ORIGINAL ARTICLE

Impact of the International Nosocomial Infection Control Consortium (INICC) Multidimensional Hand Hygiene Approach over 13 Years in 51 Cities of 19 Limited-Resource Countries from Latin America, Asia, the Middle East, and Europe

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OBJECTIVE. To assess the feasibility and effectiveness of the International Nosocomial Infection Control Consortium (INICC) multidimensional hand hygiene approach in 19 limited-resource countries and to analyze predictors of poor hand hygiene compliance.

DESIGN. An observational, prospective, cohort, interventional, before-and-after study from April 1999 through December 2011. The study was divided into 2 periods: a 3-month baseline period and a 7-year follow-up period.

SETTING. Ninety-nine intensive care unit (ICU) members of the INICC in Argentina, Brazil, China, Colombia, Costa Rica, Cuba, Greece, El Salvador, India, Lebanon, Lithuania, Macedonia, Mexico, Pakistan, Panama, Peru, Philippines, Poland, and Turkey.

PARTICIPANTS. Healthcare workers at 99 ICU members of the INICC.

METHODS. A multidimensional hand hygiene approach was used, including (1) administrative support, (2) supplies availability, (3) education and training, (4) reminders in the workplace, (5) process surveillance, and (6) performance feedback. Observations were made for hand hygiene compliance in each ICU, during randomly selected 30-minute periods.

RESULTS. A total of 149,727 opportunities for hand hygiene were observed. Overall hand hygiene compliance increased from 48.3% to 71.4% ($P < .01$). Univariate analysis indicated that several variables were significantly associated with poor hand hygiene compliance, including males versus females (63% vs 70%; $P < .001$), physicians versus nurses (62% vs 72%; $P < .001$), and adult versus neonatal ICUs (67% vs 81%; $P < .001$), among others.

CONCLUSIONS. Adherence to hand hygiene increased by 48% with the INICC approach. Specific programs directed to improve hand hygiene for variables found to be predictors of poor hand hygiene compliance should be implemented.

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The impact of hand hygiene before patient contact for infection prevention was demonstrated 160 years ago when Semmelweis studied the relationship between improved hand antisepsis and reduced mortality from puerperal sepsis.[1] Since then, it has been reported that improved hand hygiene practice reduces healthcare-associated infection (HAI) rates and antimicrobial resistance.[2-4]

HAIs threaten patient safety and cause patient morbidity and mortality.[5] Most studies of HAIs are from developed countries;[6] in limited-resource countries (LRCs), this problem

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had not been systematically addressed until the International Nosocomial Infection Control Consortium (INICC) started analyzing and publishing HAI rates determined using standardized definitions and methods.[7-11]

Hand hygiene remains the cornerstone in cross HAI prevention among patients. Successful interventions to improve hand hygiene have been reported from high-income countries[12] and from limited-resource countries.[3,13,14] From the 1980s, investigators have analyzed the effectiveness of interventions to improve hand hygiene, including the impact of supplies availability, published by Preston et al[15] in 1981; the use of reminders and posters in the workplace, published by Conly et al[16] in 1989; the use of monitoring and performance feedback, published by Mayer et al[17] in 1986; administrative support, published by Larson et al[18] in 1997; the introduction of alcohol-based hand rub (AHR), published by Graham[19] in 1990; and the effectiveness of education, published by Dubbert et al[20] in 1990 and by Dorsey et al[21] in 1996. The 1997 study by Larson et al[18] explicitly referred to a multidimensional approach that considered several interventions in a study conducted in the United States. Likewise, Rosenthal and colleagues have implemented programs in Argentina since 1993 combining administrative support, supplies availability, education and training, process surveillance, and performance feedback, which produced a sustained improvement in hand hygiene compliance[3,13] with a reduction in HAI rates.[3]

The US Centers for Disease Control and Prevention (CDC) published its hand hygiene guideline in 2002.[22] In 2005, the World Health Organization (WHO) launched the program Clean Care Is Safer Care to promote hand hygiene worldwide.[23] In 2009, the WHO published its guidelines, which included a combination of previously published data and a new formulation for AHR products, among several other recommendations.[4]

