International Nosocomial Infection Control Consortium (INICC) Report, Data Summary of 36 Countries, for 2004- 2009.

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ABSTRACT

The results of a surveillance study conducted by The International Nosocomial Infection Control Consortium (INICC) from January 2004 through December 2009 in 422 ICUs of 36 countries in Latin America, Asia, Africa, and Europe are herein reported. During the period of the 6-year study, using Centers for Disease Control and Prevention (CDC) US National Healthcare Safety Network (NHSN; formerly the National Nosocomial Infection Surveillance system [NNIS]) definitions for device-associated healthcare-associated infection (DA-HAI), we gathered prospective data from 313,008 patients hospitalized in the consortium's hospital ICUs for an aggregate of 2,194,897 ICU bed days. In spite of the fact that the use of devices in the developing countries' ICUs was remarkably similar to that reported in U.S. ICUs in the CDC's NHSN, rates of device-associated nosocomial infection were significantly higher in the ICUs of the INICC hospitals: the pooled rate of central line-associated bloodstream infection (CLAB) in the INICC ICUs, 6.8 per 1000 central line days, is almost three-fold higher than the 2.0 per 1000 central line-days reported in comparable U.S. ICUs, and the overall rate of ventilator-associated pneumonia (VAP) was also far higher, 15.8 vs 3.3 per 1000 ventilator-days, as was the rate of catheter-associated urinary tract infection (CAUTI), 6.3 vs. 3.3 per 1000 catheter-days.

Noticeably, the frequencies of resistance of *Pseudomonas aeruginosa is*olates to imipenem (47.2% vs 23.0% respectively), *Klebsiella pneumoniae* isolates to ceftazidime (76.3% vs 27.1% respectively), *Escherichia coli is*olates to ceftazidime (66.7% vs 8.1% respectively), *Staphylococcus aureus is*olates to methicilin (84.4% vs 56.8% respectively), were also higher in the consortium's ICUs; and the crude unadjusted excess mortalities of device-related infections ranged from 7.3% (CAUTI) to 15.2% (VAP).

***Key Words*:** INICC; International Nosocomial Infection Control Consortium; network; Hospital infection; nosocomial infection; health care-associated infection; device-associated infection; ventilator-associated pneumonia; catheter-associated urinary tract infection; central line-associated bloodstream infections; bloodstream infection; urinary tract infection; antibiotic resistance; developing countries; limited resources countries; low income countries..

INTRODUCTION

The present is an updated report of data on device-associated infections (DA-HAI) within intensive care units (ICUs) collected by hospitals participating in the International Nosocomial Infection Control Consortium (INICC)[1-17] between January 2004 and December 2009.

INICC is an international non-profit, open, multi-center, collaborative healthcare-associated infection control program with a surveillance system based on that of the U.S. National Healthcare Safety Network (NHSN,[18-19] formerly the National Nosocomial Infection Surveillance system [NNIS][20]). INICC was founded in Argentina in 1998, being the first multinational research network established to control and reduce DA-HAI through the analysis of data collected on a voluntary basis by a pool of hospitals worldwide. [1-17] INICC has the following goals: Create a dynamic global network of hospitals in the developing world that conduct surveillance of device-associated healthcare-associated infections (DA-HAIs) by means of standardized definitions and established methodologies, promote implementation of evidence-based infection control practices, and perform applied infection control research; provide training and surveillance tools to individual hospitals which can allow them to conduct outcome and process surveillance of DA-HAIs, measure their consequences, and assess the impact of infection control practices; improve safety and quality of health care world-wide through implementation of systematized programs to reduce rates of DA-HAI associated mortality, excess lengths of stay,[21-24] excess costs and bacterial resistance.

METHODS

At this time the INICC has focused on surveillance and prevention of DA-HAI in adult and pediatric ICUs and high-risk nurseries.[3, 10, 13, 25] Data are collected using standardized CDC NHSN protocols and definitions. [19-20]

The methodology of INICC have both outcome surveillance and process surveillance components. The modules of the components may be used singly or simultaneously, but, once selected; they must be used for a minimum of 1 calendar month.[3, 10, 13, 25]

All DA-HAIs of the Outcome Surveillance Component are categorized using standard CDC NHSN definitions that include laboratory and clinical criteria.[19] Both laboratory-confirmed BSIs and clinical sepsis without microbiologic confirmation of BSI are recorded and reported.[26]

Data are classified into specific module protocols addressing the following: DA-HAI rates: excess length of stay, evaluation of DA-HAI costs, crude excess mortality, microbiological profile, bacterial resistance, and antimicrobial-use data within the Outcome Surveillance Component. Besides, INICC methodology includes a process for adjudication and validation of reported HAIs. [3, 10, 13, 25]

Infection control professionals (ICPs) collect data on central line-associated primary bloodstream infections (CLABs), catheter-associated urinary tract infections (CAUTIs) and ventilator-associated pneumonias (VAPs) occurring in patients hospitalized in a specific patient-care location, in nearly all hospitals. ICUs are stratified according to the patient population: adult, pediatric or neonatal units (NICUs).

All NICUs are level III or level II/III units, and ICPs collect data on CLABs and umbilical catheter-associated primary BSIs or VAPs for each of 5 birth-weight categories (<750 g, 750-1000 g, 1001 – 1500 g, 1501 – 2500 g, >2500 g). Corresponding denominator data, patient-days and specific device-days are also collected.

