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

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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 1,000 ICU-days. Ventilator-associated pneumonia posed the greatest risk (16.7 per 1,000 ventilator-days in the adult ICUs, 12.8 per 1,000 ventilator-days in the pediatric ICU, and 0.44 per 1,000 ventilator-days in the neonatal ICUs), followed by central line–associated bloodstream infections (4.6 per 1,000 catheter-days in the adult ICUs, 8.23 per 1,000 ventilator-days in the pediatric ICU, and 9.6 per 1,000 ventilator-days in the neonatal ICUs) and catheter-associated urinary tract infections (4.2 per 1,000 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: Nosocomial infection; hospital infection; health care–acquired infection; device associated infection; central line–associated bloodstream infection; ventilator-associated pneumonia; catheter-associated urinary tract infection; developing country; limited-resource country; infection control; surveillance; incidence density; length of stay; mortality; microorganism profile; bacterial resistance.

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Conflict of interest: None to report.

0196-6553/$36.00

doi:10.1016/j.ajic.2010.10.018

In the United States as well as several other high-income countries, device-associated (DA) health care–associated infection (HAI) surveillance in the intensive care unit (ICU) plays an important role in hospital infection control and quality assurance.[1] Likewise, surveillance was reported by the Centers for Disease Control and Prevention's (CDC) Study of the Efficacy of Nosocomial Infection Control as an efficacious tool to reduce DA-HAIs.[2]

In a growing body of literature, DA-HAIs are considered the principal threat to patient safety in the ICU and are among the main causes of patient morbidity and mortality.[3-5] The CDC's National Nosocomial Infection Surveillance System and National Healthcare Safety Network (NHSN) have promulgated standardized criteria for DA-HAI surveillance.[6,7] This standardized

surveillance method allows for the determination of DA-HAI rates per 1,000 device-days, comparable among health care centers, and provides infection control practitioners (ICPs) with a detailed picture of the institutional problems that they face, allowing them to devise effective solutions.

In the context of an expanded framework for DA-HAI control, most of the relevant studies of ICU-acquired infections have been carried out in industrialized countries.[8] Few published studies have reported data on DA-HAI rates using standardized definitions in developing countries.[9-17]

The International Nosocomial Infection Control Consortium (INICC) was founded in 1998 when selected hospitals from Latin America were invited to participate in a project to measure DA-HAI rates using standardized definitions and methodologies.[18] This project rapidly expanded to include hospitals located in different parts of the world. Today the INICC is a worldwide network of approximately 300 ICUs from 40 countries in Latin America, Asia, Africa, and Europe.[9-17]

On a monthly basis, health care facilities send routinely gathered data to the INICC, which enters the reports into an international database. INICC hospital members provide general medical and surgical inpatient services to adults and children hospitalized in the ICUs.

In the specific case of the Philippines, no data on DA-HAI rates have been published until now. The findings of the present study form an integral part of the INICC and reflect the outcome and process surveillance data that are collected systematically.

METHODS

Setting

This study was carried out in 6 adult ICUs (AICUs), including a burn ICU, a surgical ICU, a coronary ICU, a neurosurgical ICU, and 2 medical-surgical ICUs; 2 neonatal ICUs (NICUs); and 1 pediatric ICU (PICU) in 3 Philippine hospitals between January 2005 and December 2009. All 3 hospitals have an infection control team comprising a physician and an ICP with at least 2 years of experience in infection control (Table 1) and a microbiology laboratory to provide in vitro susceptibility testing of clinical isolates using standardized methods. Each hospital's Institutional Review Board approved the study protocol. Patient confidentiality was protected by codifying the recorded information, making it identifiable only to the infection control team.

Surveillance

On a daily basis, data were collected prospectively from each patient admitted to one of the 9 ICUs using specifically designed forms. The data were gathered according to the definitions of DA-HAI promulgated by the CDC's National Nosocomial Infection Surveillance System and NHSN[6,7] and following the methodology prescribed by the INICC.[18] ICPs collected data on central line–associated primary bloodstream infections (CLABSIs), catheter-associated urinary tract infections (CAUTIs), and ventilator-associated pneumonias (VAPs) occurring in patients hospitalized in an ICU. Corresponding denominator data, patient-days and specific device-days, were collected as well.

