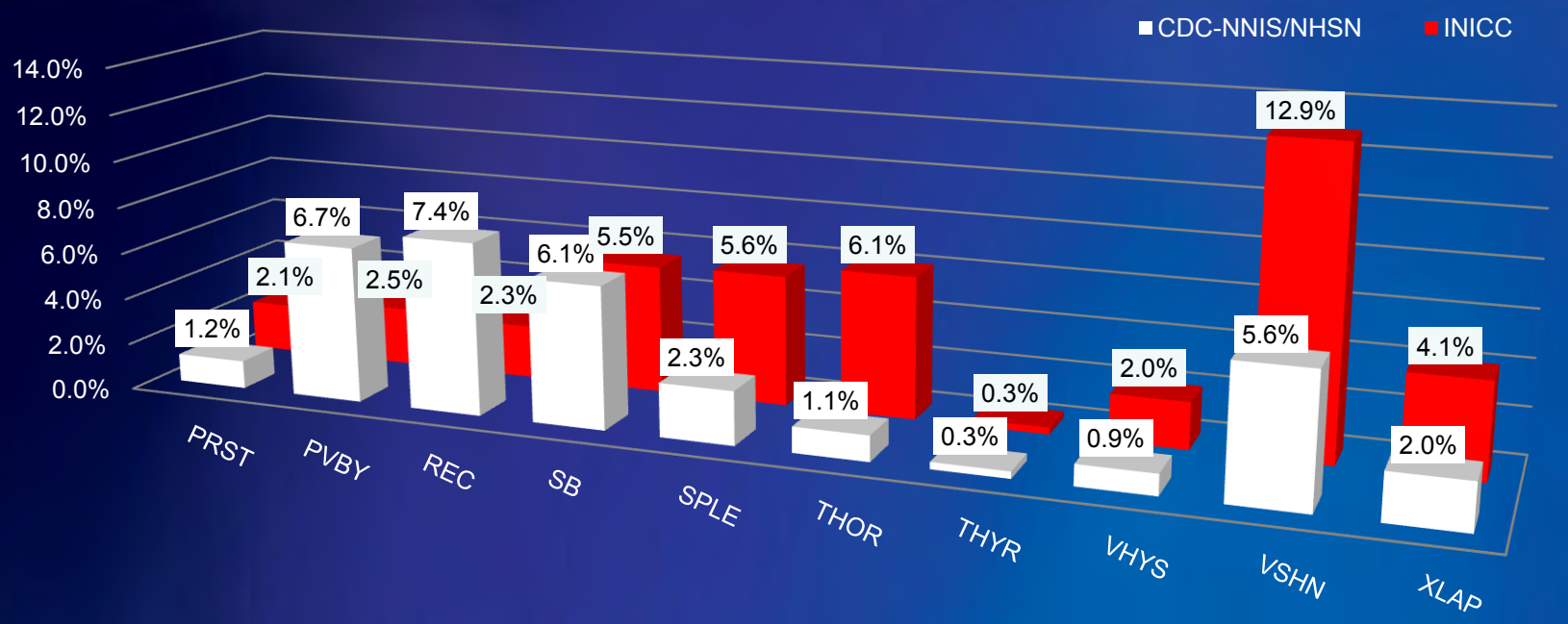


FUSN: Spinal fusion
FX: Open Reduction of Fracture
GAST: Gastric surgery
HER: Herniorrhaphy

HPRO: Hip prosthesis
HYST: Abdominal hysterectomy
KPRO: Knee prosthesis
LAM: Laminectomy

NECK: Neck surgery
NEPH: Kidney surgery

SSI rates: Comparing CDC-NHSN (USA) and International data (INICC)



PRST: Prostatectomy
PVBY: Peripheral vascular bypass surgery
REC: Rectal surgery

SB: Small bowel surgery
SPLE: Spleen surgery
THOR: Thoracic surgery
THYR: Thyroid and/or parathyroid surgery

VHYS: Vaginal Hysterectomy
VSHN: Ventricular shunt
XLAP: Exploratory abdominal surgery

EXTRA LENGTH OF STAY

Extra Length of Stay Rate of Central-Line Associated Bloodstream Infection

Table 14

Pooled means and 95% CIs of the distribution of the length of stay and crude excess length of stay* of ICU patients with DA-HAI, adult and pediatric ICUs combined

	LOS, total days	Patients, n	Pooled average LOS, days	95% CI
LOS of patients without DA-HAI	746,251	119,501	6.2	6.2-6.3
LOS of patients with CLABSI	28,709	1679	17.1	16.3-17.9
Extra LOS of patients with CLABSI	28,709	1679	10.9	10.1-11.6
LOS of patients with CAUTI	30,982	1677	18.5	17.6-19.4
Extra LOS of patients with CAUTI	30,982	1677	12.2	11.4-13.1
LOS of patients with VAP	90,146	5020	18.0	17.5-18.5
Extra LOS of patients with VAP	90,146	5020	11.7	11.3-12.2

CI, confidence interval; *LOS*, length of stay.

Table 15

Pooled means and 95% CIs of the distribution of the length of stay and crude excess length of stay* of infants in NICUs, all birth weight categories combined

	LOS, total days	Patients, n	Pooled average LOS, days	95% CI
LOS of infants without DA-HAI	537	5910	9.1	8.4-9.9
LOS of infants with CLABSI	72	204	35.3	28.7-42.3
Extra LOS of infants with CLABSI	72	204	26.2	20.3-32.4
LOS of infants with VAP	42	175	24.0	17.9-31.0
Extra LOS of infants with VAP	42	175	14.9	8.9-21.1

American Journal of Infection Control, 2012.

EXTRA MORTALITY

EXTRA MORTALITY RATES in ADULT ICUs

Table 12
Pooled means and 95% CIs of the distribution of crude mortality and crude excess mortality* of ICU patients with DA-HAIs, adult and pediatric ICUs combined

	Deaths, n	Patients, n	Pooled crude mortality, %	95% CI
Crude mortality of patients without DA-HAI	11,908	119,501	10.0	9.8-10.14
Crude mortality of patients with CLABSI	414	1679	24.7	22.6-26.8
Crude excess mortality of patients with CLABSI	414	1679	14.7	12.8-16.6
Crude mortality rate of patients with CAUTI	290	1677	17.3	15.5-19.2
Crude excess mortality of patients with CAUTI	290	1677	7.3	5.7-9.1
Crude mortality rate of patients with VAP	1265	5020	25.2	24.0-24.5
Crude excess mortality of patients with VAP	1265	5020	15.2	14.2-14.3

CI, confidence interval.
*Crude excess mortality of DA-HAI 5 crude mortality of ICU patients with DA-HAI - crude mortality of patients without DA-HAI.

American Journal of Infection Control, 2012.

Extra Mortality of CLABSI

Country	ICU Type	Mortality without HAI (%)	Mortality with CLABSI (%)	Extra Mortality (%)	RR	95% CI	P	Year
Argentina (INICC Study)	Adult	29.6	54.2	24.6	-	-	-	2003
Brazil (INICC Study)	Adult	19.2	47.1	27.8	2.44	1.46-4.09	0.0001	2008
Colombia (INICC Study)	Adult	18.1	36.6	18.5	2.02	1.42-2.87	0.0001	2006
Cuba (INICC Study)	Adult	33.0	50.0	17.0	1.52	0.4 – 6.1	0.5552	2011
El Salvador (INICC Study)	PICU	13.			1.84	0.97 – 3.50	0.0586	2011
El Salvador (INICC Study)	NICU	12.			3.09	2.17 – 4.42	0.001	2011
India (INICC Study)	Adult	6.6	10.6	4.0	1.60	1.08-2.37	0.0001	2007
Lebanon (INICC Study)	Adult	19.1	60.0	40.9	3.14	1.38 – 7.13	0.0039	2011
Macedonia (INICC Study)	Adult	2.4	30.0	28	6.80,	5.25 – 8.81	0.0001	2010
Mexico (INICC Study)	Adult	21.8	41.8	20	1.92	0.95-3.85	0.06	2007
Morocco (INICC Study)	Adult	24.9	100	75.1	4.02	1.50 – 0.77	0.0027	2009
Peru (INICC Study)	Adult	14.0	29.0	15.0	2.07	1.07-4.04	0.0280	2008
Philippines (INICC Study)	Adult	6.8	10.0	3.2	1.48	0.21 –10.56	0.695	2011
Philippines (INICC Study)	PICU	3.8	50.0	46.3	13.3	2.88 – 61.7	0.0001	2011
Philippines (INICC Study)	NICU	5.6	25.0	19.4	4.46	0.62 – 32.3	0.1033	2011
Tunisia (INICC Study)	PICU, NICU	8.2	14.7	6	1.79,	0.69 – 4.62,	0.2226	2010
INICC 15 countries\	NICU	9.4	37.1	27.7		21.1 – 34.5		2011
INICC 18 countries	Adult, PICU	15.3	29.6	14.3	-	-	-	2008
INICC 18 countries	NICU	14.3	39.7	25.4	-	-	-	2008
INICC 25 countries	Adult, PICU	14.4	38.1	23.6	-	21.6 – 25.7	-	2009
INICC 25 countries	NICU	8.8	34.5	25.7	-	26.7 – 42.9	-	2010
INICC 36 countries	Adult, PICU	10.0	24.7	14.7		12.8 – 16.6		2010
INICC 36 countries	NICU	9.1	35.3	26.2	-	20.3 – 32.4		2010
INICC 8 countries	Adult, PICU, NICU	17.1	35.2	18.0	-	-	-	2006

Range: 3% to 75%

Extra Mortality of VAP

Country	ICU Type	Mortality without HAI (%)	Mortality with VAP (%)	Extra Mortality (%)	RR	95% CI	P	Year
Argentina (INICC Study)	Adult	37.2	71.4	34.2	-	-	-	2003
Argentina (INICC Study)	Adult	33.2	63.5	30.3	-	-	0.0001	2005
Brazil (INICC Study)	Adult	19.2	34.5	15.3	2.91	2.72-3.13	0.0001	2008
Colombia (INICC Study)	Adult	18.1	35.0	16.9	1.93	1.24 – 3.00	0.003	2006
Costa Rica (INICC Study)	Adult					0.45 – 32.95	0.1678	2009
Croatia (INICC Study)	Adult					0.96-59.64	0.0236	2006
Cuba (INICC Study)	Adult	33	80	47	2.42	0.9 – 6.5	0.0693	2011
El Salvador (INICC Study)	PICU	13.6	19.0	5.5	1.4	0.78 – 2.53	0.2592	2011
El Salvador (INICC Study)	NICU	12.3	23.0	10.7	1.88	1.20 – 2.93	0.0050	2011
India (INICC Study)	Adult	6.6	25.6	19.0	3.87	2.70-5.54	0.0001	2007
Lebanon (INICC Study)	Adult	19.1	15.0	-	0.78	0.25 – 2.47	0.6780	2011
Macedonia (INICC Study)	Adult	2.4	45.5	43	19.05	5.25 – 8.81	0.0001	2010
Morocco (INICC Study)	Adult	24.9	81.6	56.7	3.28	2.51 – 4.29	0.0001	2009
Peru (INICC Study)	Adult	14.0	38.5	24.5	2.75	2.00-3.78	0.0001	2008
Philippines (INICC Study)	Adult	6.8	9.7	3.0	1.44	0.67 – 3.06	0.3454	2011
Philippines (INICC Study)	PICU	3.8	0.0	-3.8	Undef	Undef	0.7373	2011
Philippines (INICC Study)	NICU	5.6	-	-	-	-	-	2011
Tunisia (INICC Study)	PICU, NICU	8.2	100	92	12.17,	3.71 – 39.96	0.0001	2010
INICC 10 countries	Adult, PICU, NICU	-	14%	-	-	2 – 27	-	2011
INICC 15 countries	NICU	9.4	27.3	17.9	-	-		2011
INICC 18 countries	Adult, PICU, NICU	15.3	42.8	27.5	-	-	-	2008
INICC 18 countries	NICU	14.3	46.5	32.2	-	-	-	2008
INICC 25 countries	Adult, PICU	14.4	43.7	29.3	-	27.1 – 31.4	-	2009
INICC 25 countries	NICU	9.4	27.3	17.9	-	11.0 – 25.8	-	2010
INICC 36 countries	Adult, PICU,	10.0	25.2	15.2				2010
INICC 36 countries	NICU	9.1	24.0	14.9	-	8.9 – 21.1	-	2010
INICC 8 countries	Adult, PICU, NICU	17.1	44.9	27.8	-	-	-	2006