The purpose of this INICC study was to establish the baseline hand hygiene compliance rate by healthcare workers (HCWs) before patient contact, analyze risk factors for poor adherence, and implement and evaluate the impact of an INICC multidimensional hand hygiene approach (IMHHA) in hospitals from 19 limited-resource countries. The IMHHA includes the following elements: (1) administrative support, (2) supplies availability, (3) education and training, (4) reminders in the workplace, (5) process surveillance, and (6) performance feedback.

METHODS

Background on the INICC

The INICC is an international, nonprofit, open, multicenter HAI surveillance network with a methodology based on the US CDC's National Healthcare Safety Network.[24] The INICC is the first research network established to measure and control HAIs in hospitals through the analysis of standardized data collected on a voluntary basis by its member hospitals. Gaining new members since its international inception in 2002, the INICC is now composed of nearly 1,000 hospitals in 200 cities of 43 limited-resource countries in Latin America, Asia, Africa, the Middle East, and Europe and has become the only source of aggregate standardized international data on the epidemiology of HAIs from limited-resource countries.[11]

Study Setting

This study was conducted in 99 ICUs of 65 INICC member hospitals from 51 cities of 19 countries (Argentina, Brazil, China, Colombia, Costa Rica, Cuba, Greece, El Salvador, India, Lebanon, Lithuania, Macedonia, Mexico, Pakistan, Panama, Peru, Philippines, Poland, and Turkey), which were successively incorporated into the study over a period of almost 13 years. Each hospital has an infection control team (ICT) composed of at least 1 infection control practitioner and 1 physician. The HCW in charge of process surveillance at each hospital has at least 2 years of infection control experience. The study protocol was approved by the institutional review boards at each hospital, and patient confidentiality was protected by codifying the recorded information, making it identifiable only to the ICT.

Study Design

An observational, prospective, cohort, interventional, before-and-after multicenter study was conducted from April 1999 through December 2011. The study was divided into 2 periods: baseline and follow-up. The baseline period for hand hygiene compliance included episodes documented at each hospital during its first 3 months of participation, and the follow-up period included episodes following the fourth month of participation.

IMHHA

The IMHHA is implemented at each hospital from the beginning of its participation in the INICC. The approach includes the following 6 components: (1) administrative support, (2) supplies availability, (3) education and training, (4) reminders in the workplace, (5), process surveillance, and (6) performance feedback. Although the components are presented individually, they are interactive elements that must concur for the effective implementation of any "multidimensional" approach.

Administrative support. Hospital administrators of the participating hospitals agreed and committed to the study, attended infection control meetings to discuss study findings, and allocated supplies of hand hygiene products.

Supplies availability. During the study period, AHR bottles were available at the entrances of ICUs, nursing stations, and near the site of patient care (individual patient room entrances, bedside tables, and/or the feet of patient beds). Sinks with water supply, soap, and paper towels were available

TABLE 1. Characteristics of the Participating Hospitals (from April 1999 through December 2011)

	Value	No. of observations
No. of ICUs by country		
Argentina	11	21,998
Brazil	4	4,837
China	5	2,079
Colombia	11	13,512
Costa Rica	1	303
Cuba	1	434
Greece	1	2,315
El Salvador	3	1,691
India	18	32,869
Lebanon	1	1,728
Lithuania	1	1,565
Macedonia	1	3,418
Mexico	10	13,201
Pakistan	3	1,830
Panama	1	551
Peru	5	6,610
Philippines	9	17,844
Poland	1	102
Turkey	12	22,840
All countries	99	149,727
Type of ICU, no. (%)		
Adult	80 (81)	131,882
Pediatric	9 (9)	9,081
Newborn	10 (10)	8,764
All ICUs	99 (100)	149,727
Type of hospital, no. (%)		
Academic teaching	27 (42)	50,515
Public	16 (25)	40,530
Private community	22 (34)	58,682
All hospitals	65 (100)	149,727

NOTE. ICU, intensive care unit.

at the entrances of ICUs, nursing stations, and common areas of ICUs.