INICC also received aggregated data from hospitals with previous experience in conducting surveillance of DA HAIs. Original and aggregated data was used to calculate DA-HAI rates. In order to calculate mortality, and length of stay, only original data was used. The Process Surveillance Component includes the following modules: hand hygiene compliance monitoring in ICUs; central and peripheral vascular catheter care compliance monitoring; urinary catheter care compliance monitoring; monitoring of compliance with measures to prevent VAP; and performance feedback. Data from the Process Surveillance Module on hand hygiene compliance are included in this report. [3, 10, 13, 25]

The identity of all INICC hospitals, cities and countries is confidential, in accordance with the INICC charter.

RESULTS

Table 1 shows characteristics of 422 ICUs from 36 countries in Latin America, Asia, Africa, and Europe currently participating in INICC that contributed data for this report. The participation of hospitals on INICC Program is as follows: mean length of participation 23.9, SD 21.7 months, and range 1 to 72 months.

For the Outcome Surveillance Component, DA-HAI rates, device utilization (DU) ratios, crude excess mortality by specific type of DA-HAI, antimicrobial utilization, and bacterial resistance for January 2004 through December 2009 are summarized (Tables 2-17).

Tables 2-7 show DA-HAI rates and DU ratios by infection type (CLAB, CAUTI, and VAP) in adult and pediatric ICUs. The data for adult combined medical/surgical ICUs were not stratified by type or size of hospital. Device-days consisted of the total number of central line-days, urinary catheter-days, or ventilator days. The DU ratio constitutes an extrinsic risk factor for DA-HAI. [19-20] DU also comprises a marker for severity of illness of patients, vis-a-vis, patients' susceptibility to DA-HAI.

Tables 8-11 show DA-HAI rates and DU ratios from the High Risk Nursery Component of the INICC system for CLABs and VAPs. For NICUs, device-days consist of the total number of central line-days, umbilical catheter days, and ventilator-days. The data for neonatal ICUs were stratified by weight.

Tables 12 and 13 provide data on crude ICU mortality in patients hospitalized in each type of unit during the surveillance period, with and without DA-HAI, and crude excess mortality of adult and pediatric patients with CLAB, CAUTI, and VAP, and infants in NICUs with CLAB or VAP.

Tables 14 and 15 provide data on crude length of stay of patients hospitalized in each type of unit during the surveillance period with and without DA-HAI and crude excess length of stay of adult and pediatric patients with CLAB, CAUTI, and VAP and infants in NICUs with CLAB or VAP.

Table 16 provides data on bacterial resistance of pathogens isolated from patients with DA-HAI in adult and pediatric ICUs and NICUs.

Table 17 provides data on hand hygiene compliance in each type of unit.

Tables 18 and 19 compare overall rates of CLAB, CAUTI and VAP (Table18)[18] and rates of antimicrobial resistance (Table19)[27] in the INICC and CDC NHSN ICUs.

Table 20 compares rates of CLAB, CAUTI and VAP in the INICC reports published in 2006,[3] 2008,[10] and 2010.[13]

DISCUSSION

The implementation effectiveness of an integrated infection control program focused on DA-HAI surveillance was demonstrated around 30 years ago, as shown in many studies conducted in the U.S., which results reported that the incidence of DA-HAI can be reduced by as much as 30%, and that a related reduction in health care costs was feasible as well.[28] For more than 30 years, the CDC's NNIS/NHSN network has provided benchmarking U.S. ICU data on DA-HAIs and antibiotic resistance, which have proven to be invaluable for researchers, and served as an inspiration to the INICC program.[3, 10, 13, 25] Initially, INICC's surveillance has concentrated on DA-HAI surveillance in the ICU: a health care setting with the highest DA-HAI rates, in which patients' safety is most seriously threatened, due to their critical condition and exposure to invasive devices. [3, 10, 13]

The rate of device use in INICC ICUs is analogous or even lower than the one reported of U.S. ICUs by the NNIS/NHSN System;[18] however, DA-HAI rates identified in INICC ICUs are exceedingly higher than the published U.S. rates (Table 18).[18, 29] Likewise, the antimicrobial resistance rates found in INICC ICUs for *Staphylococcus aureus* isolates as resistant to methicillin (MRSA), *enterobacteria* resistant to ceftazidime (extended-spectrum beta-lactamase producers), and *Pseudomonas aeruginosa* as resistant to fluoroquinolones were far higher than NHSN ICUs' rates (Table 19).[27] Nonetheless, the rates found in the INICC ICUs for enterococcal isolates as resistant to vancomycin is much lower than NHSN ICUs' rates.[27]

Such higher DA-HAI rates may reflect the typical ICU situation in limited-resources countries as a whole,[30] and several reasons have been exposed to explain this fact.[30] Among the primary plausible causes, it can be mentioned that, in almost all the limited-resources countries, there are still no legally enforceable rules or regulations concerning the implementation of infection control programs, such as national infection control guidelines; yet, in the few cases in which there is a legal framework, adherence to and compliance with the guidelines is most irregular and hospital accreditation is not mandatory. In most INICC hospitals, lack of official regulations is strongly correlated to the considerable variability found in the compliance with hand hygiene recommendations. This situation is further emphasized by the fact that administrative and financial support in most INICC hospitals is insufficient to fund infection control programs,[30] and invariably results in extremely low nurse-to-patient staffing ratios—which have proved to be highly connected to high DA-HAI rates in ICUs—,[3]

hospital over-crowding, lack of medical supplies, and in an insufficient number of experienced nurses or trained healthcare workers.