Definitions of DA-HAIs

VAP. VAP is indicated in a mechanically ventilated patient with a chest radiograph that shows new or progressive infiltrates, consolidation, cavitation, or pleural effusion. The patient also must meet at least one of the following criteria: new onset of purulent sputum or change in character of sputum, organism cultured from blood, or isolation of an etiologic agent from a specimen obtained by tracheal aspirate, bronchial brushing or bronchoalveolar lavage, or biopsy.

Laboratory-confirmed CLABSI. A CLABSI is laboratory-confirmed when a patient with a central venous catheter in place has a recognized pathogen isolated from one or more percutaneous blood cultures obtained after 48 hours of vascular catheterization and is not related to an infection at another site. The patient also must have at least one of fever (temperature $\geq$38°C), chills, or hypotension. With skin commensals (eg, diphtheroids, *Bacillus* spp, *Propionibacterium* spp, coagulase-negative staphylococci, or micrococci), the organism is cultured from two or more blood cultures. Clinical sepsis is suspected when a patient with a central venous catheter has at least one of the following clinical signs with no other recognized cause: fever (temperature $\geq$38°C), hypotension (systolic blood pressure $\leq$90 mmHg), or oliguria ($\leq$20 mL/hour).

CAUTI. For a diagnosis of CAUTI, a patient with a urinary catheter in place must meet one of two criteria: (1) one or more of the following sings and symptoms with no other recognized cause: fever (temperature $\geq$38°C), urgency, suprapubic tenderness, and urine culture positive for $\geq 10^5$ cfu/mL, with no more than two microorganisms isolated; and (2) positive dipstick analysis for leukocyte esterase or nitrate and pyuria ($\geq$10 leukocytes/mL) with no other recognized cause.

Culture techniques

VAP. In most cases, a deep tracheal aspirate from the endotracheal tube was cultured aerobically and Gram-stained.

CLABSI. The central line was removed aseptically, and the distal 5 cm of the catheter was amputated

Table 1. Features of the INICC hospitals and ICUs, hospitals A, B, and C, January 2005 to December 2009

Variable	Burn ICU	Surgical ICU	Coronary ICU	Medical-surgical ICU	Neurosurgical ICU	PICU	NICU	Overall
ICUs, n	1	1	1	2	1	1	2	9
Hospital type								
Academic	0	0	1	2	1	1	1	6
Private	1	1	0	0	0	0	1	3
Patients studied, n	191	225	847	1,331	293	252	1,813	4,952
Total ICU days	2,156	1,503	2,210	7,588	1,548	1,638	24,090	40,733
Device use*								
Ventilator-days	135	1,246	596	4,513	881	391	2,279	10,041
Ventilator use	0.06	0.83	0.27	0.59	0.57	0.24	0.09	0.25
Central line-days	9	84	739	3,025	268	486	625	5,236
Central line use	0.001	0.06	0.33	0.40	0.17	0.30	0.03	0.13
Urinary catheter-days	402	1,397	1,236	4,886	1,924	214	-	10,093
Urinary catheter use	0.19	0.93	0.56	0.64	0.99	0.13	-	0.25

*DU ratios were calculated by dividing the total number of device-days by the total number of patient-days. Device-days are the total number of days of exposure to the device (central line, ventilator, or urinary catheter) by all of the patients in the selected population during the selected time period. Patient-days are the total number of days that patients are in the ICU during the selected time period.

and cultured using a standardized semiquantitative method.[19] Concomitant blood cultures were drawn percutaneously in all cases.

CAUTI. A urine sample was aseptically aspirated from the sampling port of the urinary catheter and cultured quantitatively.

In all cases, standard laboratory methods were used to identify microorganisms, and a standardized susceptibility test was performed.[20]

DA-HAI rate calculation

Outcomes measured during the surveillance period included the incidence density rate of VAP (number of cases per 1,000 mechanical ventilator-days), CLABSI (number of cases per 1,000 central line-days), and CAUTI (number of cases per 1,000 urinary catheter-days). The rates of VAP, CLABSI, and CAUTI per 1,000 device-days were calculated by dividing the total number of DA-HAIs by the total number of specific device-days and multiplying the result by 1,000.[21]

Device utilization (DU) ratios were calculated by dividing the total number of device-days by the total number of patient-days. Device-days are the total number of days of exposure to the device (ventilator, central line, or urinary catheter) for all of the patients in the selected population during the selected time period. Patient-days are the total number of days that patients are in an ICU during the selected time period.[21]