Education and training. At the study's ICUs, the ICT members provided 30-minute education sessions to HCWs during each work shift, at the beginning of the study period, and periodically during the follow-up period. Education included basic information about indications of hand hygiene and the correct procedures and technique for hand hygiene.

Reminders in the workplace. Poster reminders were displayed all around the hospital settings (ie, hospital entrance, corridors, ICT office, ICU entrances, nursing stations, beside each sink, and beside each AHR bottle). They included simple instructions on hand hygiene performance, in line with the contents of the education and training program.

Process surveillance. Process surveillance of hand hygiene practices consisted of the registrations of potential opportunities for hand hygiene[4] and the actual number of hand hygiene episodes, either with soap and water or AHR. HCWs' hand hygiene practice was directly monitored by an observer (a member of the ICT) following a standardized protocol and completing hand hygiene process surveillance INICC forms.[7] Observations were conducted unobtrusively at specific time periods distributed over 3 work shifts (morning, afternoon, and evening). HCWs were not aware of the schedule of the monitoring period. The monitoring included hand hygiene compliance before patient contact and before an aseptic task. Potential confounders of hand hygiene included type of ICU, professional category, sex, work shift, and type of contact.

Performance feedback. Every month, the INICC headquarters team prepares and sends to each participating ICU a final month-by-month report on compliance with hand hygiene. These charts contain a running tally of hand hygiene compliance by HCWs of the ICUs and compliance comparing several variables, such as sex, HCW professional status, ICU type, contact type, and work shift. Those charts were reviewed at monthly ICT meetings and were also posted in the ICUs to give performance feedback to the HCWs of the participating ICUs.[7] The performance feedback process started on average at the third month of participation.[7]

Training of the ICT for Process Surveillance

The ICT member investigators were self-trained by means of a procedure manual sent from the INICC headquarters in Buenos Aires specifying how to carry out the hand hygiene process surveillance and how to fill in the INICC forms.[7] ICT members had continuous telephone or e-mail access to a support team at the INICC headquarters.

Data Collection and Processing

Completed INICC process surveillance forms for hand hygiene were sent monthly by ICT members from each participating ICU to the INICC headquarters. The team at the INICC headquarters uploaded the data into a database, analyzed the data, and sent to ICT members of each participating ICU a report on hand hygiene compliance showing hand hygiene compliance by month, sex, HCW profession, ICU, work shift, and type of contact.[7]

Statistical Methods

Univariate analysis of variables associated with poor hand hygiene and of the impact of the hand hygiene approach. The aggregated independent variables (sex of HCWs, profession of HCWs, type of ICU, type of contact, etc) of all observed hand hygiene opportunities and hand hygiene compliance during the whole study and hand hygiene compliance during the baseline period versus that during the follow-up period were compared using the Fisher exact test for dichotomous variables and the unmatched Student *t* test for continuous variables. Relative risk (RR) ratios were calculated for comparisons of analyzed variables associated with hand hygiene using Epi Info, version 6 (CDC); VCStat (Castiglia) was used to calculate 95% confidence intervals (CIs). Differences with

TABLE 2. Distribution of Hand Hygiene (HH) Compliance by Type of Intensive Care Unit (ICU)

ICU type	No. of ICUs	No. of opportunities for HH	No. of HH compliance	HH compliance, mean % (95% CI)
Burn	1	1,324	1,176	89 (87–90.5)
Medical cardiac	7	16,067	10,729	64 (63.4–64.9)
Cardiosurgical	3	4,975	3,943	79 (78.1–80.4)
Medical	4	8,873	7,150	81 (79.7–81.4)
Medical-surgical	48	74,683	46,547	62 (62.0–62.7)
Newborn	9	8,764	7,101	81 (80.2–81.8)
Neurosurgical	6	9,715	7,767	80 (79.1–80.7)
Pediatric	10	9,081	6,443	71 (70–71.9)
Respiratory	1	413	272	66 (61.1–70.4)
Surgical	8	8,299	4,963	60 (58.7–60.9)
Trauma	1	6,671	5,449	82 (80.7–82.6)
Ward	1	862	757	88 (85.4–89.9)
All	99	149,727	101,877	68 (67.8–68.3)

NOTE. CI, confidence interval.