World Bank categorizes countries into four economic strata based on 2007 gross national income (GNI) per capita: (1)low income, $935 or less; (2)lower middle income, $936–3,705; (3)upper middle income, $3,706–11,455; and (4) high income, $11,456 or more.[31] Within this categorization, 144 out of 209 (68%) are low-income and lower middle-income economies—which can also be referred to as lower income countries, low resources countries, developing economies, or developing or emerging countries—representing more than 75% of the world population. The relation between DA-HAI rates and the country socio economic level (low income, mid low income and high income), and between DA-HAI rates and their association to the type of hospital (Public, Academic, and Private) has recently analyzed, and published by INICC.[32]

DA-HAI surveillance is primary and essential to reduce the hospitalized patients' risk of infection, because it effectively describes and addresses the importance and characteristics of the threatening situation created by HAIs. This must be followed by the implementation of practices aimed at DA-HAI prevention and control. Additionally, participation in INICC has played a fundamental role, not only in increasing the awareness of DA-HAI risks in the INICC ICUs, but also in providing an exemplary basis for the institution of infection control practices. In many INICC ICUs, for example, the high incidence of DA-HAI has been reduced by carrying out targeted performance feedback programs for hand hygiene and central line, mechanical ventilator, and urinary catheter care.[33-39] Finally, it is of utmost importance to restrict the administration of anti-infective in order to effectively control of antibiotic resistance.

In order to compare a hospital's DA-HAI rates and DU ratios with the rates identified in this report, it is required that the hospital concerned starts collecting their data by applying the methods and methodology described for CDC NHSN and INICC, and then calculate infection rates and DU ratios for the Device-associated Module.

The major aim of these data is to serve as a guide for the implementation of prevention strategies and other quality improvement efforts locally, in order to help reduce DA-HAI rates to the minimum possible level.

In conclusion, the data presented in this report strengthen the fact that HAIs, particularly DA-HAIs in ICU patients in limited-resources countries, pose a grave and many times concealed risk to patient safety, as compared with the developed world. It is INICC's main goal to enhance infection control practices, by

facilitating elemental, feasible and inexpensive tools and resources to tackle this problem effectively and systematically, leading to greater and stricter adherence to infection control programs and guidelines, and to the correlated reduction in DA-HAI and its adverse effects, in the ICUs participating in INICC, as well as at any other healthcare facility of the developing world.

REFERENCES

1. Rosenthal VD, Guzman S, Orellano PW. Nosocomial infections in medical-surgical intensive care units in Argentina: attributable mortality and length of stay. Am J Infect Control 2003;31:291-5.
2. Rosenthal VD, Guzman S, Crnich C. Device-associated nosocomial infection rates in intensive care units of Argentina. Infect Control Hosp Epidemiol 2004;25:251-5.
3. Rosenthal VD, Maki DG, Salomao R, et al. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Ann Intern Med 2006;145:582-91.
4. Ramirez Barba EJ, Rosenthal VD, Higuera F, et al. Device-associated nosocomial infection rates in intensive care units in four Mexican public hospitals. Am J Infect Control 2006;34:244-7.
5. Moreno CA, Rosenthal VD, Olarte N, et al. Device-associated infection rate and mortality in intensive care units of 9 Colombian hospitals: findings of the International Nosocomial Infection Control Consortium. Infect Control Hosp Epidemiol 2006;27:349-56.
6. Leblebicioglu H, Rosenthal VD, Arikan OA, et al. Device-associated hospital-acquired infection rates in Turkish intensive care units. Findings of the International Nosocomial Infection Control Consortium (INICC). J Hosp Infect 2007;65:251-7.
7. Mehta A, Rosenthal VD, Mehta Y, et al. Device-associated nosocomial infection rates in intensive care units of seven Indian cities. Findings of the International Nosocomial Infection Control Consortium (INICC). J Hosp Infect 2007;67:168-74.
8. Salomao R, Rosenthal VD, Grimberg G, 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;24:195-202.
9. Cuellar LE, Fernandez-Maldonado E, Rosenthal VD, 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;24:16-24.
10. Rosenthal VD, Maki DG, Mehta A, et al. International Nosocomial Infection Control Consortium report, data summary for 2002-2007, issued January 2008. Am J Infect Control 2008;36:627-37.
11. Pawar M, Mehta Y, Purohit A, Trehan N, Rosenthal VD. Resistance in gram-negative bacilli in a cardiac intensive care unit in India: risk factors and outcome. Ann Card Anaesth 2008;11:20-6.
12. Madani N, Rosenthal VD, Dendane T, Abidi K, Zeggwagh AA, Abouqal R. 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). Int Arch Med 2009;2:29.
13. Rosenthal VD, Maki DG, Jamulitrat S, et al. International Nosocomial Infection Control Consortium (INICC) report, data summary for 2003-2008, issued June 2009. Am J Infect Control 2010;38:95-104 e2.
14. Navoa-Ng JA, Berba R, Arreza-Galapia Y, ., et al. Device-Associated Infections Rates in Adult, Pediatric and Neonatal Intensive Care Units of Hospitals from Philippines: International Nosocomial Infection Control Consortium (INICC) Findings. American Journal Infection Control 2011;In Press.
15. Guanche-Garcell H, Requejo-Pino O, Rosenthal VD, Morales-Pérez C, Delgado-González O, Fernández-González D. Device-Associated Infections Rates in Adults Intensive Care Units of University Cuban Hospitals: International Nosocomial Infection Control Consortium (INICC) Findings. Int J Infect Dis 2011;In Press.
16. Kanj SS, Nada Z, Rosenthal VD, Nisreen S, Lamia A, Zeina K. Device-Associated Infections Rate in an Intensive Care Unit of a Lebanese University Hospital: International Nosocomial Infection Control Consortium (INICC) Findings. Journal of Global Infectious Diseases 2011;In Press.
17. Dueñas L, Bran-de-Casares A, Rosenthal V.D., Jesús ML. Device-Associated Infections Rates in ICUs from El Salvador: INICC Findings. The Journal of Infection in Developing Countries 2011;In Press.
18. Edwards JR, Peterson KD, Andrus ML, Dudeck MA, Pollock DA, Horan TC. National Healthcare Safety Network (NHSN) Report, data summary for 2006 through 2007, issued November 2008. Am J Infect Control 2008;36:609-26.
19. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control 2008;36:309-32.
20. Emori TG, Culver DH, Horan TC, et al. National nosocomial infections surveillance system (NNIS): description of surveillance methods. Am J Infect Control 1991;19:19-35.

