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Major article

Device-associated infection rates, bacterial resistance, length of stay, and mortality in Kuwait: International Nosocomial Infection Consortium findings

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Background: To report the results of the International Infection Control Consortium (INICC) study conducted in Kuwait from November 2013-March 2015.
Methods: A device-associated health care–acquired infection (DA-HAI) prospective surveillance study in 7 adult, pediatric, and neonatal intensive care units (ICUs) using the U.S. Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN) definitions and INICC methods.
Results: We followed 3,732 adult and pediatric patients for 21,611 bed days and 671 neonatal patients for 4,515 bed days. In the medical-surgical ICUs, the central line–associated bloodstream infection (CLABSI) rate was 3.5 per 1,000 central line days, the ventilator-associated pneumonia (VAP) rate was 4.0 per 1,000 mechanical ventilator days, and the catheter-associated urinary tract infection (CAUTI) rate was 3.3 per 1,000 urinary catheter days; all of them were lower than INICC rates (CLABSI: 4.9; VAP: 16.5; and CAUTI: 5.3) and higher than NHSN rates (CLABSI: 0.9; VAP: 1.1; and CAUTI: 1.2). Resistance of *Staphylococcus aureus* to oxacillin was 100%, resistance of *Acinetobacter baumannii* to imipenem and meropenem was 77.6%, and resistance of *Klebsiella pneumoniae* to imipenem and meropenem was 29.4%. Extra length of stay was 27.1 days for CLABSI, 22.2 days for VAP, and 19.2 days for CAUTI in adult and pediatric ICUs. Extra crude mortality was 19.9% for CLABSI, 30.9% for VAP, and 11.1% for CAUTI in adult and pediatric ICUs.
Conclusions: DA-HAI rates in our ICUs are higher than the CDC-NSHN rates and lower than the INICC international rates.

BACKGROUND

Increasingly in scientific literature, device-associated health care–acquired infections (DA-HAIs) are considered one of the principal threats to patient safety in the intensive care unit (ICU) and are among the main causes of patient morbidity and mortality.[1]

The effectiveness of implementing an integrated infection control program focused on DA-HAI surveillance was demonstrated in the many studies conducted in the United States whose results reported not only that the incidence of DA-HAI can be reduced by as much as 30%, but that a related reduction in health care costs was also feasible.[2]

In the same way, it is fundamental to address the burden of antimicrobial-resistant infections and report pathogens and

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susceptibility to antimicrobials of DA-HAI–associated pathogens; therefore, informed decisions can be made to effectively reduce transmission of resistant strains and their determinants, such as strains with phenotypes with very few available treatments with chances of success.[3]

For >40 years, the U.S. Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN)[4] has provided benchmarking U.S. ICU data on DA-HAIs, which have proven invaluable for researchers, and served as an inspiration to the International Nosocomial Infection Control Consortium (INICC).[5]

The INICC is an international nonprofit, open, multicenter, collaborative health care–associated infection control network with a surveillance system based on that of the CDC's NHSN.[6] Founded in Argentina in 1998, the INICC is the first multinational surveillance and research network established to measure, control, and reduce DA-HAI and surgical site infections (SSIs) hospital-wide through the analysis of data collected on a voluntary basis by a pool of hospitals worldwide.[7]

The INICC has the following goals: to create a dynamic global network of hospitals worldwide and conduct surveillance of DA-HAIs and SSIs using standardized definitions and established methodologies, to promote the implementation of evidence-based infection control practices, and to carry out applied infection control research; to provide training and surveillance tools to individual hospitals, which can allow them to conduct outcome and process surveillance of DA-HAIs and SSIs, to measure their consequences, and to assess the impact of infection control practices; and to improve the safety and quality of health care worldwide through the implementation of systematized programs to reduce rates of DA-HAIs and SSIs, their associated mortality, excess lengths of stay (LOSs), excess costs, antibiotic usage, and bacterial resistance.[8]

This report is a summary of data on DA-HAIs collected between November 2013 and March 2015 in 7 ICUs in 2 hospitals in Kuwait that participate in the INICC.[5,7]

METHODS

Background on the INICC

The INICC is comprised of >2,000 hospitals in 500 cities of 66 countries in Latin America, Asia, Africa, Middle East, and Eastern Europe and has become the only source of aggregate standardized international data on the epidemiology of health care–associated infections (HAIs) worldwide.[5] The INICC is focused on the surveillance and prevention of DA-HAI in adult ICUs, pediatric ICUs, and neonatal intensive care units (NICUs), step-down units, and inpatient wards and SSIs in surgical procedures hospital-wide.