P values less than .05 by 2-tailed tests were considered significant.

Multivariate analysis of variables associated with poor hand hygiene. The aggregated described independent variables of all observed hand hygiene opportunities and hand hygiene compliance during the whole study were compared using logistic regression for dichotomous and continuous variables. Odds ratios with 95% CIs were calculated for comparisons of analyzed variables associated with hand hygiene using PASW Statistics 18. Differences with *P* values less than .05 by 2-tailed tests were considered significant.

Multivariate analysis of the impact of the IMHHA. Hand hygiene opportunities and hand hygiene compliance during baseline and follow-up were explored for changes in hand hygiene compliance rates following an ICU joining the INICC. We looked at the follow-up period stratified by 3-month periods over the first year, yearly for the second and third year of participation, and every 2 years from the fourth to the seventh year. We present the results of a logistic regression model to consider change in hand hygiene compliance in INICC-participating ICUs over time since the beginning of the hand hygiene surveillance. Odds ratios are presented, comparing each time period since the start of the surveillance with the average baseline of 3 months. This is a large data set, with ~150,000 observations, and so we were able to adjust for the effect of each ICU on hand hygiene compliance as a categorical variable in the analysis. Because of the different length of follow-up for each ICU (from 1 month to 7 years), for each time period only ICUs with follow-up in that time period were included in the baseline period used for calculating the odds ratio of hand hygiene compliance for that period.

TABLE 3. Hand Hygiene (HH) Compliance by Type of Variable—Univariate Analysis

Variable	HH %[a]	Comparison	RR (95% CI)	*P*
Sex				
Female	70	F vs M	0.90 (0.89–0.91)	.0001
Male	63			
HCW				
Nurses	72	Ns vs Ph	0.86 (0.85–0.88)	.0001
Physicians	62	Ns vs AS	0.78 (0.77–0.80)	.0001
Ancillary staff	57	Ph vs AS	0.91 (0.89–0.93)	.0001
Procedure				
Noninvasive	68	Ni vs I	0.98 (0.97–0.99)	.0037
Invasive	69			
ICU type				
Adult	67	Ad vs Pe	0.94 (0.92–0.97)	.0001
Pediatric	71	Ad vs Nb	0.83 (0.81–0.85)	.0001
Newborn	81	Nb vs Pe	0.88 (0.85–0.91)	.001
Work shift				
Morning	67	Mo vs Af	1.00 (0.99–1.02)	.7926
Afternoon	67	Mo vs Nt	0.92 (0.91–0.94)	.0001
Night	72	Af vs Nt	0.92 (0.91–0.94)	.0001

NOTE. Ad, adult; Af, afternoon work shift; AS, ancillary staff; CI, confidence interval; F, female; HCW, healthcare worker; I, invasive; ICU, intensive care unit; M, male; Mo, morning work shift; Nb, newborn; Ni, noninvasive; Ns, nurses; Nt, night work shift; Pe, Pediatric; Ph, physicians; RR, relative risk.

[a] No. of HH compliance/no. of HH opportunities.

RESULTS

From April 1999 through December 2011 (12 years and 9 months), we recorded a total 149,727 opportunities for hand hygiene before patient contact and before an aseptic task. Characteristics of participating hospitals are shown in Table 1.