Range: 3% to 92%

Extra Mortality of CAUTI

Country	ICU Type	Mortality without HAI (%)	Mortality with CAUTI (%)	Extra Mortality (%)	RR	95% CI	P	Year
Argentina (INICC Study)	Adult	37.2	42.9	5.7	-	-	-	2003
Brazil (INICC Study)	Adult	19.2	30.0	10.7	1.56	0.69-3.52	0.2875	2008
Colombia (INICC Study)	Adult				1.58	0.78-3.18	0.199	2006
Cuba (INICC Study)	Adult	40.0	50.0	10.0	1.25	0.40-3.93	0.7018	2008
El Salvador (INICC Study)	PICU	13.6	18.2	4.6	1.34	0.33 – 5.41	0.681	2011
India (INICC Study)	Adult	6.6	18.2	11.6	2.83	2.57-3.12	0.0001	2007
Lebanon (INICC Study)	Adult	19.1	12.5	-	0.65	0.16 – 2.65	0.5487	2011
Morocco (INICC Study)	Adult	24.9	43.6	18.7	1.75	1.08 – 2.85	0.0218	2009
Peru (INICC Study)	Adult	14.0	18.2	4.2	1.30	0.49-3.49	0.6028	2008
Philippines (INICC Study)	Adult	6.8	3.8	-2.9	0.57	0.08 – 4.06	0.5683	2011
INICC 10 countries	Adult, PICU, NICU	-	15%	-	-	3 – 28	-	2011
INICC 18 countries	Adult, PICU,	15.3	35.8	20.5			-	2008
INICC 25 countries	Adult, PICU,	14.4	32.9	18.5	-	15.1 – 22.1	-	2009
INICC 36 countries	Adult, PICU,	10.0	17.3	7.3	-	5.7 – 9.1	-	2010
INICC 8 countries	Adult, PICU	17.1	38.4	21.3			-	2006

Range: 4% to 21%

Extra Costs and Length of Stay of HAIs

Tarricone et al. Cost Effectiveness and Resource Allocation 2010, 8:8
http://www.resource-allocation.com/content/8/1/8

RESEARCH Open Access

Hospital costs of central line-associated bloodstream infections and cost-effectiveness of closed vs. open infusion containers. *The case of Intensive Care Units in Italy*

Rosanna Tarricone[1], Aleksandra Torbica[1*], Fabio Franzetti[2], Victor D Rosenthal[3]

Abstract

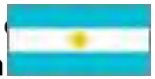
Objectives: The aim was to evaluate direct health care costs of central line-associated bloodstream infections (CLABSI) and to calculate the cost-effectiveness ratio of closed fully collapsible plastic intravenous infusion containers vs. open (glass) infusion containers.

Methods: A two-year, prospective case-control study was undertaken in four intensive care units in an Italian teaching hospital. Patients with CLABSI (cases) and patients without CLABSI (controls) were matched for admission departments, gender, age, and average severity of illness score. Costs were estimated according to micro-costing approach. In the cost effectiveness analysis, the cost component was assessed as the difference between production costs while effectiveness was measured by CLABSI rate (number of CLABSI per 1000 central line days) associated with the two infusion containers.

Results: A total of 43 cases of CLABSI were compared with 97 matched controls. The mean age of cases and controls was 62.1 and 66.6 years, respectively (p = 0.143); 56% of the cases and 57% of the controls were females (p = 0.922). The mean length of stay of cases and controls was 17.41 and 8.55 days, respectively (p < 0.001). Overall, the mean total costs of patients with and without CLABSI were € 18,241 and € 9087, respectively (p < 0.001). On average, the extra cost for drugs was € 843 (p < 0.001), for supplies € 133 (p = 0.116), for lab tests € 171 (p < 0.001), and for specialist visits € 15 (p = 0.019). The mean extra cost for hospital stay (overhead) was € 7,180 (p < 0.001). The closed infusion container was a dominant strategy. It resulted in lower CLABSI rates (3.5 vs. 8.2 CLABSIs per 1000 central line days for closed vs. open infusion container) without any significant difference in total production costs. The higher acquisition cost of the closed infusion container was offset by savings incurred in other phases of production, especially waste management.

Conclusions: CLABSI results in considerable and significant increase in utilization of hospital resources. Use of innovative technologies such as closed infusion containers can significantly reduce the incidence of healthcare acquired infection without posing additional burden on hospital budgets.

The attributable cost and length of hospital stay because of nosocomial pneumonia in intensive care units in 3 hospitals in Argentina: A prospective, matched analysis



Victor D. Rosenthal, MD, MSc, CIC,[a] Sandra Guzman, RN, ICP,[a] Oscar Migone, MS,[b] and Nasia Safdar, MD[c]
Buenos Aires, Argentina, and Madison, Wisconsin

Background: No information is available on the financial impact of nosocomial pneumonia in Argentina. To calculate the cost of nosocomial pneumonia in intensive care units, a 5-year, matched cohort study was undertaken at 3 hospitals in Argentina.

Setting: Six adult intensive care units (ICU).

Methods: Three hundred seven patients with nosocomial pneumonia (exposed) and 307 patients without nosocomial pneumonia (unexposed) were matched for hospital, ICU type, year admitted to study, length of stay more than 7 days, sex, age, antibiotic use, and average severity of illness score (ASIS). The patient's length of stay (LOS) in the ICU was obtained prospectively in daily rounds, the cost of a day was provided by the hospital's finance department, and the cost of antibiotics prescribed for nosocomial pneumonia was provided by the hospital's pharmacy department.

Results: The mean extra LOS for 307 cases (compared with controls) was 8.95 days, the mean extra antibiotic defined daily doses (DDD) was 15, the mean extra antibiotic cost was $996, the mean extra total cost was $2255, and the extra mortality was 30.3%.

Conclusions: Nosocomial pneumonia results in significant patient morbidity and consumes considerable resources. In the present study, patients with nosocomial pneumonia had significant prolongation of hospitalization, cost, and a high extra mortality. The present study illustrates the potential cost savings of introducing interventions to reduce nosocomial pneumonia. To our knowledge, this is the first study evaluating this issue in Argentina. (Am J Infect Control 2005;33:157-61.)

The attributable cost, length of hospital stay, and mortality of central line-associated bloodstream infection in intensive care departments in Argentina: A prospective, matched analysis

Victor Daniel Rosenthal, MD, MSc, CIC,[a] Sandra Guzman, RN, ICP,[a] Oscar Migone, MS,[b] and Christopher J. Crnich, MD[c]
Buenos Aires, Argentina, and Madison, Wisconsin

Background: Limited information is available on the financial impact of central venous catheter-associated bloodstream infection (BSI) in Argentina. To calculate the cost of BSIs in the intensive care department (ICU), a 5-year prospective nested case-control study was undertaken at 3 hospitals in Argentina.

Methods: We studied 6 adult ICUs from 3 hospitals. In all, 142 patients with BSI and 142 control patients without BSI were matched for hospital, type of ICU, year of admission, length of stay, sex, age, and average severity of illness score. Patients' length of stay in the ICU was obtained prospectively on daily rounds. The hospitals' finance departments provided the cost of each ICU day. The hospitals' pharmacies provided the cost of antibiotics prescribed for BSIs.

Results: The mean extra length of stay for patients with BSI compared with control patients was 11.9 days, the mean extra antibiotic defined daily dose was 22.6, the mean extra antibiotic cost was $1913, the mean extra cost was $4888.42, and the excess mortality was 24.6%.

Conclusions: In this study, patients with central venous catheter-associated BSI experienced significant prolongation of hospitalization, increased use of health care costs, and a higher attributable mortality. These findings support the need to implement preventative interventions for patients hospitalized with central venous catheters in Argentina. (Am J Infect Control 2003;31:475-80.)

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JANUARY 2007, VOL. 28, NO. 1

ORIGINAL ARTICLE

Attributable Cost and Length of Stay for Patients With Central Venous Catheter–Associated Bloodstream Infection in Mexico City Intensive Care Units: A Prospective, Matched Analysis

Francisco Higuera, MD; Manuel Sigfrido Rangel-Frausto, MD; Victor Daniel Rosenthal, MD, CIC, MSc; Jose Martinez Soto, MD; Jorge Castañon, MD; Guillermo Franco, MD; Natividad Tabal-Galan, RN, ICP; Javier Ruiz, MD; Pablo Duarte, MD; Nicholas Graves, PhD

BACKGROUND. No information is available about the financial impact of central venous catheter (CVC)–associated bloodstream infection (BSI) in Mexico.

OBJECTIVE. To calculate the costs associated with BSI in intensive care units (ICUs) in Mexico City.

DESIGN. An 18-month (June 2002 through November 2003), prospective, nested case-control study of patients with and patients without BSI.

SETTING. Adult ICUs in 3 hospitals in Mexico City.

PATIENTS AND METHODS. A total of 55 patients with BSI (case patients) and 55 patients without BSI (control patients) were compared with respect to hospital, type of ICU, year of hospital admission, length of ICU stay, sex, age, and mean severity of illness score. Information about the length of ICU stay was obtained prospectively during daily rounds. The daily cost of ICU stay was provided by the finance department of each hospital. The cost of antibiotics prescribed for BSI was provided by the hospitals' pharmacy departments.

RESULTS. For case patients, the mean extra length of stay was 6.1 days, the mean extra cost of antibiotics was $598, the mean extra hospital cost was $11,591, and the attributable extra mortality was 20%.

CONCLUSIONS. In this study, the duration of ICU stay for patients with central venous catheter–associated BSI was significantly longer than that for control patients, resulting in increased healthcare costs and a higher attributable mortality. These conclusions support the need to implement preventive measures for hospitalized patients with central venous catheters in Mexico.

Infect Control Hosp Epidemiol 2007; 28:31-35

The attributable cost, length of hospital stay, and mortality of central line-associated BLOODSTREAM INFECTION in intensive care departments in Argentina: A prospective, matched analysis.

Table 1. Baseline characteristics of patients

	Case patients (N = 142)	Control patients (N = 142)
Average length of stay ≥ 7d (%)	142 (100)	142 (100)
Mean age (SD)	70.09 (±14.17)	68.88 (±13.74)*
No. males (%)	83 (58.5)	83 (58.5)*
No. admitted to medical/surgical ICU (%)	116 (81.7)	116 (81.7)*
Mean ASIS (SD)	3.30 (±1.08)	3.09 (±0.90)*
Number included in study by year (%)		
1998	25 (17.6)	27 (19.0)
1999	50 (35.2)	49 (34.5)
2000	46 (32.4)	37 (26.1)
2001	19 (13.4)	27 (19.0)
2002	2 (1.4)	2 (1.4)

ASIS, Average severity of illness score; *ICU*, intensive care unit.
*No statistical difference found.

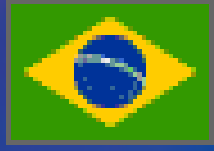
Rosenthal VD, et al. Am J Infect Control 2003;31(8):475-80.

The attributable cost, length of hospital stay, and mortality of central line-associated BLOODSTREAM INFECTION in intensive care departments in Argentina: A prospective, matched analysis.

	Case (N= 142)	Control (N= 142)	Extra Expenditures
Total days	3,322	1,632	1690
Average length of stay in ICU	23.39 (SE 1.49)	11.49 (SE 0.68)	11.90
Total fixed cost	$830,500	$408,000	$422,500
Mean fixed cost	$5,848 (SE 372.89)	$2,873 (SE 171.07)	$2,975
Antibiotic utilization			
Total antibiotics (in DDD*)	4,568	1,356	3,212
Mean antibiotic use per patient (DDD*)	32.16 (SE 2.81)	9.54 (SE 1.05)	22.62
Total cost of antibiotics	$301,488	$29,832	$271,656
Mean costs of antibiotics per patient	$2,123 (SE 186.06)	$210 (SE 23.09)	$1,913
Aggregate costs	$1,131,988	$437,832	$694,156
Mean aggregate costs per patient	$7,971.74	$3,083.32	$4,888.42
Average mortality	77/142 (54.2%)	42/142 (29.6%)	24.6%

Rosenthal VD, et al. Am J Infect Control 2003;31(8):475-80.