21. Rosenthal VD, Udwadia FE, Munoz HJ, et al. Time-dependent analysis of extra length of stay and mortality due to ventilator-associated pneumonia in intensive-care units of ten limited-resources countries: findings of the International Nosocomial Infection Control Consortium (INICC). Epidemiol Infect 2011:1-7.
22. Barnett AG, Graves N, Rosenthal VD, Salomao R, Rangel-Frausto MS. Excess length of stay due to central line-associated bloodstream infection in intensive care units in Argentina, Brazil, and Mexico. Infect Control Hosp Epidemiol 2010;31:1106-14.
23. Rosenthal VD, Dwivedy A, Calderon ME, et al. Time-dependent analysis of length of stay and mortality due to urinary tract infections in ten developing countries: INICC findings. J Infect 2010;62:136-41.
24. Barnett AG, Beyersmann J, Allignol A, Rosenthal VD, Graves N, Wolkewitz M. The Time-Dependent Bias and its Effect on Extra Length of Stay due to Nosocomial Infection. Value Health 2011;14:381-6.
25. Rosenthal VD, Maki DG, Graves N. The International Nosocomial Infection Control Consortium (INICC): Goals and objectives, description of surveillance methods, and operational activities. Am J Infect Control 2008;36:e1-e12.
26. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control 1988;16:128-40.
27. Hidron AI, Edwards JR, Patel J, et al. NHSN annual update: antimicrobial-resistant pathogens associated with healthcare-associated infections: annual summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. Infect Control Hosp Epidemiol 2008;29:996-1011.
28. Hughes JM. Study on the efficacy of nosocomial infection control (SENIC Project): results and implications for the future. Chemotherapy 1988;34:553-61.
29. Rosenthal VD. Health-care-associated infections in developing countries. Lancet 2011;377:186-8.
30. Allegranzi B, Bagheri Nejad S, Combescure C, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. Lancet;377:228-41.
31. The World Bank. The World Bank List of Economies The World Bank, 2008. (Accessed May 12, 2010, 2010, at http://www.worldbank.org/.)
32. Rosenthal VD, Lynch P, Jarvis RW, et al. Socioeconomic Impact on Device-Associated Infections in Limited-Resource Neonatal Intensive Care Units: Findings of INICC. Infection 2011;In Press.
33. Rosenthal VD, McCormick RD, Guzman S, Villamayor C, Orellano PW. Effect of education and performance feedback on handwashing: the benefit of administrative support in Argentinean hospitals. Am J Infect Control 2003;31:85-92.
34. Rosenthal VD, Guzman S, Pezzotto SM, Crnich CJ. Effect of an infection control program using education and performance feedback on rates of intravascular device-associated bloodstream infections in intensive care units in Argentina. Am J Infect Control 2003;31:405-9.
35. Rosenthal VD, Guzman S, Safdar N. Effect of education and performance feedback on rates of catheter-associated urinary tract infection in intensive care units in Argentina. Infect Control Hosp Epidemiol 2004;25:47-50.
36. Higuera F, Rosenthal VD, Duarte P, Ruiz J, Franco G, Safdar N. The effect of process control on the incidence of central venous catheter-associated bloodstream infections and mortality in intensive care units in Mexico. Crit Care Med 2005;33:2022-7.
37. Rosenthal VD, Guzman S, Safdar N. Reduction in nosocomial infection with improved hand hygiene in intensive care units of a tertiary care hospital in Argentina. Am J Infect Control 2005;33:392-7.
38. Rosenthal VD, Guzman S, Crnich C. Impact of an infection control program on rates of ventilator-associated pneumonia in intensive care units in 2 Argentinean hospitals. Am J Infect Control 2006;34:58-63.
39. Rosenthal VD, Maki DG, Rodrigues C, et al. Impact of International Nosocomial Infection Control Consortium (INICC) strategy on central line-associated bloodstream infection rates in the intensive care units of 15 developing countries. Infect Control Hosp Epidemiol 2010;31:1264-72.

Table 1. Features of the participating INICC hospitals, 2004-9

	America	*Asia*	*Africa*	*Europe*	*Pooled*
ICUs, n	123	241	6	52	422
ICUs, type					
Medical ICU	3	34	0	5	42
Medical Cardiac	6	17	0	4	27
Medical-surgical ICU	69	50	2	17	138
Neurosurgical ICU	1	22	0	2	25
Neurologic ICU	0	3	0	1	4
Neonatal ICU	19	10	2	5	36
Pediatric ICU	20	16	0	9	45
Respiratory ICU	0	16	1	1	18
Surgical ICU	3	40	1	6	50
Surgical-cardiothoracic ICU	0	26	0	2	28
Trauma ICU	2	7	0	0	9
Hospitals, n					
Academic teaching	19	45	5	25	94
Public	32	40	1	2	75
Private community	28	16	0	2	46

ICU, intensive care unit.