Length of stay and mortality calculation

Length of stay (LOS) and mortality data were collected prospectively from the daily INICC surveillance forms. The crude extra LOS is the difference between the LOS of patients in the ICU with a DA-HAI and that of patients in the ICU in the same period who did not acquire a DA-HAI.[18] The crude excess mortality was calculated as the difference between the crude overall case fatality rate of patients with a DA-HAI and that of patients hospitalized in the ICU during that period who did not acquire a DA-HAI.[18]

Statistical analysis

Data analyses were performed using EpiInfo version 6.04b (Centers for Disease Control and Prevention, Atlanta, GA) and SPSS version 16.0 (SPSS Inc, Chicago, IL). Baseline differences among rates were analyzed using χ^2 analyses for dichotomous variables and the *t* test for continuous variables. Relative risk (RR) ratios, 95% confidence intervals (CIs), and *P* values were determined for all outcomes.

RESULTS

Features of the study population

During the 5 years of the study, surveillance data were collected prospectively for 2,887 patients hospitalized in the AICUs for at total of 15,005 ICU-days, 252 patients hospitalized in the PICU for 1,638 days, and 1,813 patients hospitalized in the NICUs for 24,090 days (Table 1). Two of the hospitals were academic hospitals, and one was a private hospital.

The patients hospitalized in the AICUs acquired 183 DA-HAIs over 15,005 days, for an overall rate of 12.2 DA-HAIs per 1,000 ICU-days (95% CI, 10.5-14.1). The PICU patients acquired 9 DA-HAIs over 1,638 days, for an overall rate of 5.5 DA-HAIs per 1,000 ICU-days (95% CI, 2.5-10.4). The NICU patients acquired 7 DA-HAIs over 24,090 days, for an overall rate of 0.29 DA-HAIs per 1,000 ICU-days (95% CI, 0.12-0.60).

Table 2. DA-HAIs per 1,000 device-days in the participating ICUs, hospitals A, B, and C, January 2005 to December 2009

Type of ICU	Infection	Device type	Device-days	DA-HAIs, n	Distribution of DA-HAIs, %	Rate per 100 patients	Rate per 1,000 device-days
Adult	VAP	MV	7,371	123	67.2	4.3	16.7 (95% CI, 14.0-20.0)
Adult	CLAB	CL	4,125	19	10.4	0.7	4.6 (95% CI, 2.7-7.2)
Adult	CAUTI	UC	9,845	41	22.4	0.4	4.2 (95% CI, 3.0 -5.7)
Pediatric	VAP	MV	391	5	55.6	2.0	12.8 (95% CI, 4.1-29.6)
Pediatric	CLAB	CL	486	4	44.4	1.6	8.2 (95% CI, 2.2-20.1)
Pediatric	CAUTI	UC	214	0	0	0	0
Neonatal	VAP	MV	2,279	1	14.3	0.1	0.44 (95% CI, 0.01-2.45)
Neonatal	CLAB	CL	625	6	85.7	0.3	9.60 (95% CI, 3.5-20.8)

CL, central line; *MV*, mechanical ventilator; *UC*, urinary catheter.
*Rate per 1,000 device-days: Rates were calculated by dividing the total number of DA-HAIs by the total number of specific device-days by all of the patients in the selected population during the selected time period and multiplying the result by 1,000.

VAP represented 67.2% of all DA-HAIs in the adult ICUs, 55.6% of those in the PICU, and 14.3% of those in the NICU. CLABSI represented 10.4% of all DA-HAIs in the AICUs, 44.4% of those in the PICU, and 85.7% of those in the NICUs. CAUTI represented 22.4% of all DA-HAIs in the AICU and 0% of those in the PICU (Table 2).

DU ratio

The DU ratio for mechanical ventilation was 0.49 in the AICUs, 0.24 in the PICU and 0.09 in the NICUs; that for central lines was 0.27 in the AICUs, 0.30 in the PICU, and 0.03 in the NICUs; and that for urinary catheters was 0.66 in the AICUs and 0.13 in the PICU (Table 2).

DA-HAI rate, mortality, and LOS

Mortality data are presented in Table 3, and LOS is summarized in Table 4.

VAP. The VAP rate was 16.7 per 1,000 mechanical ventilation-days (95% CI, 14.0-20.0) in the AICUs, 12.8 per 1,000 mechanical ventilation-days (95% CI, 4.1-29.6) in the PICU and 0.44 per 1,000 mechanical ventilation-days (95% CI, 0.01-2.45) in the NICUs (Table 2).