Setting and study design

This prospective cohort surveillance study was conducted in 7 ICUs from 2 hospitals in Kuwait City through the implementation of the INICC Multidimensional Approach (IMA), as subsequently described. The types of ICUs participating in this study were as follows: 2 coronary, 2 medical-surgical, 2 pediatric, and 1 neonatal.

In accordance with the INICC's charter, the identity of all INICC hospitals and cities is kept confidential.

INICC multidimensional approach

The IMA includes the implementation of the methodology of the CDC's NSHN, but adds the collection of other data essential to increasing infection preventionists' sensitivity to detect HAIs and avoid underreporting.[6] According to standard CDC's NSHN methods, numerators are the number of HAIs of each type, and denominators are device days collected from all patients, as pooled data (ie, without determining the number of device days related to a particular patient and without collecting features or characteristics per specific patient).[6] This design differs from the INICC Surveillance System because the design of the cohort study through the INICC methods also includes collecting specific data per patient from all patients, both those with and those without HAI, collecting risk factors of HAIs, such as invasive devices, and collecting surrogates of HAIs, which include but are not limited to high temperature, low blood pressure, results of cultures, antibiotic therapy, LOS, and mortality. By collecting data on all patients in the ICU, it is possible to match patients with and without HAI by several characteristics to estimate extra LOS, mortality, and cost.

The IMA comprises the simultaneous implementation of the following 6 components for HAI control and prevention: (1) a bundle of interventions, (2) education, (3) outcome surveillance, (4) process surveillance, (5) feedback on HAI rates and consequences, and (6) performance feedback.

Outcome and process surveillance are conducted by means of an online platform called the INICC Surveillance Online System (ISOS). The ISOS comprises 15 modules: 10 for outcome surveillance and 5 for process surveillance. The modules of the outcome surveillance and process surveillance components may be used singly or simultaneously, but once selected they must be used for a minimum of 1 calendar month.

In this study, we present the results of the outcome surveillance modules. The results of process surveillance, feedback on HAI rates and consequences, and performance feedback were not included in this article because will be published in another future study.

Outcome surveillance

Outcome surveillance through the ISOS allows the classification of prospective, active, cohort surveillance data into specific module protocols that apply the NHSN definitions published in 2013.[6] The site-specific criteria include reporting instructions and provide full explanations integral to their adequate application.[6]

The ISOS surveillance includes the following 10 modules: cohort surveillance of HAIs in adult and pediatric ICUs; cohort surveillance of HAIs in NICUs; cohort surveillance of HAIs in inpatient wards and step-down units; cohort surveillance of surgical procedures and SSIs; aggregated surveillance of HAIs in adult and pediatric ICUs; aggregated surveillance of HAIs in NICUs; microorganism profile and bacterial resistance; laboratory-based surveillance of multidrug-resistant organisms and *Clostridium difficile* infections; antimicrobial consumption; and surveillance of needlestick injuries.

Data collection and analysis

The ISOS follows the INICC protocol and infection preventionists, who collected daily data on central line–associated bloodstream infections (CLABSIs), catheter-associated urinary tract infections (CAUTIs), and ventilator-associated pneumonias (VAPs) and denominator data, patient days, and specific device days in the ICUs.

These data were uploaded to the ISOS and were used to calculate DA-HAI rates per 1,000 device days, mortality, and LOS according to the following formulas: device days consisted of the total number of central line (CL) days, urinary catheter (UC) days, or mechanical ventilator (MV) days. Crude excess mortality of DA-HAI equals crude mortality of ICU patients with DA-HAI minus crude mortality of patients without DA-HAI. Crude excess LOS of DA-HAI equals crude LOS of ICU patients with DA-HAI minus crude LOS of patients without DA-HAI. Device utilization ratio (DUR) equals the total number of device days divided by the total number of bed days.

Training

The INICC chairman trained the principal and secondary investigators at the hospitals. Investigators were also provided with tutorial movies, manuals, and training tools that described in detail how to perform surveillance and upload surveillance data through the ISOS. In addition, investigators attended webinars, had continuous e-mail and telephone access to a support team at the INICC Central Office in Buenos Aires, Argentina.