Table 2. Pooled means and 95% CI of the distribution of central line-associated bloodstream infection rates (per 1000 central line-days) and central line utilization ratios by type of adult and pediatric ICU.

Type of ICU	No of ICUs	No of patients	No of CLAB (LCBI) *	No of CLAB (CSEP) †	No of CLAB (LCBI+CSEP)	Central line-days	Pooled mean CLAB rate	95% CI
Medical	42	30,823	425	691	1,116	75,846	14.7	13.8 – 15.6
Medical Cardiac	27	26,704	147	186	333	53,287	6.2	5.6 – 6.9
Medical/Surgical	138	109,237	3,016	436	3,452	506,934	6.8	6.6 – 7.0
Neurologic	4	3,869	106	1	107	8,306	12.9	10.6 – 15.5
Neurosurgical	25	8,109	93	0	93	20,249	4.6	3.7 – 5.6
Pediatric	45	20,905	523	152	675	63,330	10.7	9.9 – 11.5
Respiratory	18	2,710	119	3	122	24,774	4.9	4.1 – 5.9
Surgical	50	63,270	946	47	993	197,207	5.0	4.7 – 5.4
Surgical cardiothoracic	28	25,130	87	15	102	66,835	1.5	1.2 – 1.9
Trauma	9	4,507	36	0	36	14,650	2.5	1.7 – 3.4
Overall	386	295,264	5,498	1,531	7,029	1,031,418	6.8	6.7 – 7.0

CI, confidence interval; ICU, intensive care unit; CLAB, central-line associated blood stream infection; *LCBI: Laboratory-confirmed blood stream infection; † CSEP, Clinical sepsis without laboratory confirmation.

Table 3. Pooled means and 95% CI of central line utilization ratios by type of adult and pediatric ICU

Type of ICU	No of ICUs	Central line-days	Patient days	Pooled mean DUR	95% CI
Medical	42	75,846	151,243	0.50	0.50 – 0.50
Medical Cardiac	27	53,287	94,180	0.57	0.56 – 0.57
Medical/Surgical	138	506,934	949,971	0.53	0.53 – 0.53
Neurologic	4	8,306	22,860	0.36	0.36 – 0.37
Neurosurgical	25	20,249	47,019	0.43	0.43 – 0.44
Pediatric	45	63,330	165,046	0.38	0.38 – 0.39
Respiratory	18	24,774	39,942	0.62	0.62 – 0.63
Surgical	50	197,207	382,523	0.52	0.51 – 0.52
Surgical cardiothoracic	28	66,835	97,426	0.69	0.68 – 0.69
Trauma	9	14,650	26,201	0.56	0.55 – 0.57
Overall	386	1,031,418	1,976,411	0.52	0.52 – 0.52

CI, confidence interval; ICU, intensive care unit; DUR: Device use ratio.

Table 4. Pooled means and 95% CI of the distribution of catheter-associated urinary tract infection rates per 1000 urinary catheter-days, by type of adult or pediatric ICU.

Type of ICU	No. of UCIs	No of Patients	No. of CAUTIs	Urinary catheter-days	Pooled mean CAUTI rate	95% CI
Medical	42	30,823	626	99,036	6.3	5.8 – 6.8
Medical Cardiac	27	26,704	193	51,723	3.7	3.2 – 4.3
Medical/Surgical	138	109,237	3,798	535,414	7.1	6.9 – 7.3
Neurologic	4	3,869	276	19,336	14.3	12.7 – 16.1
Neurosurgical	25	8,109	219	35,468	6.2	5.4 – 7.1
Pediatric	45	20,905	183	38,789	4.7	4.1 – 5.5
Respiratory	18	2,710	206	21,109	9.8	8.5 – 11.2
Surgical	50	63,270	869	173,759	5.0	4.7 – 5.4
Surgical cardiothoracic	28	25,130	90	56,185	1.6	1.3 – 1.9
Trauma	9	4,507	135	18,722	7.2	6.1 – 8.5
Overall	386	295,264	6,595	1,049,541	6.3	6.2 – 6.5

CI, confidence interval; ICU, intensive care unit; CAUTI, catheter-associated urinary tract infection.

Table 5. Pooled means and 95% CI of urinary catheter utilization ratios by type of adult or pediatric ICU

Type of ICU	No. of UCIs	Urinary catheter-days	Patient-days	Pooled mean DUR	95% CI
Medical	42	99,036	151,243	0.65	0.65 – 0.66
Medical Cardiac	27	51,723	94,180	0.55	0.55 – 0.55
Medical/Surgical	138	535,414	949,971	0.56	0.56 – 0.56
Neurologic	4	19,336	22,860	0.85	0.84 – 0.85
Neurosurgical	25	35,468	47,019	0.75	0.75 – 0.76
Pediatric	45	38,789	165,046	0.24	0.23 – 0.24
Respiratory	18	21,109	39,942	0.53	0.52 – 0.53
Surgical	50	173,759	382,523	0.45	0.45 – 0.46
Surgical cardiothoracic	28	56,185	97,426	0.58	0.58 – 0.58
Trauma	9	18,722	26,201	0.71	0.71 – 0.72
Overall	386	1,049,541	1,976,411	0.53	0.53 – 0.53

CI, confidence interval; ICU, intensive care unit; DUR: Device use ratio.