The Attributable Cost, And Length Of Hospital Stay Of Central Line Associated BLOOD STREAM INFECTION In Intensive Care Units In Brazil. A Prospective, Matched Analysis



	BSI	Controls	Extra	RR	95 % CI	P-value
Total patients (n)	70	140				
Total Antibiotic DDD, (DDD)	4243	2124				
Antibiotic DDD per patient, (DDD)	60.61	15.17	45.44			
Total Antibiotic cost (US$)	312,225.54	99,930.12				
Antibiotic cost per patient, (US$)	4,460.36	713.78	3,746.58			
Length of Stay (days)	**30.58 ± 20.41**	**6.95 ± 4.89**	**23.6**	4.40	4.08 – 4.75	0.0000
Cost (US$)	**9,843.35**	**1,937.18**	**7,906**			
Total deaths (n)	23	45				
Crude mortality (%)	32.9%	32.1%		1.02	0.62 – 1.69	0.9316

Reinaldo Salomao, Victor D. Rosenthal, et al. APIC Meeting. Tampa, USA. June 2006.

The Attributable Cost, And Length Of Hospital Stay Of Central Line Associated BLOOD STREAM INFECTION In Intensive Care Units In Mexico. A Prospective, Matched Analysis.

	Control (N= 55)	Case (N= 55)	Overall Attributable Extra Expenditures	Attributable Extra Expenditures per patient
Average length of stay in ICU (days)	406	739	333	**6.05**
Antibiotics (US$)	13,354.35	46,265.96	32,911.61	598.39
Other medicaments (US$)	128,415.14	129,832.44	1,417.30	25.77
Disposables (US$)	219,345.82	308,808.79	89,462.97	1,626.60
Cultures (US$)	1,171.40	2,111.85	940.45	17.10
Other lab tests (US$)	37,441.19	61,174.01	23,732.82	431.51
X ray, Scan, etc (US$)	15,198.40	19,556.44	4,358.04	79.24
Other costs (US$)	44,395.46	71,105.56	26,710.09	485.64
Hospitalization (fixed costs) (US$)	496,326.78	954,294.33	457,967.55	8326.68
Total cost (US$)	955,648.55	1,593,149.38	637,500.83	**11,590.92**

Higuera F, Rangel-Frausto M, Rosenthal VD, Graves N, et al. Infection Control and Hospital Epidemiology. January 2007.

The attributable cost and length of hospital stay because of nosocomial pneumonia in intensive care units in 3 hospitals in Argentina: A prospective, matched analysis

Victor D. Rosenthal, MD, MSc, CIC,[a] Sandra Guzman, RN, ICP,[a] Oscar Migone, MS,[b] and Nasia Safdar, MD[c]
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Conclusions: Nosocomial pneumonia results in significant patient morbidity and consumes considerable resources. In the present study, patients with nosocomial pneumonia had significant prolongation of hospitalization, cost, and a high extra mortality. The present study illustrates the potential cost savings of introducing interventions to reduce nosocomial pneumonia. To our knowledge, this is the first study evaluating this issue in Argentina. (Am J Infect Control 2005;33:157-61.)

Table 1. Baseline characteristics of patients with and without nosocomial pneumonia

	Cases, N = 307 (%)	Control, N = 307 (%)	*P* value
LOS (7 or more days)	307 (100)	307 (100)	NS
Age, mean, SD, years	73.79 SD 11.97	69.90 SD 11.48	NS
Sex (male)	157/307 (51.1)	157/307 (51.1)	NS
ICU (Ms ICU)	247/307 (80.5)	247/307 (80.5)	NS
Average severity of illness score, mean, SD	3.34 SD 0.95	3.11 SD 0.83	NS
Year	1998 (5.2)	1998 (6.8)	NS
	1999 (20.5)	1999 (18.9)	
	2000 (24.4)	2000 (22.8)	
	2001 (43.0)	2001 (44.6)	
	2001 (6.8)	2001 (6.8)	

ICU, Intensive care unit; *LOS*, length of stay; *Ms ICU*, Medical Surgical Intensive care unit.

Table 2. Extra expenditures of nosocomial pneumonia

	Case (N = 307)	Control (N = 307)	Attributable extra expenditures
Total days	6043	3295	Total extra days: 2748
LOS	19.68	10.73	Mean extra days: 8.95
	SE 0.794	SE 0.308	*T* test *P* value ≤0.000
	SD 13.90	SD 5.39	
	Percentile 25% 11	Percentile 25% 8	
	Percentile 75% 24	Percentile 75% 11	
	Median 16	Median 9	
Total fixed cost	$1,510,750 (SE 0.794)	$823,750	Fixed Extra Cost: $687,000
Mean fixed cost	$4,921 (SE 198,43)	$2,683 (SE 76.97)	Mean extra cost: $2,238
Total antibiotic DDD	7815	3181	Antibiotic extra DDD: 4,634
Mean antibiotic DDD	25.45 (SE 1.4)	10.36 (SE 0.64)	Mean extra antibiotic DDD: 15.09
Total antibiotic cost	$515,790	$209,946	Antibiotic extra cost: $305,844
Mean antibiotic cost	$1,680.09 (SE 93.85)	$683.86 (SE 42.73)	Mean extra antibiotic cost: $996.22
Total global cost	$1,518,565	$826,931	Total extra global cost: $691,634
Mean Global Cost	$4,946.46	$2,693.58 (SE 77.3)	Mean total extra global cost: $2,252.88
	SE 199.57	SE 77.3	
	SD 3,496.79	SD 1,354.55	*T* test *P* value 0.0000
	Percentile 25% 2751	Percentile 25% 2000	
	Percentile 75% 6049	Percentile 75% 2780	
	Median 4010	Median 2257	

DDD, Defined daily dose; *LOS*, length of stay.

Table 3. Extra mortality of nosocomial pneumonia

	Case (N = 307)	Control (N = 307)	Attributable extra expenditures
Total mortality	195	102	Total extra dead: 90
Percentage mortality	63.51%	33.22%	Extra attributable mortality: 30.3%
			Kruskal Wallis 56.31
			P value ≤0.000

INICC Platform and Strategy in order to Counduct Surveillance: in ICU, in General Wards and in Surgical Procedures

Detailed Surveillance in ICU

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance ▾ | ICU Aggregated Surveillance Data ▾ | Inpatient Wards and Step Down Units Outcome Surveillance | Microbiology Results ▾

Adult and Pediatric Units
Neonatal CRF#1B

Surgical Procedures | Frequently Asked Questions | Welcome, **test** ▾

Available Documentation

CDC- NHSN- Definitions of HAI- 2013
CDC- NHSN- Device Associated Infections Report- 2011
CDC- NHSN- Microorganism Profile and Bacterial Resistance Report- 2008
CDC- NHSN- Surgical Site Infection Rates- Risk Adjusted Measures- 2006 to 2008
CDC- NHSN- Surgical Site Infection and Device Assoaciated Inf Rates Report- 2006 to 2008
INICC- Device Associated Infections Rates Report- 2004 to 2009
INICC- Methodology- 2008
INICC- Surgical Site Infection Rates Report- 2006 to 2010

Agreggated Surveillance in ICU

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance | **ICU Aggregated Surveillance Data** | Inpatient Wards and Step Down Units Outcome Surveillance | Microbiology Results

ICU Process Surveillance | Surgical Procedures | Fr

- Adult and Pediatric ICU Aggregated Surveillance Data
- Neonatal ICU Aggregated Surveillance Data

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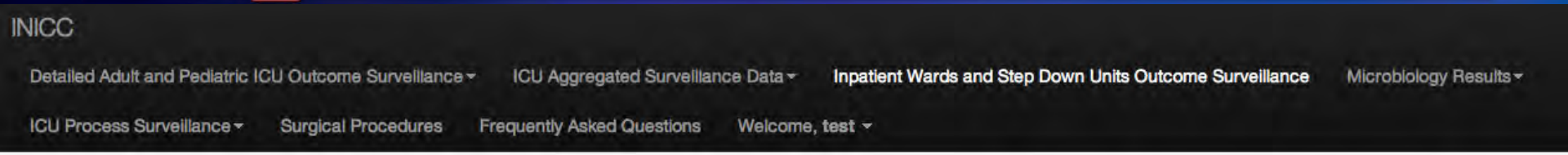
Detailed Surveillance in General Wards and Step Down Units



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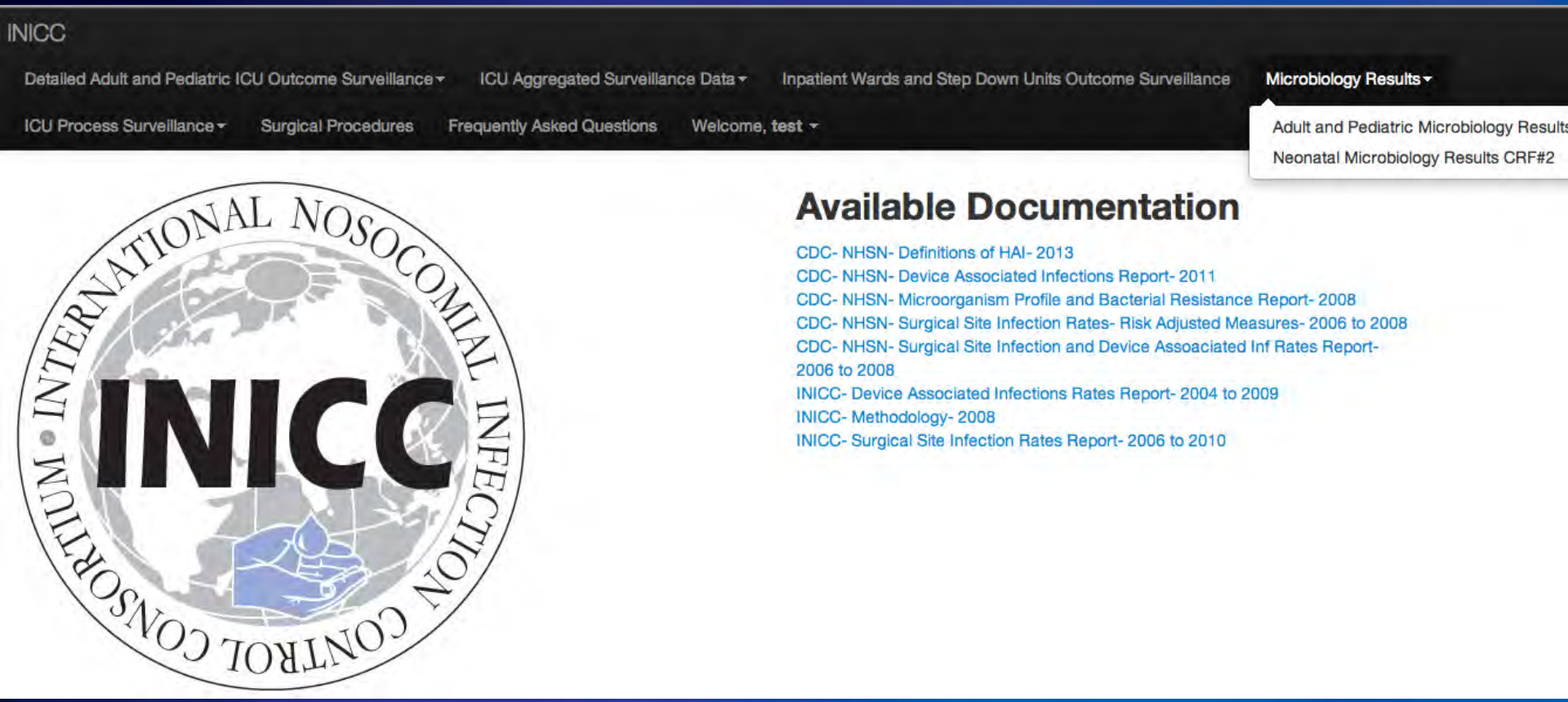
INICC- Methodology- 2008
INICC- Surgical Site Infection Rates Report- 2006 to 2010

Micoorganism Profile and Bacterial Resistance



Bundles of Care

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance ▾ | ICU Aggregated Surveillance Data ▾ | Inpatient Wards and Step Down Units Outcome Surveillance | Microbiology Results ▾

ICU Process Surveillance ▾ | Surgical Procedures | Frequently Asked Questions | Welcome, **test** ▾

- Hand Hygiene compliance CRF#3
- Bundle to Prevent BSI CRF#4
- Bundle to Prevent UTI CRF#5
- Bundle to Prevent PNEU CRF#6

INTERNATIONAL NOSOCOMIAL INFECTION CONTROL CONSORTIUM

INICC

Available Documentation

CDC- NHSN- Definitions of HAI- 2013
CDC- NHSN- Device Associated Infections Report- 2011
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Surveillance of Surgical Procedures