Definitions

The ISOS uses the CDC's NHSN surveillance definitions and criteria for all specific types of HAIs published in 2013.[6]

Statistical analysis

EpiInfo version 6.04b (CDC, Atlanta, GA), SPSS 16.0 (SPSS, Chicago, IL), and INICC Online System version 2.0 (INICC, Buenos Aires, Argentina), were used to conduct data analysis. Relative risk ratios, 95% confidence intervals, and *P* values were determined for primary and secondary outcomes.

RESULTS

The mean length of the ICUs' participation in the INICC program ± SD is 15.7 ± 6.6 months (range, 4–22 months), which is detailed as follows: 1 coronary ICU participated for 4 months; 1 coronary ICU participated for 7 months; 1 medical-surgical ICU, 1 NICU, and 1 pediatric ICU participated for 17 months; 1 pediatric ICU participated for 18 months, and 1 medical-surgical ICU participated for 21 months.

For the outcome surveillance component, DA-HAI rates, DURs, crude excess mortality, crude excess LOS, by specific type of DA-HAI, microorganism profile, and bacterial resistance from November 2013-March 2015 are summarized in Tables 1-4.

Table 1 shows DA-HAI rates in all the participating ICUs. The highest CLABSI and CAUTI rates were found in the medical-surgical ICUs, and the highest VAP rates were found in the coronary ICUs. DA-HAI rates in the NICU were stratified by weight category. The highest CLABSI rates were found in the 0.750-1.000 kg birth weight category, and the highest VAP rates were found in the 1.001-1.500 birth weight category.

Regarding bacterial resistance of pathogens isolated from patients with DA-HAI in ICUs, we found a high resistance to imipenem or meropenem for *Acinetobacter baumannii* (77.6%; n = 49), *Pseudomonas aeruginosa* (63.0%; n = 27), and *Klebsiella pneumoniae* (29.4%; n = 17). *P aeruginosa* had also a high resistance to piperacillin-tazobactam (35.0%; n = 20), ciprofloxacin (29.6%; n = 27), and amikacin (23.3%; n = 30). *K pneumoniae* had also a high resistance to ceftriaxone (73.3%; n = 15). We also found a high resistance to ciprofloxacin for *Escherichia coli* and *Staphylococcus aureus* (100%; n = 2), to oxacillin for coagulase-negative *Staphylococcus* (50%; n = 2), and to vancomycin for *Enterococcus faecalis* (100%; n = 2).

Table 2 provides data on DURs for CL, UC, and MV and their respective confidence intervals. The highest CL, UC, and MV DURs were found in the medical-surgical ICUs. CL DUR was the highest in the

Table 1
Pooled means of the distribution of central line–associated bloodstream infection rates, ventilator-associated pneumonia rates, and catheter-associated urinary tract infection rates by type of location in adult and pediatric patients and central line-associated bloodstream infection rates and ventilator-associated pneumonia rates by weight category in neonatal patients, device-associated module, 2013-2015

Type of ICU	ICU, n	Patients, n	CL days, n	CLABI, n	CLABI rate	MV days, n	VAP, n	VAP rate	UC days, n	CAUTI, n	CAUTI rate
Adult and pediatric ICUs											
Coronary	2	1,174	406	0	0.0	233	3	12.9	495	1	2.0
Medical-surgical	2	2,002	14,819	52	3.5	11,885	47	4.0	11,399	38	3.3
Pediatric	2	556	2,037	2	1.0	3,484	1	0.3	1,383	2	1.4
Pooled	6	3,732	17,262	54	3.1	15,602	51	3.3	13,277	41	3.1
Neonatal ICU by birth weight category, kg											
<0.750	1	20	97	3	30.9	234	0	0.0			
0.750-1.000	1	46	218	8	36.7	324	0	0.0			
1.001-1.500	1	120	300	6	20.0	506	1	2.0			
1.501-2.500	1	255	258	1	3.9	554	1	1.8			
>2.500	1	230	305	0	0.0	453	0	0.0			
Pooled	1	671	1,178	18	15.3	2,071	2	1.0			

NOTE. Device-associated health care–acquired infection rates are expressed as health care–associated infection per 1,000 device days.
Abbreviations: *CAUTI*, catheter-associated urinary tract infection; *CL*, central line; *CLABSI*, central line–associated bloodstream infection; *ICU*, intensive care unit; *MV*, mechanical ventilator; *UC*, urinary catheter; *VAP*, ventilator-associated pneumonia.