CLABSI. The CLABSI rate was 4.61 per 1,000 central line-days (95% CI, 2.7-7.2) in the AICUs, 8.23 per 1,000 central line-days (95% CI, 2.2-20.1) in the PICU, and 9.6 per 1,000 central line-days (95% CI, 3.5-20.8) in the NICUs. Of the CLABSIs, 72% were laboratory-confirmed and 28% were identified as clinical sepsis (Table 2).

CAUTI. The CAUTI rate was 4.16 per 1,000 urinary catheter-days (95% CI, 3.0-5.7) in the AICUs and 0.0 in the PICU (Table 2).

Microorganism profile and bacterial resistance

Overall, 21.1% of all DA-HAIs were caused by *Acinetobacter* spp, 67.2% of which were resistant to piperaciline-tazobactam; 19.7% were caused by *Pseudomonas* spp, 56.6% of which were resistant to imipenem, 17.6% were resistant to ceftazidime, and 33.3% were resistant to piperaciline; 13.2% by *Enterobacter* spp, 15.4% of which were resistant to imipenem; 13.2% by *Klebsiella* spp, 53.8% of which were resistant to ceftazidime and 50% were resistant to ceftriaxone; 6.6% by *Candida* spp; 6.6% by *Escherichia coli* sp, 53.3% of which were resistant to ceftriaxone; 3.9% by *Staphylococcus aureus*, 84.0% of which were methicilin-resistant; 5.3% by coagulase-negative staphylococci, 89.0% of which were methicillin-resistant; 4.7% by *Stenotrophomonas* spp; and 2.6% by *Enterococcus* spp (Table 5).

DISCUSSION

Although DA-HAIs are a well-recognized primary and serious cause of patient morbidity and attributable mortality in the developing countries,[9-17] this is the first multicenter study to report DA-HAI rates in selected ICUs in the Philippines. DA-HAIs are also an important factor in the rapidly increasing costs of health care.[9,10,22,23] Several studies in the United States have indicated that the incidence of DA-HAI can be reduced by as much as 30%, with correlative reductions in health care costs. Of note, those studies were conducted in US hospitals with infection control programs that included targeted device-associated surveillance.[2]

Moreover, a study conducted in two Philippine NICUs demonstrated that infection control interventions are feasible and possibly effective in that area. The investigators found that although hand hygiene compliance improved and overall mortality decreased during the intervention period, rates of colonization with drug-resistant pathogens and of sepsis did not change significantly at either NICU.[24] But that study reported only the overall rate of DA-HAIs, not the DA-HAI rate per 1,000 device-days as in the present study.

A study of 3 adult ICUs in Malaysia found a DA-HAI rate of 20.6 per 1,000 bed-days,[25] significantly higher than the rate of 12.2 per 1,000 bed-days in our adult

Table 3. Crude extra mortality of patients with DA-HAIs in the participating ICUs, hospitals A and B, January 2005 to December 2009

Type of ICU	Type of patient	Patients	Crude mortality	Crude extra mortality	RR	95% CI	*P* value
Adult	Patients without DA-HAI, %	2,291	6.8%	-	-	5.8-7.9	
Adult	Patients with CLABSI, %	10	10.0%	3.2%	1.48	0.21-10.56	.695
Adult	Patients with VAP, %	72	9.7%	3.0%	1.44	0.67-3.06	.3454
Adult	Patients with CAUTI, %	26	3.8%	−2.9%	0.57	0.08-4.06	.5683
Pediatric	Patients without infection, %	240	3.8%	-	-	1.7-7.0	
Pediatric	Patients with CLABSI, %	4	50.0%	46.3%	13.3	2.88-61.71	.0001
Pediatric	Patients with VAP, %	3	0.0%	−3.8%	Undefined	Undefined	.7373
Pediatric	Patients with CAUTI, %	0	-				
Neonatal	Patients without infection, %	1,729	5.6%	-		4.6-6.8	
Neonatal	Patients with CLABSI, %	4	25.0%	19.4%	4.46	0.62-32.0	.1033
Neonatal	Patients with VAP, %	0	-	-	-	-	-

Table 4. Crude extra LOS of patients with DA-HAIs in participating ICUs, hospitals A and B, January 2005 to December 2009