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance ▾ | ICU Aggregated Surveillance Data ▾ | Inpatient Wards and Step Down Units Outcome Surveillance | Microbiology Results ▾

ICU Process Surveillance ▾ | **Surgical Procedures** | Frequently Asked Questions | Welcome, **test** ▾

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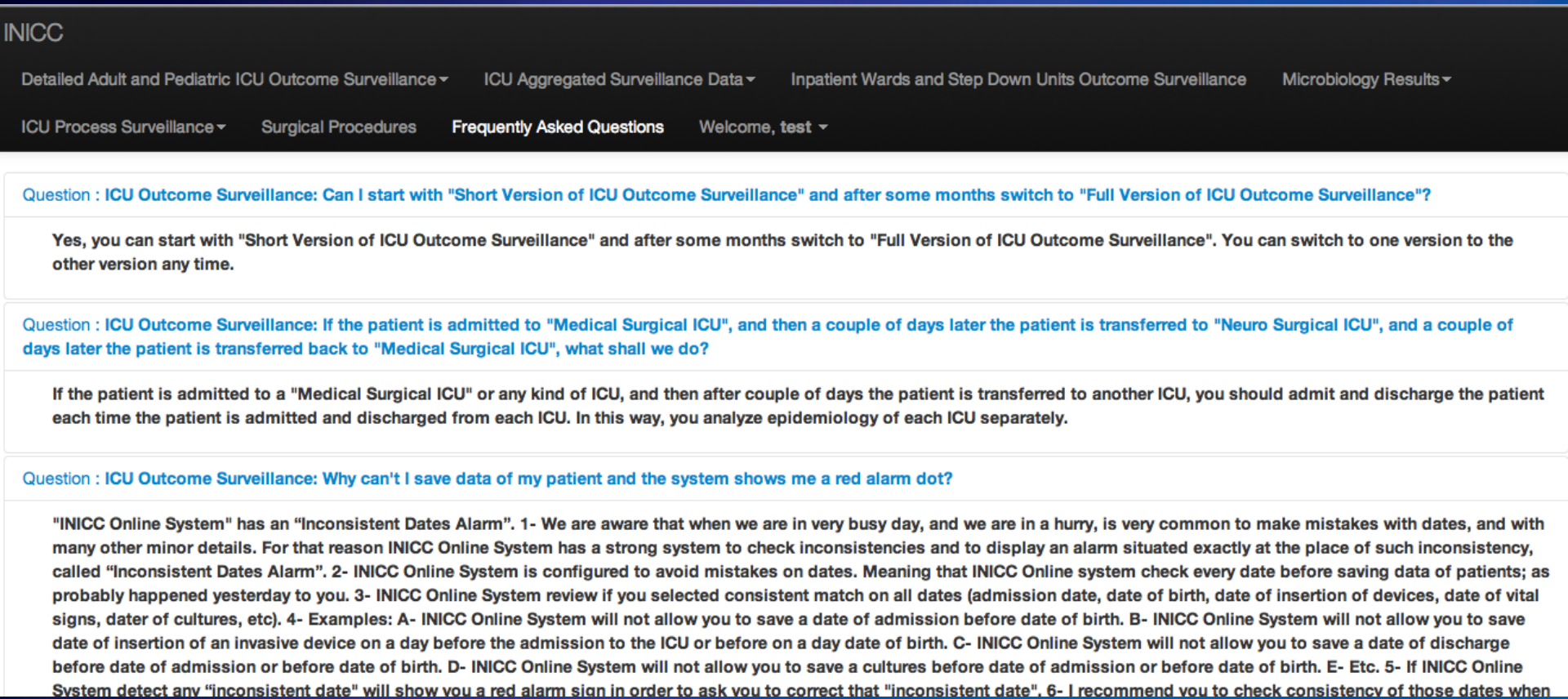
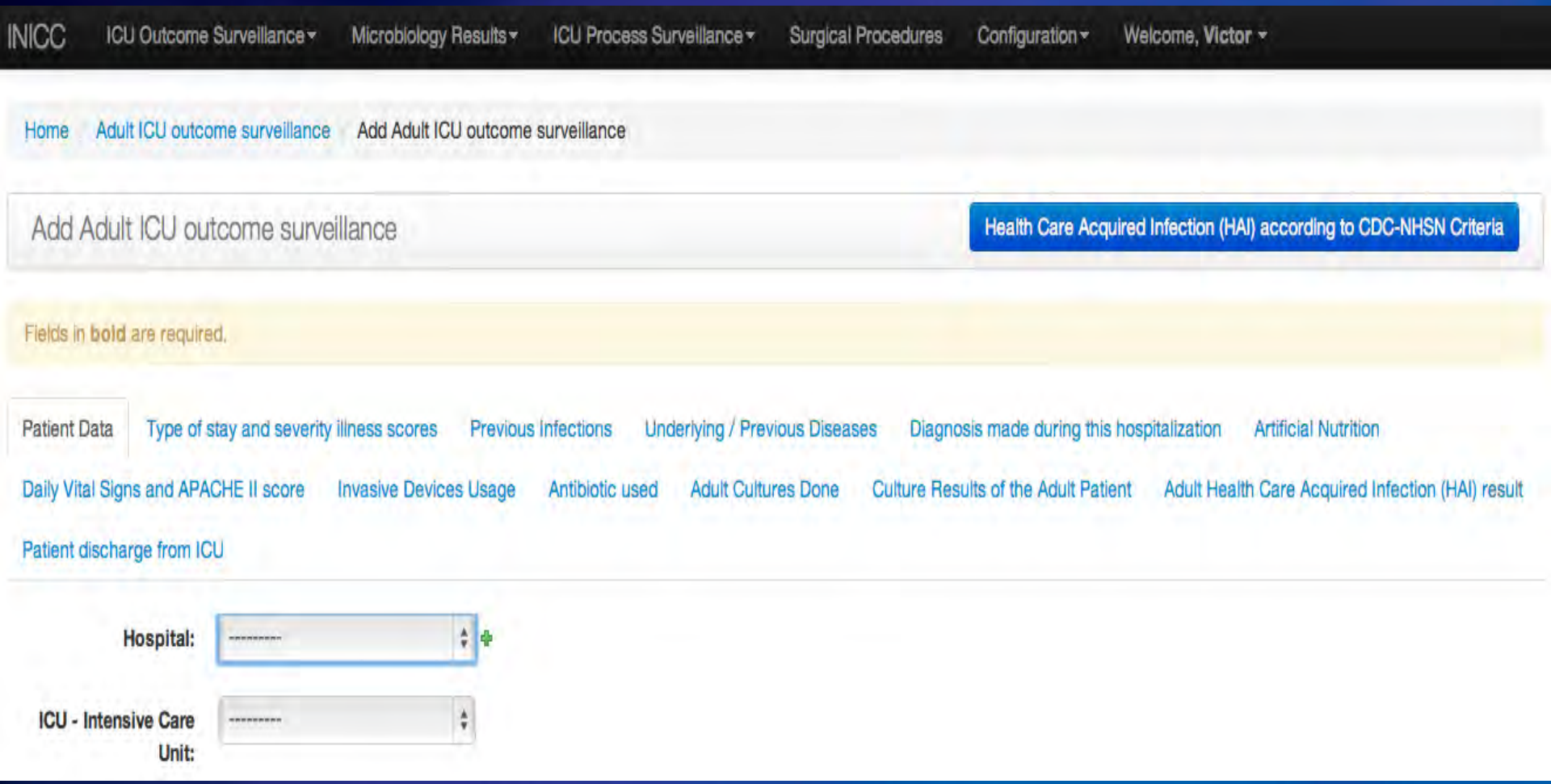
Go to "http://admin.inicc.org/admin/pacientes/surgeryvigilancepatient/"

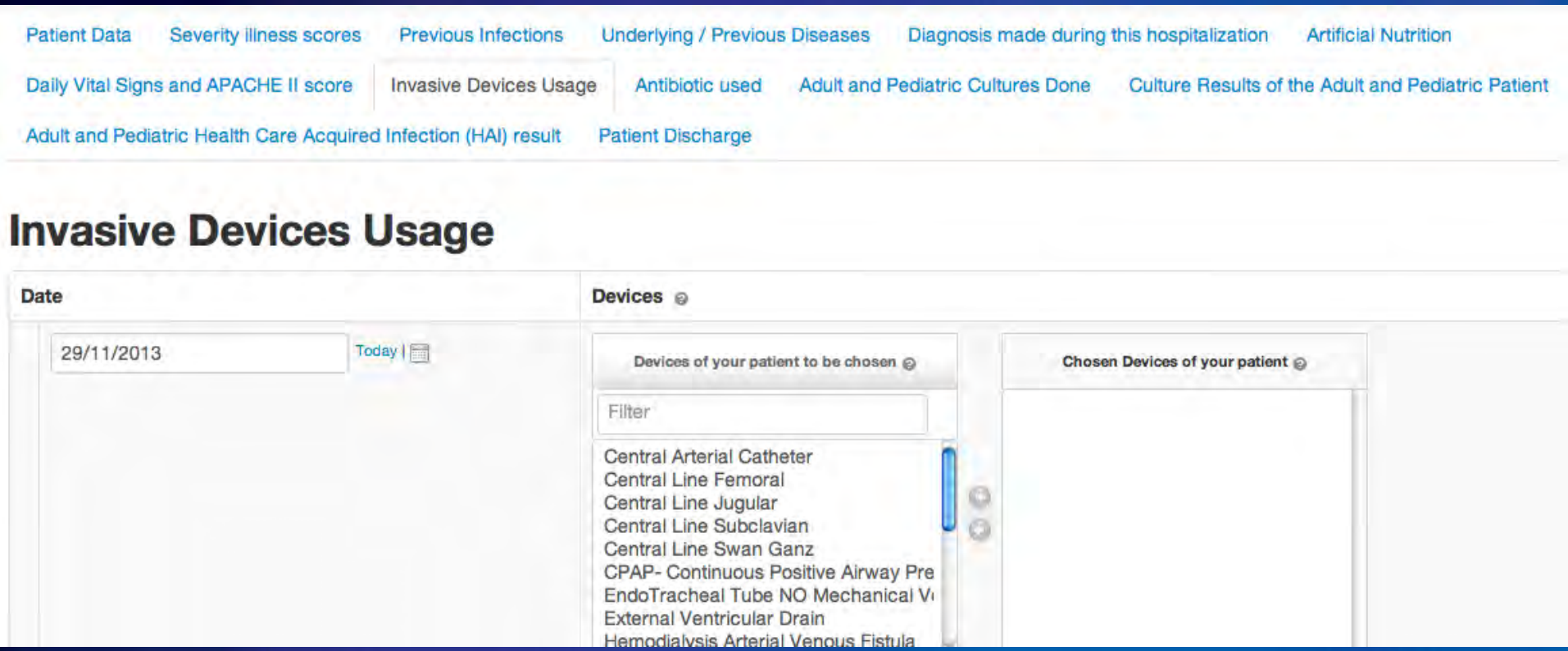
Frequent Asked Questions



Detailed Surveillance in ICU



Detailed Surveillance in ICU



Detailed Surveillance in ICU

Patient Data | Severity illness scores | Previous Infections | Underlying / Previous Diseases | Diagnosis made during this hospitalization | Artificial Nutrition | Daily Vital Signs and APACHE II score | Invasive Devices Usage | Antibiotic used | Adult and Pediatric Cultures Done | Culture Results of the Adult and Pediatric Patient | Adult and Pediatric Health Care Acquired Infection (HAI) result | Patient Discharge

Patient Discharge

Date of discharge from ICU: 29/11/2013 Today |

Final ICU outcome: ----------

Detailed Surveillance in ICU

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance | ICU Aggregated Surveillance Data | Inpatient Wards and Step Down Units Outcome Surveillance | Microbiology Results

ICU Process Surveillance | Surgical Procedures | Frequently Asked Questions | Welcome, **test**

Change Adult and Pediatric ICU outcome surveillance

Health Care Acquired Infection (HAI) according to CDC-NHSN Criteria

Fields in **bold** are required.