Table 2
Pooled means of the distribution of central line utilization ratios, urinary catheter utilization ratios, and ventilator utilization ratios by type of location for adult and pediatric patients, device-associated module, 2013-2015

ICU type	ICU, n	Bed days	CL days	DUR, CL (95% CI)	MV days	DUR, MV (95% CI)	UC days	DUR, UC (95% CI)
Adult and pediatric ICUs								
Coronary	2	4,090	406	0.10 (0.09-0.11)	233	0.06 (0.05-0.06)	495	0.12 (0.11-0.13)
Medical-surgical	2	12,670	14,819	1.17 (1.15-1.19)	11,885	0.94 (0.93-0.94)	11,399	0.90 (0.89-0.90)
Pediatric	2	4,851	2,037	0.42 (0.41-0.43)	3,484	0.72 (0.70-0.73)	1,383	0.29 (0.27-0.30)
Pooled	6	21,611	17,262	0.80 (0.79-0.80)	15,602	0.72 (0.71-0.73)	13,277	0.61 (0.61-0.62)
Neonatal ICU by birth weight category, kg								
<0.750	1	511	97	0.19 (0.16-0.23)	234	0.46 (0.41-0.50)		
0.750-1.000	1	1,378	218	0.16 (0.14-0.18)	324	0.24 (0.21-0.26)		
1.001-1.500	1	2,025	300	0.15 (0.14-0.16)	506	0.25 (0.23-0.27)		
1.501-2.500	1	1,461	258	0.18 (0.16-0.20)	554	0.38 (0.35-0.40)		
>2.500	1	1,029	305	0.30 (0.27-0.32)	453	0.44 (0.41-0.47)		
Pooled	1	4,515	1,178	0.26 (0.25-0.27)	2,071	0.46 (0.44-0.47)		

Abbreviations: *CI*, confidence interval; *CL*, central line; *DUR*, device utilization ratio; *ICU*, intensive care unit; *MV*, mechanical ventilator; *UC*, urinary catheter.

Table 3
Pooled means of the distribution of crude mortality, crude excess mortality, length of stay, and crude excess length of stay of adult, pediatric, and neonatal intensive care unit patients with and without device-associated health care–acquired infection

Patients	Patients, n	Deaths, n	Pooled crude mortality, %	Pooled crude extra mortality, % (95% CI)	LOS, total days	Pooled average. LOS, days	Pooled average. extra LOS, days (95% CI)
Adult and pediatric ICUs							
Without DA-HAI	3,607	266	7.4	—	18,731	5.2	—
With CLABSI	44	12	27.3	19.9 (7.6-39.3)	874	19.9	14.7 (13.3-15.9)
With CAUTI	27	5	18.5	11.1 (0.0-34.9)	520	19.2	14.1 (12.4-15.6)
With VAP	34	13	38.2	30.9 (13.8-57.1)	755	22.2	17.1 (15.4-18.5)
Neonatal ICU							
Without DA-HAI	655	52	7.9	—	5,699	8.7	—
With CLABSI	18	7	38.9	30.9 (9.7-69.7)	644	35.8	27.1 (24.6-29.7)
With VAP	2	0	0	—	67	33.5	24.8 (17.4-33.6)

Abbreviations: *CAUTI*, catheter-associated urinary tract infection; *CI*, confidence interval; *CLABSI*, central line–associated bloodstream infection; *DA-HAI*, device-associated health care–acquired infection; *ICU*, intensive care unit; *LOS*, length of stay; *VAP*, ventilator-associated pneumonia.

Table 4
Benchmarking of device-associated health care–acquired infection rates in this report compared with the reports of the INICC (2007-2012) and U.S. NHSN (2013)