Type of ICU	Type of patient	Average LOS, days	Crude extra LOS, days	95% CI	RR
Adult	Patients without DA-HAI	4.3	-	4.1-4.4	-
Adult	Patients with CLABSI	16.2	11.9	9.0-33.5	3.79
Adult	Patients with VAP	12.4	8.2	9.9-15.8	2.91
Adult	Patients with CAUTI	11.9	7.7	8.3-18.0	2.79
Pediatric	Patients without DA-HAI	5.6	-	5.0-6.3	
Pediatric	Patients with CLABSI	17.0	11.4	6.9-62.5	3.03
Pediatric	Patients with VAP	10.7	5.1	4.0-52.1	1.90
Pediatric	Patients with CAUTI	0.0	0.0	0.0	-
Neonatal	Patients without DA-HAI	12.6	-	12.1-13.2	-
Neonatal	Patients with CLABSI	28.0	15.4	11.2-104.2	2.21
Neonatal	Patients with VAP	0	0.0	-	

ICUs. In that study, the most common DA-HAI was VAP, similar to our results. The PICU CLABSI rate was 8.23 per 1,000 central line-days (95% CI, 2.2-20.1), which is similar to the INICC's reported rate of 7.8 per 1,000 central line-days (95% CI, 7.1-8.5) and higher than the NHSN's mean rate of 3.1 per 1,000 central line-days (95% CI, 2.5-3.8). The NICU CLABSI rate of 9.6 per 1,000 central line-days (95% CI, 3.5-20.8) was similar to the INICC's rate of 13.9 per 1,000 central line-days (95% CI, 12.4-15.6) but higher than the NHSN's mean rate of 2.9 per 1,000 central line-days (95% CI, 2.8-3.0). The CLABSI rate in AICUs was 4.6 per 1,000 central line-days (95% CI, 2.7-7.2), lower than the INICC's rate in medical-surgical ICUs of 7.4 per 1,000 central line-days (95% CI, 7.2-7.7) but higher than the NHSN's mean rate of 1.5 per 1,000 central line-days (95% CI, 1.4-1.6).

In the Malaysian study,[25] the PICU VAP rate of 12.8 per 1,000 mechanical ventilation-days (95% CI, 4.1-29.6) was lower than the INICC's reported rate of 5.5 per 1,000 mechanical ventilation-days (95% CI, 4.9-6.0) but higher than the NHSN's mean rate of 1.8 per 1,000 mechanical ventilation-days (95% CI, 1.6-2.1). The NICU VAP rate of 0.44 (95% CI, 0.01-2.5) per 1,000 mechanical ventilation-days was also lower than the INICC's rate of 9.5 per 1,000 mechanical ventilation-days (95% CI, 7.9-11.3) but similar to the NHSN's mean rate of 1.6 per 1,000 mechanical ventilation-days (95% CI, 1.5-1.8). Finally, the AICU VAP rate of 16.7 per 1,000 mechanical ventilation-days (95% CI, 14.0-20.0) was similar to the INICC's overall rate of 14.7 per 1,000 mechanical ventilation-days (95% CI, 14.2-15.2) but higher than the NHSN's mean rate of 1.9 per 1,000 mechanical ventilation-days (95% CI, 1.8-2.1).

A study of 38 hospitals in Thailand reported a CLABSI rate of 5.2 per 1,000 central-line days and a VAP rate of 11.2 per 1,000 mechanical ventilator-days in the PICUs. [26] These values are slightly lower than the CLABSI rate of 8.2 per 1,000 central-line days and the VAP rate of 12.8 per 1,000 mechanical ventilator-days found in our PICUs.

The mortality rate of patients without DA-HAI in the AICUs and the PICU in the present study was lower than the overall mortality rate reported in INICC ICUs (3.8% [95% CI, 1.7%-7.0%] and 6.8% [95% CI, 5.8%-7.9%] vs 14.4% [95% CI, 14.1%-14.7%]).[12] In addition, the mortality of NICU patients without DA-HAI of 5.6%

Table 5. Microorganism profile in the participating ICUs, hospitals A and B, January 2005 to December 2009