Patient Data | Severity illness scores | Previous Infections | Underlying / Previous Diseases | Diagnosis made during this hospitalization | Artificial Nutrition | Daily Vital Signs and APACHE II score | Invasive Devices Usage | Antibiotic used | Adult and Pediatric Cultures Done | Culture Results of the Adult and Pediatric Patient | Adult and Pediatric Health Care Acquired Infection (HAI) result | Patient Discharge

Hospital: INICC Test Hospital

ICU - Intensive Care Unit: Critical Care- Medical/Surgica

Detailed Surveillance in ICU

INICC

Detailed Adult and Pediatric ICU Outcome Surveillance | ICU Aggregated Surveillance Data | Inpatien

ICU Process Surveillance | Surgical Procedures | Frequently Asked Questions | Welcome, test

Select Patient HAI Critera

Criteria : **Age**

Age

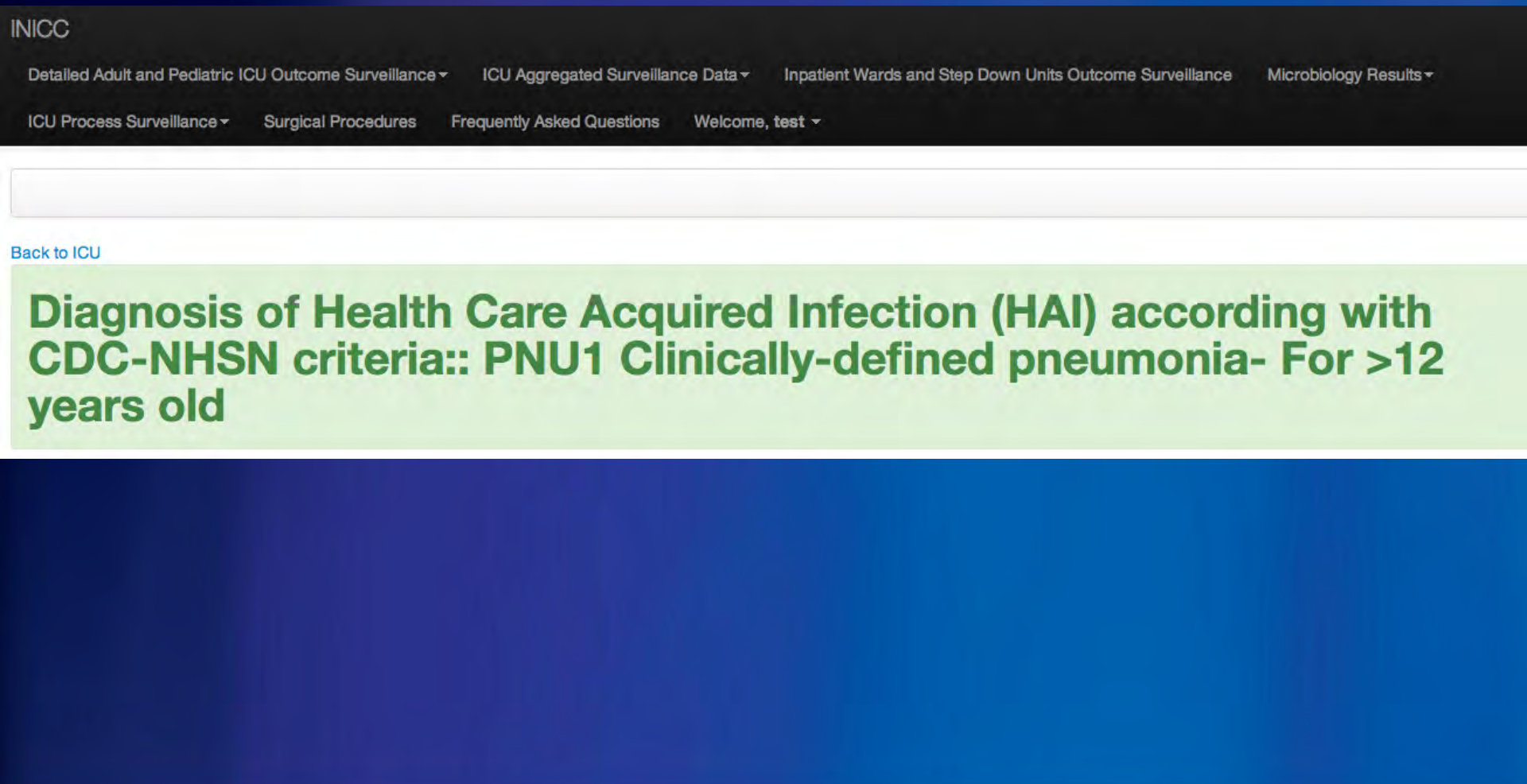
- ☐ <=1 year old
- ☐ >12 years old
- ☐ >=1 year old or <=12 years old
- ☐ Any age

Criteria : **Signs and Symptoms- Vital Signs**

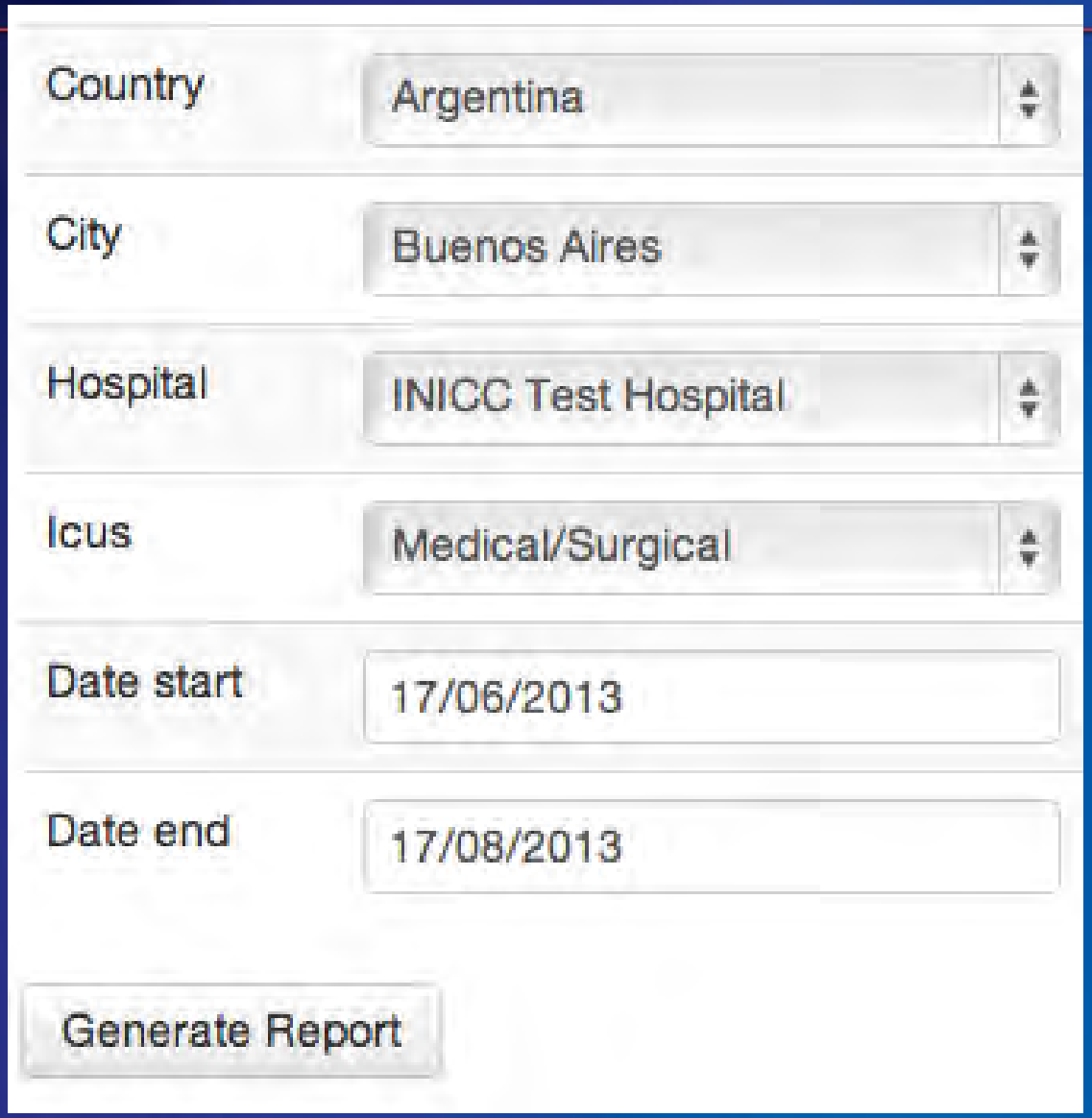
Vital Signs

- ☐ Bradycardia (<100 beats/min)
- ☐ Fever (>38C or >100.4F)
- ☐ Hypotension*, *With no other recognized cause
- ☐ Hypothermia (<36.5C or <97.7F)
- ☐ Tachycardia (>170 beats/min)
- ☐ Temperature instability