Type of ICU	This report (95% CI)	INICC report[5] (95% CI)	RR (95% CI), *P* value	U.S. NHSN report[4]	RR (95% CI), *P* value
Medical-surgical ICU					
CL, DUR	1.17 (1.15-1.19)	0.54 (0.54-0.54)		0.37	
CLABSI rate	3.5 (2.6-4.6)	4.9 (4.8-5.1)	0.71 (0.54-0.94), .0147	0.8	4.3 (3.2-5.7), .0001
MV, DUR	0.94 (0.93-0.94)	0.36 (0.36-0.36)		0.24	
VAP rate	4.0 (2.9-5.3)	16.5 (16.1-16.8)	0.24 (0.18-0.32), .0001	1.1	3.62 (2.6-4.9), .001
UC, DUR	0.90 (0.89-0.90)	0.62 (0.62-0.62)		0.54	
CAUTI rate	3.3 (2.3-4.6)	5.3 (5.2-5.8)	0.62 (0.45-0.85), .0036	1.3	2.6 (1.9-3.6), .0001
Pediatric ICU					
CL, DUR	0.42 (0.41-0.43)	0.50 (0.50-0.50)		0.45	
CLABSI rate	1.0 (0.1-3.5)	6.1 (5.7-6.5)	0.16 (0.04-0.6), .0032	1.2	0.79 (0.20-3.2), .7490
MV, DUR	0.72 (0.70-0.73)	0.53 (0.53-0.53)		0.37	
VAP rate	0.3 (0.2-4.6)	7.9 (7.4-8.4)	0.03 (0.005-0.26), .0001	0.7	0.37 (0.05-2.7), .3089
UC, DUR	0.29 (0.27-0.30)	0.31 (0.31-0.32)		0.21	
CAUTI rate	1.4 (0.2-5.2)	5.6 (5.1-6.1)	0.26 (0.06-1.0), .0396	2.5	0.58 (0.15-2.3), .4457
Newborn ICU (1,501-2,500 g)					
CL, DUR	0.18 (0.16-0.20)	0.21 (0.20-0.21)		0.17	
CLABSI rate	3.9 (0.1-21.6)	4.8 (3.7-6.1)	0.80 (0.11-5.8), .8299	0.6	6.88 (0.96-49.6), .0260
MV, DUR	0.38 (0.35-0.40)	0.10 (0.10-0.11)		0.06	
VAP rate	1.8 (0.0-10.1)	10.7 (8.4-13.4)	0.17 (0.02-1.21), .0446	0.5	3.32 (0.41-26.6), .2302

Abbreviations: *CAUTI*, catheter-associated urinary tract infection; *CI*, confidence interval; *CL*, central line; *CLABSI*, central line–associated bloodstream infection; *DUR*, device utilization ratio; *ICU*, intensive care unit; *INICC*, International Nosocomial Infection Control Consortium; *MV*, mechanical ventilator; *NSHN*, National Healthcare Safety Network; *RR*, relative risk; *UC*, urinary catheter; *VAP*, ventilator-associated pneumonia.

>2.500 kg birth weight category, and MV DUR was the highest in the <0.750 kg birth weight category.

Table 3 provides data on crude ICU mortality and LOS in patients hospitalized in each type of unit during the surveillance period, with and without DA-HAI, and crude excess mortality and LOS of adult and pediatric patients with CLABSI, CAUTI, and VAP. The DA-HAIs associated with a higher mortality were VAP in adult and pediatric patients and CLABSI in neonatal patients. The DA-HAIs associated with the longest LOS were VAP in adult and pediatric patients and CLABSI in neonatal patients.

Table 4 compares the rate results of this report from Kuwait with the INICC international report for the period 2007-2012 and with the U.S. NHSN report of 2013.[4,5] Overall, we found lower CLABSI, CAUTI, and VAP rates in this study than in the INICC international report, but we found higher DA-HAI rates in this study compared with the U.S. NHSN data. The DUR was higher in most cases as well, but the CL DUR was lower in the pediatric ICUs compared with the INICC and U.S. CDC's NHSN.

Table 5 compares the antimicrobial resistance rates of this report from Kuwait with the INICC international report for the period 2007-2012 and with the U.S. CDC's NHSN report of 2012.[3] In most cases, we found higher resistance rates than those found in the U.S. CDC's NHSN report.

DISCUSSION

Within the scientific literature addressing the burden of DA-HAIs in Kuwait's ICUs, it was shown that the DA-HAI rates found in their setting were higher than the rates reported by the NHSN.[4] In a study published in 2008 by Aly et al, the CLABSI rate was 2.30 per 1,000 CL days and the VAP rate was 9.1 per 1,000 ventilator days.[9] In a study published in 1999, 18.4% of the patients in the studied ICU from Kuwait had bacteremia, and 52% of the deaths in the ICU were related to this infection.[10] Finally, Salama et al found that the baseline rates in an ICU from Kuwait for VAP were 17.6 per 1,000 MV days and for CLABSI were 18.6 per 1,000 CL days.[11] These rates are higher than the ones that we found in this study and higher than the NHSN rates. In our Kuwaiti ICUs, DA-HAI rates and pooled DURs were similar or lower than the global INICC report and higher than the U.S. NHSN data.[4,5] Likewise, the antimicrobial resistance rates found in our ICUs were higher than the U.S. NHSN[3] and INICC[5] report rates for *S aureus* resistant to oxacillin, *E faecalis* resistant to vancomycin, *P aeruginosa* resistant to imipenem or meropenem and piperacillin-tazobactam, *A baumannii* resistant to imipenem or meropenem, and *K pneumoniae* resistant to ceftriaxone or ceftazidime and imipenem or meropenem. On the other hand, the resistance rates for *P aeruginosa* to amikacin were higher in this study than the U.S. NHSN report,[3] but lower than the INICC-reported