Table 6. Pooled means and 95% CI of the distribution of ventilator-associated pneumonia rates, per 1000 ventilator-days by type of adult or pediatric ICU

Type of ICU	No. of units	No of patients	Ventilator days	No. of VAP	Pooled mean VAP rate	95% CI
Medical	42	30,823	86,095	661	7.7	7.1 – 8.3
Medical Cardiac	27	26,704	21,877	236	10.8	9.5 – 12.3
Medical/Surgical	138	109,237	357,214	6,570	18.4	17.9 – 18.8
Neurologic	4	3,869	4,015	113	28.1	23.2 – 33.8
Neurosurgical	25	8,109	14,475	303	20.9	18.7 – 23.4
Pediatric	45	20,905	86,675	560	6.5	5.9 – 7.1
Respiratory	18	2,710	18,571	514	27.7	25.4 – 30.1
Surgical	50	63,270	135,431	2,213	16.3	15.7 – 17.0
Surgical cardiothoracic	28	25,130	32,575	484	14.9	13.6 – 16.2
Trauma	9	4,507	12,266	491	40.0	36.6 – 43.7
Overall	386	295,264	769,194	12,145	15.8	15.5 – 16.1

CI, confidence interval; ICU, intensive care unit; VAP, ventilator-associated pneumonia.

Table 7. Pooled means and 95% CI of ventilator utilization ratios by type of adult or pediatric ICU

Type of ICU	No. of units	Patient days	Ventilator days	Pooled Mean DUR	95% CI
Medical	42	151,243	86,095	0.57	0.57 – 0.57
Medical Cardiac	27	94,180	21,877	0.23	0.23 – 0.24
Medical/Surgical	138	944,836	357,214	0.38	0.38 – 0.38
Neurologic	4	22,860	4,015	0.18	0.17 – 0.18
Neurosurgical	25	47,019	14,475	0.31	0.30 – 0.31
Pediatric	45	165,046	86,675	0.53	0.52 – 0.53
Respiratory	18	39,942	18,571	0.46	0.46 – 0.47
Surgical	50	382,523	135,431	0.35	0.35 – 0.36
Surgical cardiothoracic	28	97,426	32,575	0.33	0.33 – 0.34
Trauma	9	26,201	12,266	0.47	0.46 – 0.47
Overall	386	1,971,276	769,194	0.39	0.39 – 0.39

CI, confidence interval; ICU, intensive care unit; DUR: Device use ratio.

Table 8. Pooled means and 95% CI of the distribution of central line-associated blood stream infection rates, per 1000 central line-days for level III NICUs

Birth-weight category, Kg	No. of units	No of Patients	Central line-days	No. of CLAB (LCBI) *	No. of CLAB (CSEP) †	No. of CLAB (LCBI+CSEP)	Pooled mean CLAB rate	95% CI
<0.750	9	73	1,104	4	8	12	10.9	5.6 – 18.9
0.750-1.000	27	1,163	9,008	68	54	122	13.5	11.3 – 16.2
1.001-1.500	30	1,916	11,700	100	60	160	13.7	11.6 – 16.0
1.501-2.500	32	5,598	14,328	83	88	171	11.9	10.2 – 13.9
>2.500	33	6,670	10,890	55	54	109	10.0	8.2 – 12.1
OVERALL	36	15,420	47,030	310	264	574	12.2	11.2 – 13.2

CI, confidence interval; NICU, neonatal intensive care unit; CLAB, central-line associated BSI; *LCBI: Laboratory-confirmed BSI; †Clinical sepsis, without laboratory confirmation.

Table 9. Pooled means and 95% CI of central line utilization ratios for level III NICUs

Birth-weight category, Kg	No. of units	Patient-days	Central line-days	Pooled mean DUR	95% CI
<0.750	9	2,716	1,104	0.41	0.39 – 0.43
0.750-1.000	27	22,796	9,008	0.40	0.39 – 0.40
1.001-1.500	30	40,875	11,700	0.29	0.28 – 0.29
1.501-2.500	32	65,358	14,328	0.22	0.22 – 0.22
>2.500	33	59,569	10,890	0.18	0.18 – 0.19
OVERALL	36	191,314	47,030	0.25	0.24 – 0.25

CI, confidence interval; NICU, neonatal intensive care unit; DUR: Device use ratio.

Table 10. Pooled means and 95% CI of the distribution of ventilator-associated pneumonia rates, per 1000 ventilator-days for level III NICUs

Birth-weight category, kg	No. of units	No of patients	Ventilator-days	No. of VAP	Pooled mean VAP rate	95% CI
<0.750	9	73	1,272	4	3.1	0.08 – 0.81
0.750-1.000	27	1,163	7,121	51	7.2	5.3 – 9.4
1.001-1.500	30	1,916	5,424	48	8.8	6.5 – 11.7
1.501-2.500	32	5,598	6,900	70	10.1	7.9 – 12.8
>2.500	33	6,670	6,936	77	11.1	8.8 – 13.9
OVERALL	36	15,420	27,653	250	9.0	7.9 – 10.2

CI, confidence interval; NICU, neonatal intensive care unit; VAP, ventilator-associated pneumonia.

Table 11. Pooled means and 95% CI of ventilator utilization ratios by type of adult or pediatric ICU

Birth-weight category, kg	No. of units	Patient-days	Ventilator-days	Pooled Mean DUR	95% CI
<0.750	9	2,716	1,272	0.47	0.45 – 0.49
0.750-1.000	27	22,796	7,121	0.31	0.31 – 0.32
1.001-1.500	30	40,875	5,424	0.13	0.13 – 0.14
1.501-2.500	32	65,358	6,900	0.11	0.10 – 0.11
>2.500	33	59,569	6,936	0.12	0.11 – 0.12
OVERALL	36	191,314	27,653	0.14	0.14 – 0.15

CI, confidence interval; ICU, intensive care unit; DUR: Device use ratio.