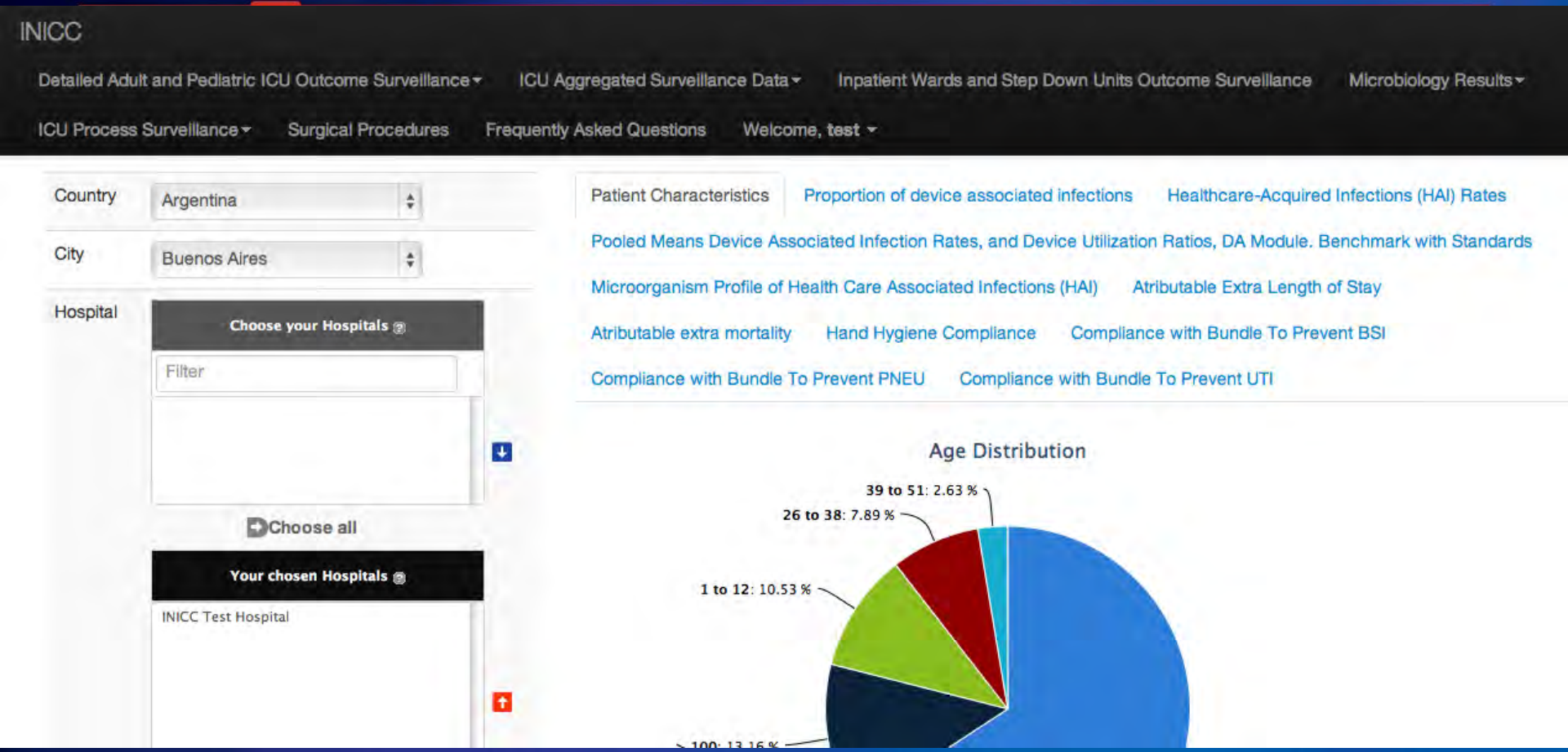
Detailed Surveillance in ICU



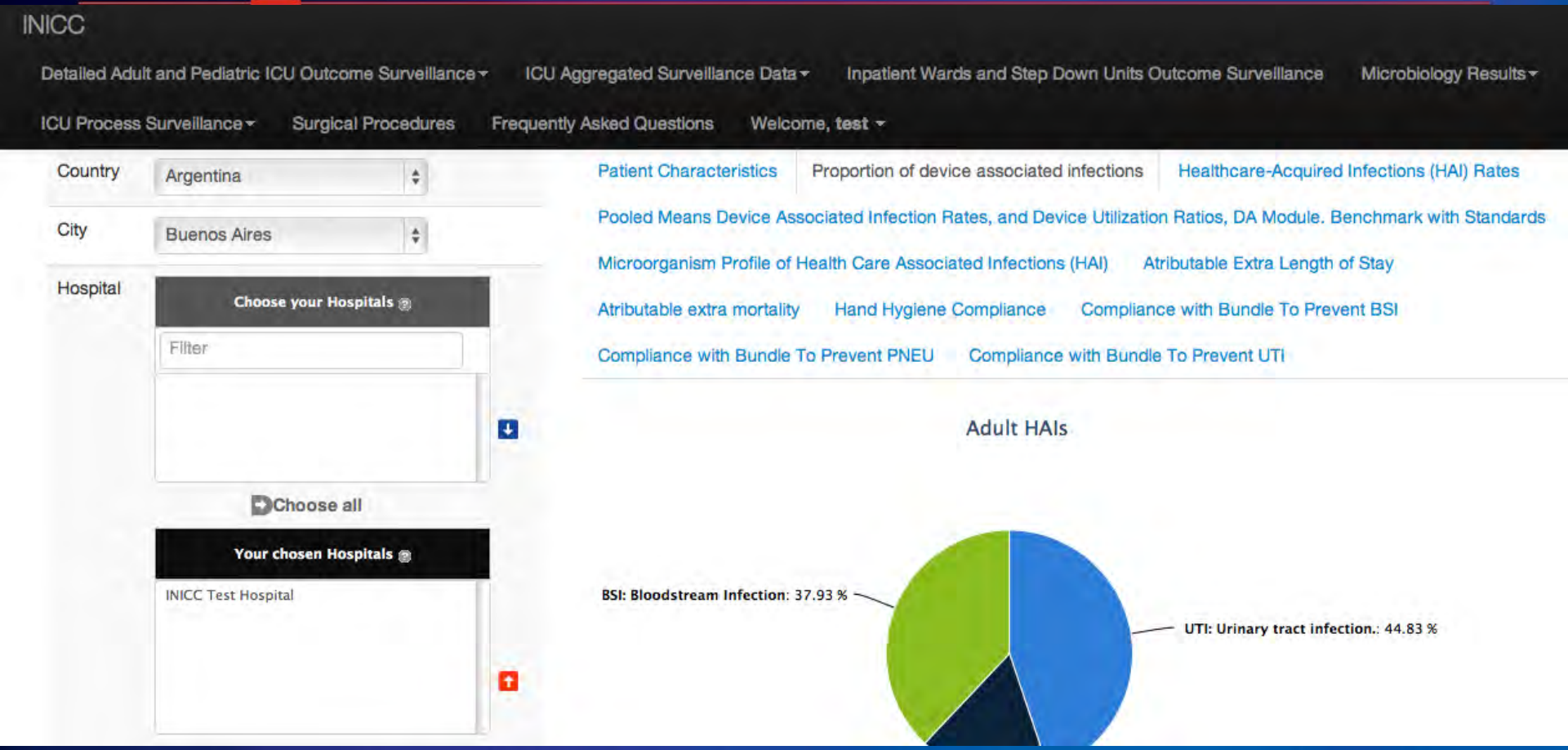
Generating ICU Report



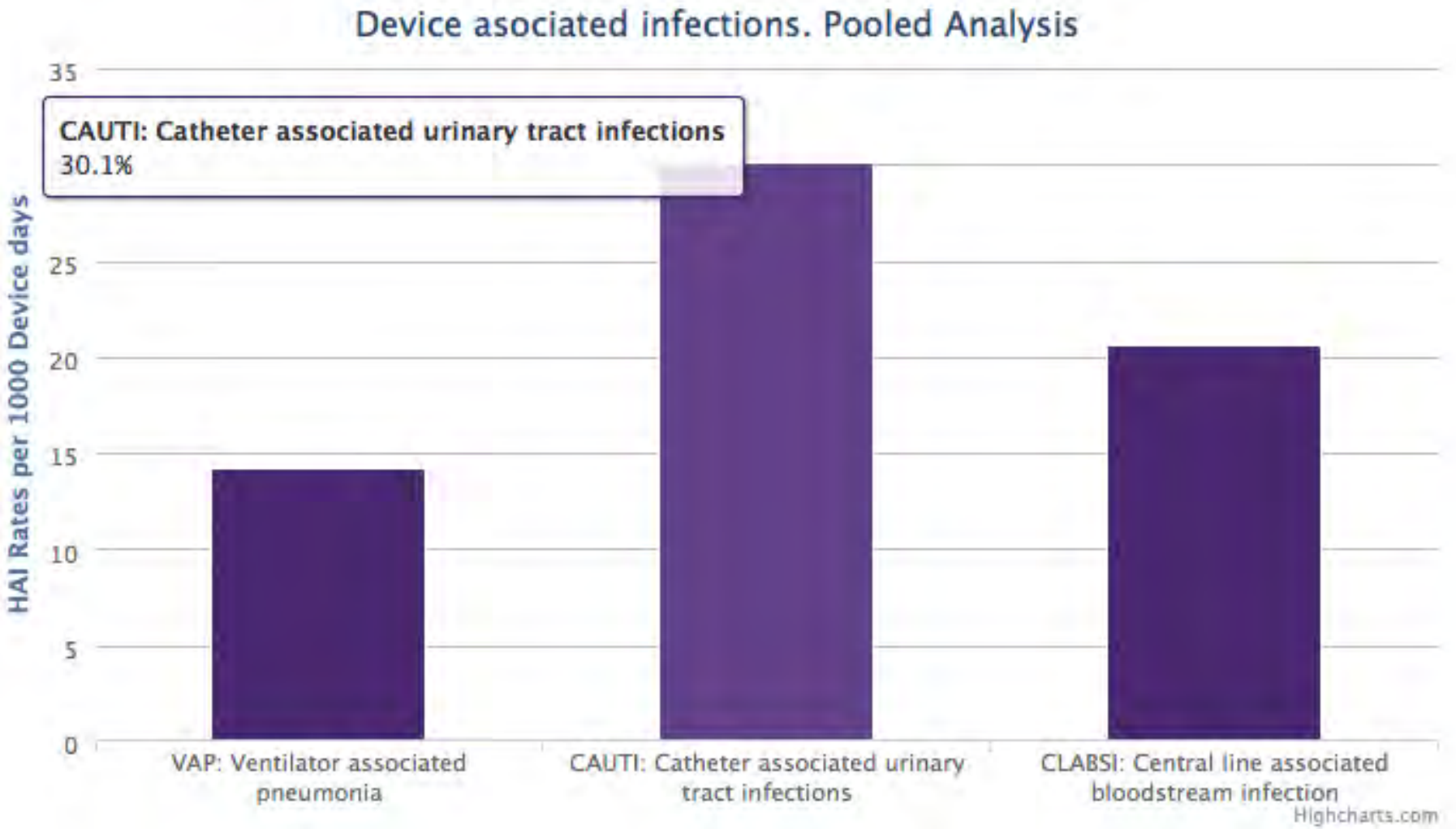
ICU Report: Patient Features



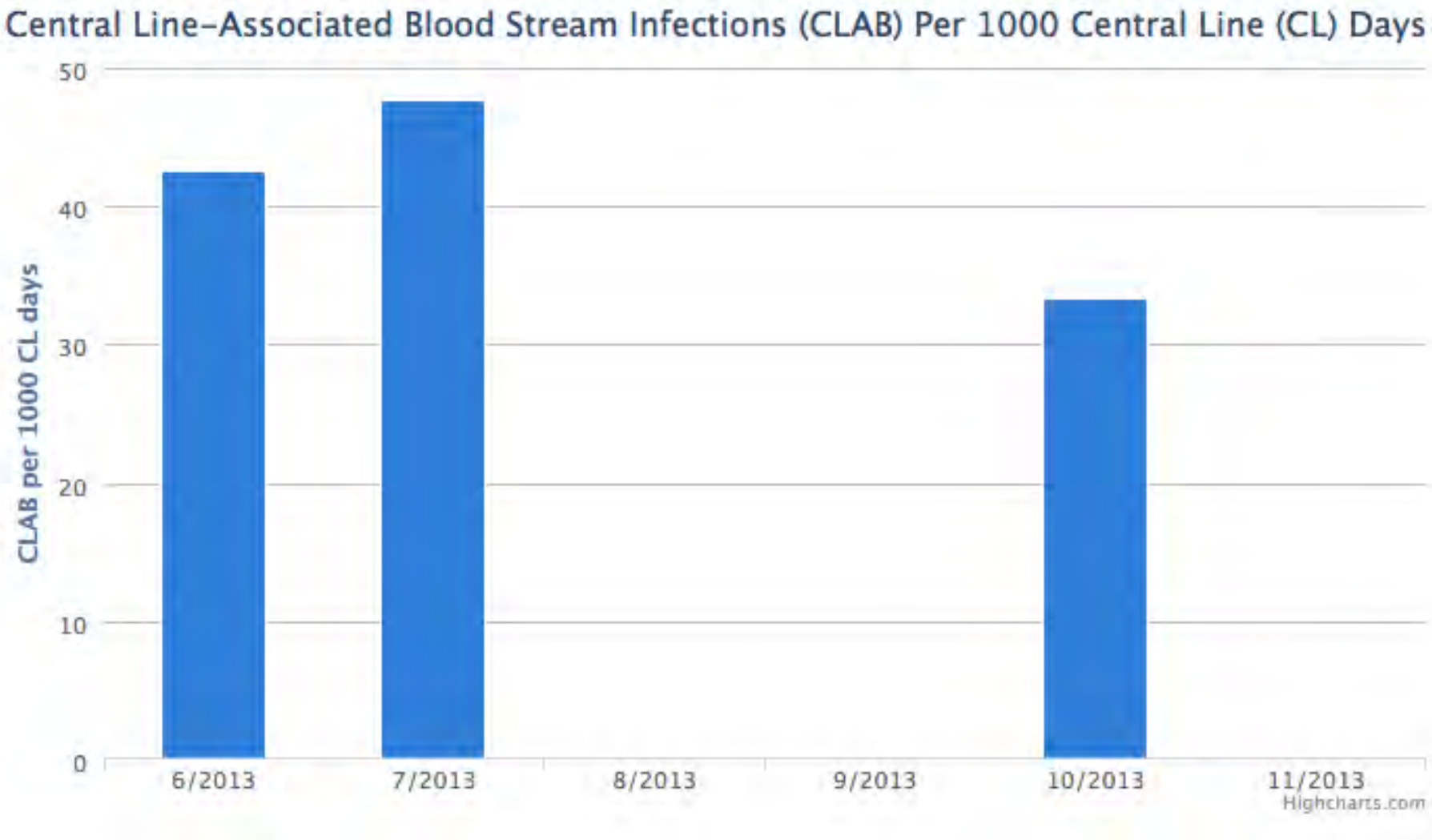
ICU Report: Proportion of HAIs



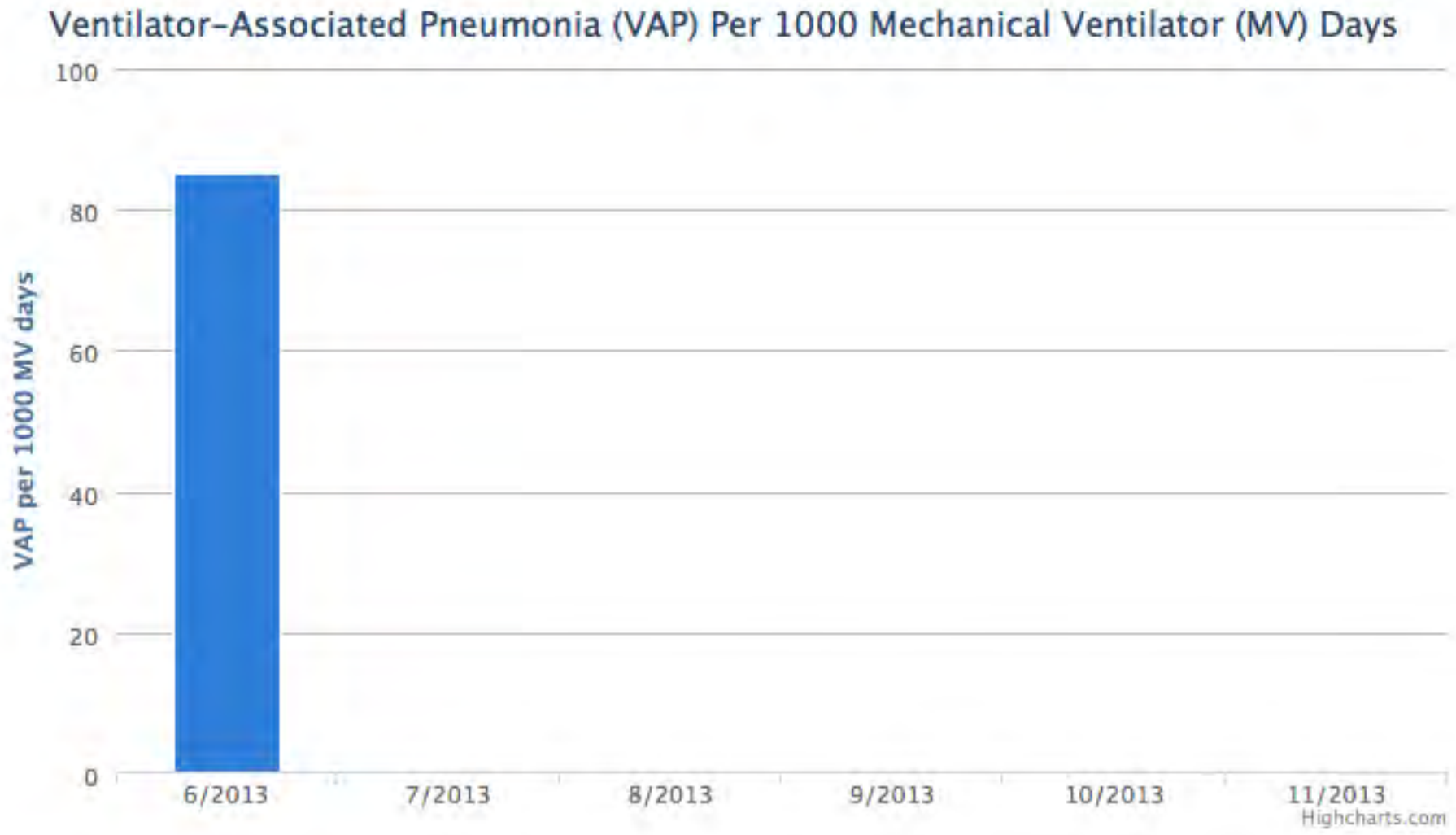
ICU Report: Device Associated Infection rates per 1000 Devices Days



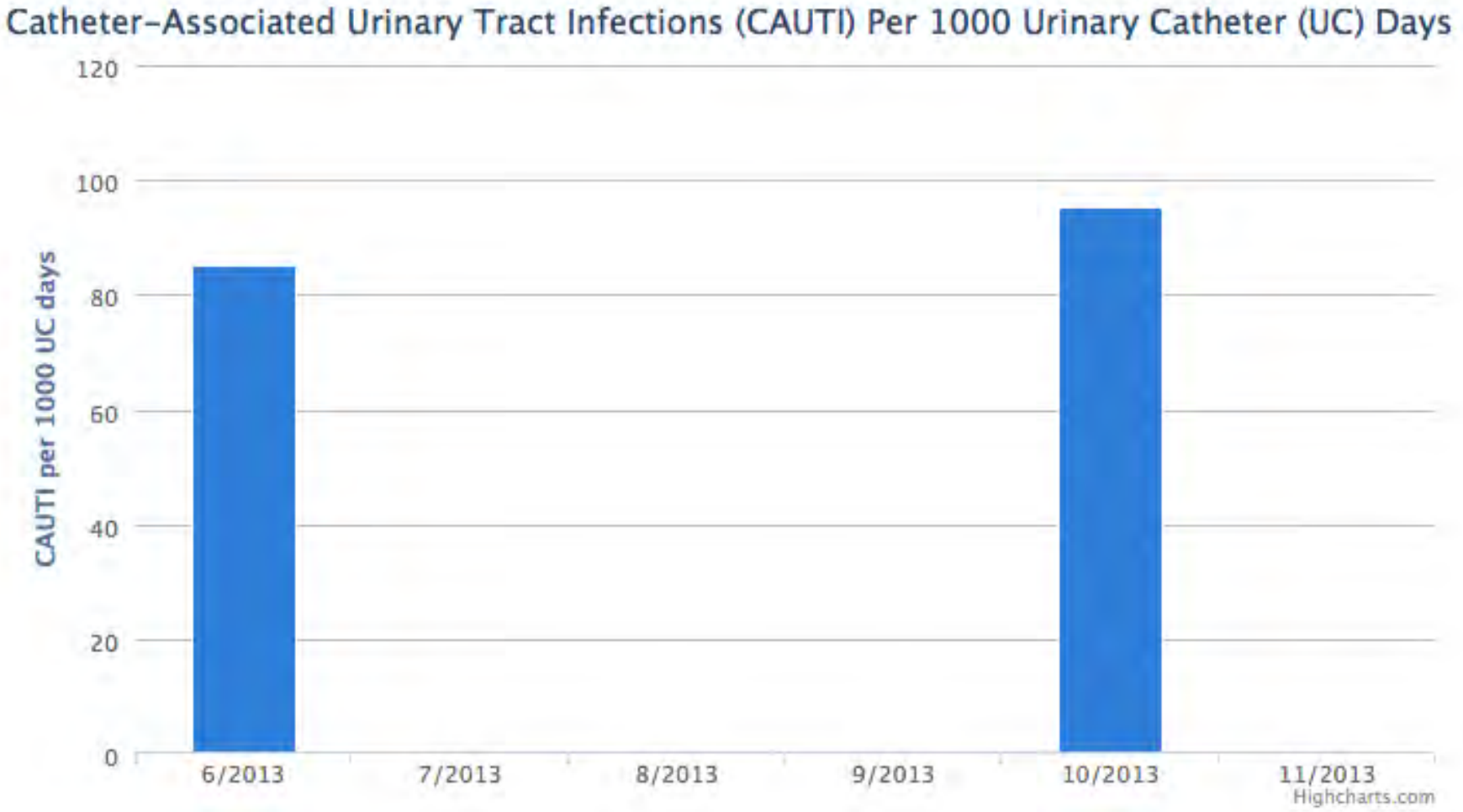
ICU Report: CLABSI per 1000 CL Days per Month



ICU Report: VAP per 1000 MV Days per Month



ICU Report: CAUTI per 1000 UC Days per Month



ICU Report: CLABSI per 1000 CL Days per Month, and Devide Utilization Rate. Benchamark with CDC NHSN and with INICC

Pooled means of central line-associated BSI rates, central line utilization ratios, DA module. Benchmark with Standards

	This Hospital	CDC- NHSN	INICC
Number of Patients	38	--	--
Number of Bed Days	710	--	--
Number of CLAB	11	--	--
Central line-days	94	--	--
Central line utilization ratio	0.13	0.54	0.53
Central line-associated BSI rate	20.58	1.40	6.80

ICU Report: VAP per 1000 MV Days per Month, and Devide Utilization Rate. Benchamark with CDC NHSN and with INICC