Microorganism related to DA-HAI	CLABSI-related	VAP-related	CAUTI-related	Overall
Acinetobacter spp	18.2%	25.5%	11.1%	21.1%
Pseudomonas spp	9.1%	27.7%	5.6%	19.7%
Enterobacter spp	0.0%	19.1%	5.6%	13.2%
Klebsiella spp	9.1%	14.9%	11.1%	13.2%
Candida spp	0.0%	0.0%	27.8%	6.6%
Escherichia coli	9.1%	4.3%	11.1%	6.6%
Coagulase-negative *Staphylococcus*	18.2%	2.1%	5.6%	5.3%
Staphylococcus aureus	9.1%	4.3%	0.0%	3.9%
Stenotrophomonas	9.1%	0.0%	11.1%	3.9%
Enterococcus spp	9.1%	2.1%	0.0%	2.6%

(95% CI, 4.6%-6.8%) in our study is lower than the 8.8% (95% CI, 8.0%-9.6%) in INICC NICUs. The average LOS in patients without DA-HAI and those with CLABSI and with VAP is our study s is similar to that reported in INICC PICUs.[12]

There are several explanations for the DA-HAI rates found in the present study. First, in the Philippines, compliance with guidelines for specific infection control practices is inadequate, national infection control surveillance is not conducted, and hospital accreditation is not mandatory. Similarly, as is commonly found in developing countries, there is an absence of legal regulations regarding the implementation of infection control programs.[27,28] Second, hand hygiene compliance is low in most Philippine health care facilities, reflecting the general situation in other developing countries.[27,28] Third, in the Philippines, as in most developing countries, the lack of administrative and financial support results in limited funds and lack of resources to deal with infection control, leading to such problems as insufficient supplies and overcrowded wards.[29] Finally, the inadequate number of trained staff and the use of antiquated technology in the Philippines are closely associated with a significantly increased risk of DA-HAI.[30]

The first measure to help reduce the risk of DA-HAI risk in hospitalized patients should be the institution of DA-HAI surveillance.[2] Next, basic, but effective, infection control practices need to be adopted to enhance DA-HAI prevention.[31-34] Needless to say, sharing knowledge and accurate information regarding this serious public health problem posed by DA-HAIs in these hospitals' ICUs can be highly motivating for developing effective high-quality infection control strategies. In this regard, there is evidence suggesting positive modifications in INICC hospital practices; hand hygiene compliance has increased substantially, performance feedback programs for hand hygiene have been instituted, and improved central line and urinary catheter care have resulted in significantly reduced incidences of VAP, CLABSIs, and CAUTIs in several INICC member hospitals.[14,35-41]

The present study has several limitations. First, our data might not adequately reflect the situation throughout the Philippines, given that we collected data from only 9 ICUs from 3 Philippine hospitals over a 5-year period. Second, the differences in DA-HAI rates among the INICC member hospitals and among various countries are associated with wide variations in the severity of illness. Similar to other cohort studies, in the present study some hospitals initiated clinical surveillance at different times.

In conclusion, DA-HAIs pose a huge and largely underrecognized threat to patient safety in the Philippines. Programs that have reduced the DA-HAI rates in INICC member hospitals outside of the Philippines provide health care personnel with simple but effective and inexpensive preventive strategies.[14,35-41] We expect this to lead to wider acceptance of infection control programs in all member hospitals of the consortium, which will lead to significant reductions in the rate of DA-HAIs, particularly in the ICU. Any hospital throughout the world can choose to participate in the INICC network, which was created to aid developing countries in preventing and controlling DA-HAIs and their adverse sequelae. INICC investigators receive the necessary training and methodological tools to conduct outcome and process surveillance, and the INICC's publication of confidentially collected data fosters the dissemination of relevant evidence-based data.

The authors thank the many health care professionals at each INICC member hospital who assisted with the DA-HAI surveillance in their hospital, including the surveillance nurses, clinical microbiology laboratory personnel, and physicians and nurses providing patient care during the study; Mariano Vilar, Debora Lopez Burgardt, and Alejo Ponce de Leon of the INICC headquarters in Buenos Aires, for their hard work and commitment to achieving the INICC's goals; and the INICC country coordinators (Altaf Ahmed, Carlos A. Álvarez Moreno, Apisarnthanarak Anucha, Luis E. Cuéllar, Bijie Hu, Hakan Leblebicioglu, Eduardo A. Medeiros, Yatin Mehta, Lul Raka, Toshihiro Mitsuda, and Virgilio Bonilla Sanchez) and INICC Advisory Board members (Carla J. Alvarado, Gary L. French, Nicholas Graves, William R. Jarvis, Patricia Lynch, Dennis Maki, Russell N. Olmsted, Didier Pittet, Wing Hong Seto, and William Rutala), who have so generously supported this unique international infection control network.

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