Table 5
Benchmarking of antimicrobial resistance rates in this report compared with the reports of the INICC (2007-2012) and U.S. NHSN (2009-2010)

	This report resistance, %	INICC resistance, %[5]	NHSN resistance, %[3]
Pathogen, antimicrobial	Pooled	CLABSI	CLABSI
Staphylococcus aureus			
Oxacillin	100	61.2	54.6
Enterococcus faecalis			
Vancomycin	50	12.2	9.5
Pseudomonas aeruginosa			
Ciprofloxacin	29.6	37.5	30.5
Piperacillin or piperacillin-tazobactam	35.0	33.5	17.4
Amikacin	23.3	42.8	10.0
Imipenem or meropenem	63.0	42.4	26.1
Klebsiella pneumoniae			
Ceftriaxone or ceftazidime	73.3	71.2	28.8
Imipenem or meropenem	29.4	19.6	12.8
Acinetobacter baumannii			
Imipenem or meropenem	77.6	66.3	62.6
Escherichia coli			
Imipenem or meropenem	0	8.5	1.9

Abbreviations: *CLABSI*, central line–associated bloodstream infection; *INICC*, International Nosocomial Infection Control Consortium; *NSHN*, National Healthcare Safety Network.

resistance rates.[5] By contrast, the resistance rates to ciprofloxacin for *P aeruginosa* and imipenem or meropenem for *E coli* were lower in this study than the U.S. NHSN report,[3] and they were also lower than the INICC-reported resistance rates.[5] These higher DA-HAI rates compared with the NHSN may be because in Kuwait low nurse-to-patient staffing ratios are usually present, which has proved to be highly connected to high DA-HAI rates in ICUs, hospital overcrowding, and an insufficient number of experienced nurses or trained health care workers.[12]

To reduce the hospitalized patients' risk of infection, DA-HAI surveillance is primary and essential because it effectively describes and addresses the importance and characteristics of the threatening situation created by DA-HAIs. This must be followed by the implementation of practices aimed at DA-HAI prevention and control. Additionally, participation in the INICC has played a fundamental role, not only in increasing the awareness of DA-HAI risks in the ICU, but also in providing an exemplary basis for the institution of infection control practices through the use of an online process surveillance tool.

The INICC program is focused on surveillance of DA-HAIs in the ICUs, step-down units, and general wards and surveillance of SSIs hospital-wide. In this particular study, we focused just on the ICUs (ie, health care settings with the highest health care–acquired rates), where patients' safety is most seriously threatened because of their critical condition and exposure to invasive devices.[12]

Over the last 12 years, the INICC has undertaken a global effort in Latin America, Asia, Africa, Middle East, and Europe to respond to the burden of DA-HAIs and has achieved extremely successful results by increasing hand hygiene compliance, improving compliance with other infection control bundles and interventions as described in several INICC publications, and consequently reducing the rates of DA-HAI and mortality.[13-17]

To compare a hospital's DA-HAI rates with the rates identified in this report, it is required that the hospital team concerned collect their data by applying the methods and methodology described for the NHSN and INICC, and then calculate infection rates and DURs for the DA-HAI module.

The particular and primary application of these data is to serve as a guide for the implementation of prevention strategies and other quality improvement efforts locally for the reduction of DA-HAI rates to the minimum possible level. Finally, it is of great importance to optimize the administration of anti-infectives to effectively control bacterial resistance.

Study limitations

The findings in this report did not consider the difference in time periods for the different data sources in the comparisons made with the INICC and NHSN.

Conclusions

The data presented in this report fortify the fact that DA-HAIs in Kuwait are a challenge for patient safety. It is the 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. This will lead to greater and stricter adherence to infection control programs and guidelines and the correlated reduction in DA-HAI and its adverse effects in the hospitals participating in the INICC and at any other health care facility worldwide.

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