Pooled means of ventilator-associated PNEU rates, ventilator utilization ratios, DA module. Benchmark with Standards

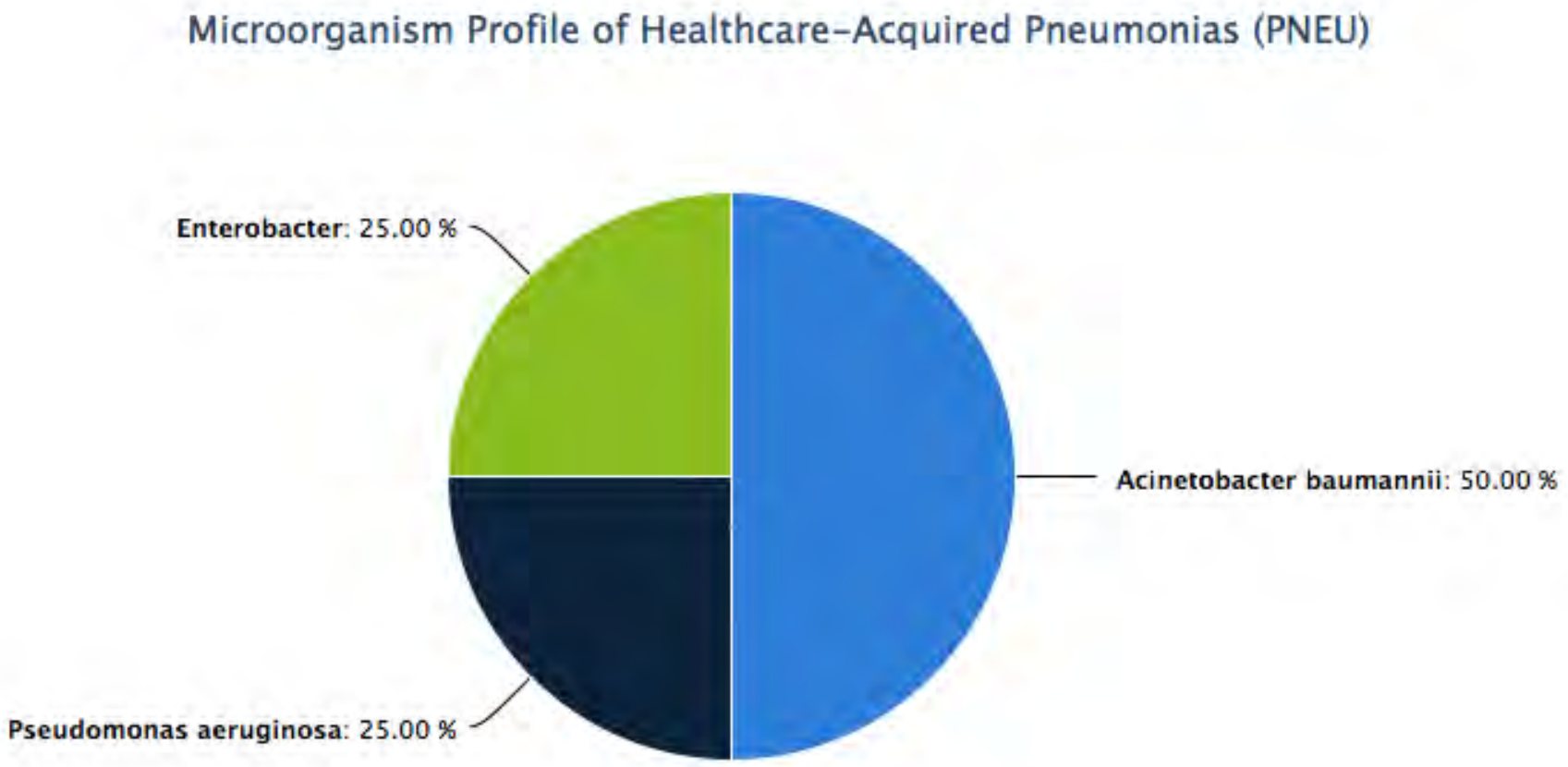
	This Hospital	CDC- NHSN	INICC
Number of Patients	38	--	--
Number of Bed Days	710	--	--
Number of VAP	5	--	--
Ventilator-days	68	--	--
Ventilator utilization ratio	0.10	0.41	0.38
Ventilator-associated PNEU rate	14.18	2.10	15.80

ICU Report: CAUTI per 1000 UC Days per Month, and Devide Utilization Rate. Benchamark with CDC NHSN and with INICC

Pooled means of Urinary Catheter Associated UTI rate, and Urinary Catheter Utilization Ratio, DA module. Benchmark with Standards

	This Hospital	CDC- NHSN	INICC
Number of Patients	38	--	--
Number of Bed Days	710	--	--
Number of UTI	13	--	--
Urinary Catheter days	73	--	--
Urinary Catheter Utilization Ratio	0.10	0.69	0.56
Urinary Catheter Associated UTI rate	30.06	2.20	6.30

ICU Report: Micrrorganism Profile of CLABSI, VAP and CAUTI



ICU Report: Extra Lenght of Stay per HAI

Pooled Means Device Associated Infection Rates, and Device Utilization Ratios, DA Module. Benchmark with Standards