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

	No. of deaths	No. of patients	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 CLAB	414	1,679	24.7%	22.6 - 26.8
Crude excess mortality of patients with CLAB	414	1,679	14.7%	12.8 - 16.6
Crude mortality rate of patients with CAUTI	290	1,677	17.3%	15.5 - 19.2
Crude excess mortality of patients with CAUTI	290	1,677	7.3%	5.7 - 9.1
Crude mortality rate of patients with VAP	1,265	5,020	25.2%	24.0 - 24.5
Crude excess mortality of patients with VAP	1,265	5,020	15.2%	14.2 - 14.3

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia.

*Crude excess mortality of DA-HAI 5 crude mortality of ICU patients with DA-HAI - crude mortality of patients without DA-HAI.

Table 13. Pooled means and 95% CI of the distribution of crude mortality and crude excess mortality*of infants in NICUs, all birth weight categories combined

	No. of deaths	No. of patients	Pooled crude mortality, %	95% CI
Crude mortality of infants without DA-HAI	537	5910	9.1%	8.4 - 9.9
Crude mortality of infants with CLAB	72	204	35.3%	28.7 - 42.3
Crude excess mortality of infants with CLAB	72	204	26.2%	20.3 - 32.4
Crude mortality of infants with VAP	42	175	24.0%	17.9 - 31.0
Crude excess mortality of infants with VAP	42	175	14.9%	8.9 - 21.1

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia.

*Crude excess mortality of DA-HAI 5 crude mortality of ICU patients with DA-HAI - crude mortality of patients without DA-HAI.

Table 14. Pooled means and 95% CI 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	No. of patients	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 CLAB	28,709	1,679	17.1	16.3 - 17.9
Extra LOS of patients with CLAB	28,709	1,679	10.9	10.1 - 11.6
LOS of patients with CAUTI	30,982	1,677	18.5	17.6 - 19.4
Extra LOS of patients with CAUTI	30,982	1,677	12.2	11.4 - 13.1
LOS of patients with VAP	90,146	5,020	18.0	17.5 - 18.5
Extra LOS of patients with VAP	90,146	5,020	11.7	11.3 - 12.2

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia.

Table 15. Pooled means and 95% CI 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	No. of patients	Pooled average LOS, days	95% CI
LOS of infants without DA-HAI	537	5910	9.1	8.4 - 9.9
LOS of infants with CLAB	72	204	35.3	28.7 - 42.3
Extra LOS of infants with CLAB	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

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia.

Table 16. Antimicrobial resistance rates in the ICUs of the International Nosocomial Infection Control Consortium.

Pathogen, antimicrobial	No, of pathogenic isolated tested, pooled (CLAB)	Resistance percentage, % (CLAB)	No, of pathogenic isolated tested, pooled (VAP)	Resistance percentage, % (VAP)	No, of pathogenic isolated tested, pooled (CAUTI)	Resistance percentage, % (CAUTI)
Staphylococcus aureus						
OXA	646	84.4%	634	73.2%	42	71.4%
Enterococcus faecalis						
VAN	98	5.1%	18	11.1%	59	5.1%
Pseudomonas aeruginosa						
FQs	285	42.1%	997	46.2%	148	50.7%
PIP or TZP	589	36.2%	1789	40.2%	254	41.7%
AMK	278	27.7%	1008	28.3%	127	29.9%
IPM or MEM	517	47.2%	1777	42.7%	255	36.5%
FEP	2	100.0%	8	37.5%	2	50.0%
Klebsiella pneumoniae						
CRO or CAZ	447	76.3%	662	68.9%	194	72.2%
IPM, MEM or ETP	508	7.9%	688	7.0%	237	7.2%
Acinetobacter baumannii						
IPM or MEM	667	55.3%	1466	66.3%	113	52.2%
Escherichia coli						
CRO or CAZ	171	66.7%	323	67.5%	320	49.7%
IPM, MEM or ETP	182	4.4%	360	4.2%	326	5.5%
FQs	133	53.4%	164	54.9%	211	32.2%

AMK, amikacin ; FEP, cefepime; CRO, ceftriaxone; ETP, ertapenem; FQs, fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin, or ofloxacin); IPM, imipenem; MEM, meropenem; OXA , oxacillin; PIP, piperacillin; TZP, piperacillin-tazobactam; CAZ, ceftazidime; VAN, vancomycin.

Table 17. Distribution of hand hygiene compliance rates by ICU type .

Type of ICU	ICUs (n)	Opportunities for HH (n)	HH compliance (n)	Pooled mean compliance (%)	95% CI
Medical	7	7,889	6,038	76.5%	75.6 - 77.5
Medical Cardiac	9	9,275	5,637	60.8%	59.8 - 61.8
Medical/Surgical	61	74,557	39,581	53.1%	52.7 - 53.5
Neurologic	2	1,436	587	40.9%	38.3 - 43.5
Neurosurgical	3	5,773	4,633	80.3%	79.2 - 81.3
New Born	16	6,940	5,428	78.2%	77.2 - 79.2
Pediatric	8	3,620	2,160	59.7%	58.0 - 61.3
Respiratory	2	1,183	443	37.4%	34.7 - 40.3
Surgical	6	7,868	5,284	67.2%	66.1 - 68.2
Surgical cardiothoracic	3	5,412	4,204	77.7%	76.5 - 78.8
Trauma	2	6,106	4,880	79.9%	78.9 - 80.9
Overall	119	130,059	78,875	60.6%	60.4 - 60.9

CI, confidence interval; ICU, intensive care unit; HH, Hand hygiene

Table 18. Comparison of DA-HAI rates, per 1000 device-days in the ICUs of the International Nosocomial Infection Control Consortium and the U.S. National Healthcare Safety Network.