Microorganism Profile of Health Care Associated Infections (HAI) | Atributable Extra Length of Stay

Atributable extra mortality | Hand Hygiene Compliance | Compliance with Bundle To Prevent BSI

Compliance with Bundle To Prevent PNEU | Compliance with Bundle To Prevent UTI

Type of patient	Average length of stay	Extra length of stay
Length of stay of Adult patient wihout HAI	12.41	0.00
Length of stay of Adult patient BSI	15.50	3.09
Length of stay of Adult patient PNEU	30	17.59
Length of stay of Adult patient UTI	16.50	4.09
Length of stay of Adult patient with several HAIs	7	0.00

ICU Report: Extra Mortality per HAI

Pooled Means Device Associated Infection Rates, and Device Utilization Ratios, DA Module. Benchmark with Standards

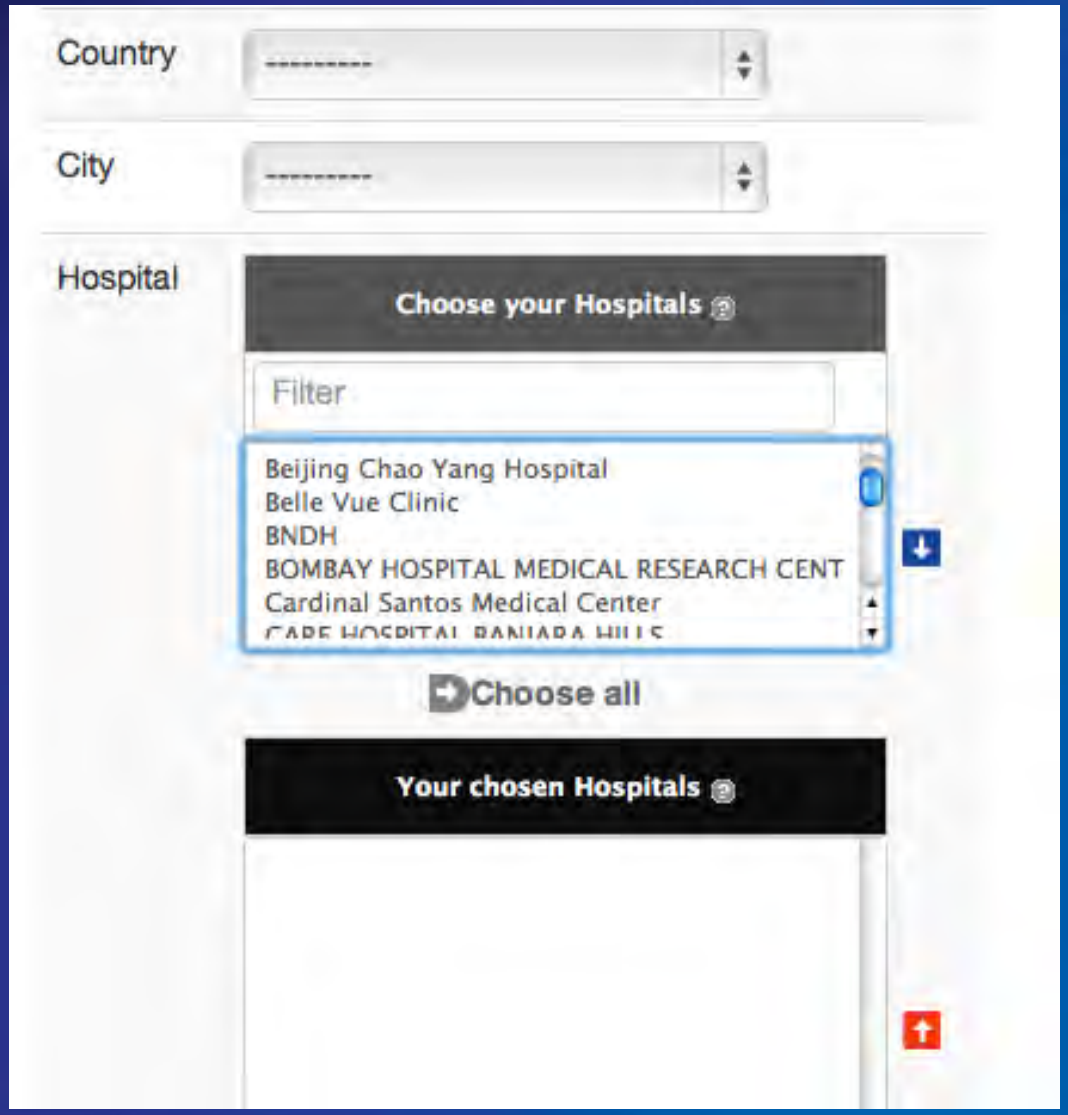
Microorganism Profile of Health Care Associated Infections (HAI) Atributable Extra Length of Stay

Atributable extra mortality | Hand Hygiene Compliance | Compliance with Bundle To Prevent BSI

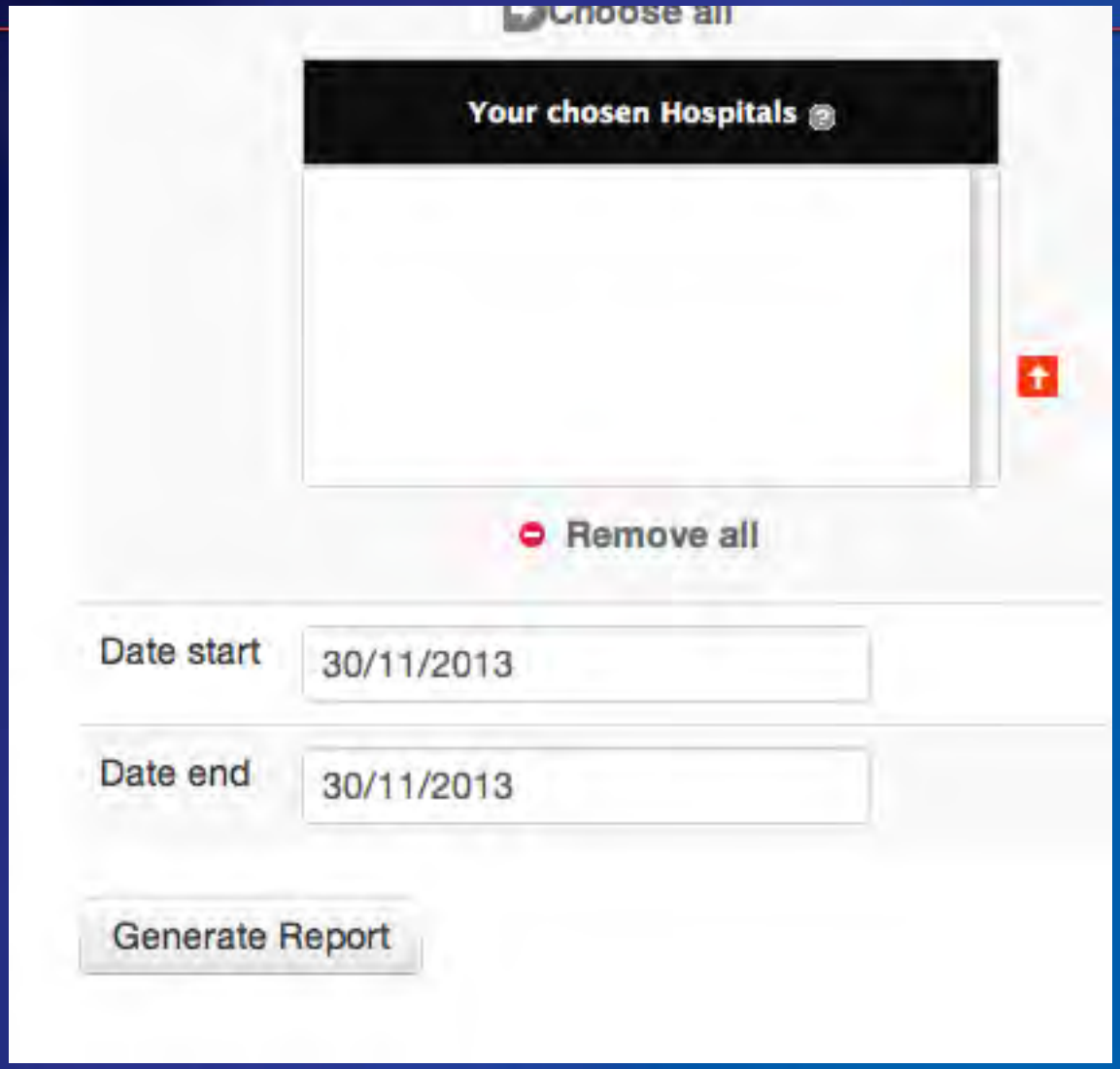
Compliance with Bundle To Prevent PNEU | Compliance with Bundle To Prevent UTI

Type of patient	Percentage of deaths (%)	Extra mortality (%)
Mortality of Adult patient wihout HAI	5.88	0.00
Mortality of Adult patient BSI	37.50	31.62
Mortality of Adult patient PNEU	75	69.12
Mortality of Adult patient UTI	25	19.12
Mortality of Adult patient with several HAIs	0	0.00

SSI Report: Generating Report



SSI Report: Generating Report



SSI Report: Hospital Setting, Patient Features, and Surgical Features

Hospital, and Patient Characteristics | Wound Clasification | Surgical Procedures

Surgical Procedures Characteristics, and Surgical Site Infections | Process Surveillance

SSI rates, Benchmark with International Standards

Hospital	
Country	Colombia
Number of Patients	376
Average Age	58.00
Average Weight	70.38
Average Heigth	159.17
Malnutrition Rate	0 / 4.00 (0 %)
Overweight Rate	1 / 4.00 (0 %)
Diabetes Rate	35 / 235.00 (0 %)

SSI Report: Wound Classification

Hospital, and Patient Characteristics | Wound Clasification | Surgical Procedures

Surgical Procedures Characteristics, and Surgical Site Infections | Process Surveillance

SSI rates, Benchmark with International Standards

Clean	207 / 376 (55 %)
Clean-Contaminated	165 / 376 (43 %)
Contaminated	0 / 376 (0 %)
Dirty	1 / 376 (0 %)

SSI Report: Wound Codes

Hospital, and Patient Characteristics | Wound Clasification | Surgical Procedures

Surgical Procedures Characteristics, and Surgical Site Infections | Process Surveillance

SSI rates, Benchmark with International Standards

Total: 376Surgical procedures

Gallbladder surgery	24 / 376 (6 %)
Herniorrhaphy	63 / 376 (16 %)
Other operative procedures not included in the NHSN categories	34 / 376 (9 %)
Other musculoskeletal	24 / 376 (6 %)
Other integumentary system	61 / 376 (16 %)
Abdominal hysterectomy	22 / 376 (5 %)
Limb amputation	4 / 376 (1 %)

SSI Report: Lenght of Stay, Lenght of Procedures, Numbers of SSIs, Microorgamism Profile

Surgical Procedures Characteristics, and Surgical Site Infections | Process Surveillance

SSI rates, Benchmark with International Standards

Surgical Procedure	Inpatient Stay	Type (Emergency/Programmed)	Average Duration	Number of surgical site infections	Surgical site infection rate	Microorganisms
Gallbladder surgery	0	0/24	1 hours 30 minutes 0 seconds	0	0	
Other operative procedures not included in the NHSN categories	0	1/33	0 hours 15 minutes 0 seconds	0	0	
Ovarian surgery	0	0/1	0 hours 25	0	0	

SSI Report: Benchmark with CDC NHSN and with INICC Per Surgical Procedure Code

Surgical Procedures	SSI rate of this hospital	SSI of CDC-NHSN	SSI of INICC
Gallbladder surgery	0	0.60	2.50
Other operative procedures not included in the NHSN categories	0		
Ovarian surgery	0		
Other integumentary system	0		
Other genitourinary	0		
Herniorrhaphy	1.59	2.30	1.80
Craniotomy	0	2.60	4.40
Gastric surgery	0	2.30	5.50
Other musculoskeletal	0		
Small bowel surgery	0	6.10	5.50

Conclusions I

- According with WHO paper, based on INICC peer review publications, HAI rates in ICUs internationally are higher than in USA and Europe.
- INICC was successful training health care workers of 50 limited resources countries since 1998 to use incidence density of HAI rates; and all them currently are members of INICC.
- INICC was successful to generate a useful benchmark to compare HAI rates between hospitals and countries.
- INICC was successful to measure adverse consequences of HAI (mortality, extra length of stay, cost, bacterial resistance)

Thank you very much

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