	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 (1501-2500 g)		
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)

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; INICC, International Nosocomial Infection Control Consortium; NHSN, National Healthcare Safety Network; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia.

Table 19. Comparison of antimicrobial resistance rates (%) in the ICUs of the International Nosocomial Infection Control Consortium and the U.S. National Nosocomial Surveillance System.

	INICC 2004–2009	U.S. NHSN 2006-2007
Pathogen, antimicrobial	**Resistance percentage, % (CLAB)**	**Resistance percentage, % (CLAB)**
Staphylococcus aureus		
OXA	84.4	56.8
Enterococcus faecalis		
VAN	5.1	78.9
Pseudomonas aeruginosa		
FQ	42.1	30.5
PIP or TZP	36.2	20.2
AMK	27.7	4.3
IPM or MEM	47.2	23.0
FEP	100.0	12.6
Klebsiella pneumoniae		
CTR or CAZ	76.3	27.1
IPM, MEM or ETP	7.9	10.8
Acinetobacter baumannii		
IMP or MEM	55.3	29.2
Escherichia coli		
CTR or CAZ	66.7	8.1
IPM, MEM or ETP	4.4	0.9
FQs	53.4	30.8

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; INICC, International Nosocomial Infection Control Consortium; NHSN, National Healthcare Safety Network; CLAB, central line-associated blood stream infection; AMK, amikacin ; FEP, cefepime; CRO, ceftriaxone; ETP, ertapenem; FQs, fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin, or ofloxacin); IPM, imipenem; MEM, meropenem; OXA , oxacillin; PIP, piperacillin; TZP, piperacillin-tazobactam; CAZ, ceftazidime; VAN, vancomycin.

Table 20. Comparison of DA-HAI rates, per 1000 device-days in the ICUs of the International Nosocomial Infection Control Consortium published in 2006, 2008, 2010, and 2011 reports.

	INICC 2002-2005 (Published in 2006)[3] Pooled Mean (95% CI)	INICC 2002-2007 (Published in 2008)[10] Pooled Mean (95% CI)	INICC 2003-2008 (Published in 2010)[13] Pooled Mean (95% CI)	INICC 2004-2009 (This report) Pooled Mean (95% CI)
Number of Countries	8	18	25	36
Participating Countries	Argentina, Brazil, Colombia, India, Mexico, Morocco, Peru, Turkey.	Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, India, Kosovo, Lebanon, Macedonia, Mexico, Morocco, Nigeria, Peru, Philippines, El Salvador, Turkey, Uruguay.	Argentina, Brazil, China, Colombia, Costa Rica, Cuba, Greece, India, Jordan, Kosovo, Lebanon, Lithuania, Macedonia, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, El Salvador, Thailand, Tunisia, Turkey, Venezuela, Uruguay.	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.
Number of ICUs	55	98	173	422
CLAB rates				
Pooled	12.5 (11.7 – 13.3)	9.2 (8.8 – 9.7)	7.6 (7.4 – 7.9)	6.8 (6.7 – 7.0)
Medical Cardiac ICU	-	9.9 (8.7 – 11.3)	8.5 (7.5 – 9.7)	6.2 (5.6 – 6.9)
Medical-surgical ICU	-	8.9 (8.4 – 9.4)	7.4 (7.2 – 7.7)	6.8 (6.6 – 7.1)
Pediatric ICU	-	6.9 (5.6 – 8.3)	7.8 (7.1 – 8.5)	4.6 (3.7 – 5.6)
Newborn ICU (1501-2500 g)	-	15.2 (10.3 – 21.5)	13.9 (12.4 – 15.6)	11.9 (10.2 – 13.9)
CAUTI rates				
Pooled	8.9 (8.3 – 9.5)	6.5 (6.1 – 6.9)	6.3 (6.0 – 6.5)	6.3 (6.2 – 6.5)
Medical Cardiac ICU	-	6.4 (5.3 – 7.7)	4.4 (3.5 – 5.3)	3.7 (3.2 – 4.3)
Medical-surgical ICU	-	6.6 (6.2 – 7.0)	6.1 (5.9 – 6.4)	7.1 (6.9 – 7.4)
Pediatric ICU	-	4.0 (2.4 – 6.2)	4.4 (3.6 – 5.4)	4.7 (4.1 – 5.5)

VAP rates				
Pooled	24.1 (22.8 – 25.5)	19.5 (18.7 – 20.3)	13.6 (13.3 – 14.0)	15.8 (15.5 – 16.1)
Medical Cardiac ICU	-	20.2 (17.0 – 23.9)	14.9 (12.4 – 17.9)	10.8 (9.5 – 12.3)
Medical-surgical ICU	-	19.8 (14.2 – 27.1)	14.7 (14.2 – 15.2)	18.4 (17.9 – 18.8)
Pediatric ICU	-	7.9 (6.0 – 10.1)	5.5 (4.9 – 6.0)	6.5 (5.9 – 7.1)
Newborn ICU (1501-2500 g)	-	6.68 (3.0 – 12.7)	9.50 (7.9 – 11.3)	10.1 (7.9 – 12.8)

CI, confidence interval; ICU, intensive care unit; DA-HAI, device associated health care associated infection; INICC, International Nosocomial Infection Control Consortium; CAUTI, catheter-associated urinary tract infections; CLAB, central line-associated blood stream infection; VAP, ventilator-associated pneumonia