Predictors of Poor Hand Hygiene Compliance

We observed 41,759 procedures in males and 76,645 in females; 97,450 in nurses, 28,609 in physicians, and 23,668 in ancillary staff; 105,181 prior to noninvasive patient contacts and 40,548 prior to invasive procedures; 131,822 in adult ICUs, 9,081 in pediatric ICUs, and 8,764 in neonatal ICUs;

TABLE 4. Hand Hygiene Compliance by Variable—Logistic Regression, Multivariate Analysis

Variable	Adjusted OR (95% CI)	*P*
Sex		
Baseline: female	1.0	
Male	0.91 (0.89–0.93)	<.001
Type of professional		
Baseline: nurses	1.0	
Physicians	0.68 (0.66–0.70)	<.001
Ancillary staff	0.52 (0.51–0.54)	<.001
Type of procedure		
Baseline: invasive	1.0	
Noninvasive	0.95 (0.93–0.98)	<.001
Type of ICU		
Baseline: newborn	1.0	
Adult	0.49 (0.47–0.52)	<.001
Pediatric	0.58 (0.54–0.62)	<.001
Work shift		
Baseline: night	1.0	
Afternoon	0.79 (0.76–0.81)	<.001
Morning	0.83 (0.81–0.86)	<.001

NOTE. CI, confidence interval; ICU, intensive care unit; OR, odds ratio.

and 68,584 during the morning shift, 46,741 during the afternoon shift, and 34,402 during the night shift. Table 2 shows hand hygiene compliance distribution among the different ICU types. Tables 3 and 4 show hand hygiene compliance according to each variable (sex, HCW professional status, type of procedure, type of ICU, and work shift) and association with poor hand hygiene, analyzed by univariate and multivariate statistical methods.

Components of the IMHHA

During the follow-up period, the 6 components of the IMHHA were applied simultaneously: 97% counted on administrative support and available supplies for hand hygiene and AHR; 98.5% educated HCWs (48.5% of them every month, 12.1% every 2 months, 15.2% every 3 months, 10.6% every 6 months, and 13.6% every year); 96% posted reminders (81.8% of them at the ICU entrance, 89.9% in common ICU areas, and 14.1% beside each bed); 100% conducted process surveillance; and 90.9% provided performance feedback (57% every month, 7% every 2 months, 18% every 3 months, 12% every 6 months, and 7% every year).

Impact of the IMHHA on Hand Hygiene Compliance

The average baseline period of the INICC ICUs was 3 months (range, 1–3 months), and their average follow-up period was 23.9 months (range, 1–80 months). Hand hygiene before patient contact or an aseptic task was 48.3% (95% CI, 47.6%–48.9%) during baseline and 71.4% (95% CI, 71.2%–71.6%) during follow-up (RR, 1.47 [95% CI, 1.45–1.51]; $P < .01$; Table 5). In Table 5, we present the results of a logistic regression model to consider change in hand hygiene compliance in INICC-participating ICUs over the whole study period.

Use of Hand Hygiene Products over Time

Use of aqueous chlorhexidine for hand washing was 100% in 1999, with a gradual reduction to 30% by 2005 and a final reduction to 20% in 2011. AHR use started in 2001, with variations from 5% to 25% from 2005 to 2010 and rise to 55% in 2011 (Figure 1).

DISCUSSION

Baseline hand hygiene compliance (48.3%) of HCWs at INICC ICUs was similar to that shown in previous studies, whose hand hygiene compliance rates ranged from 9% to 75%.[4] There was higher compliance among females, as also identified among individuals unrelated to health care, such as the findings of Guinan et al[25] showing higher compliance by female students. Compliance was higher among nurses, as also shown in a study by Rosenthal et al[3] in 2005, in which compliance was lower among physicians and ancillary staff than among nurses. Morning and afternoon shifts were significantly associated with lower hand hygiene compliance compared with the night shift. This can be explained by the fact that ICUs are more crowded and busy during day shifts than night shifts. In 1982, Haley and Bregman[26] overcrowding and understaffing hindered the efforts of HCWs to perform hand hygiene. We also showed that the highest hand hygiene compliance was in neonatal ICUs. Watanakunakorn et al[27] found remarkable variations by unit, with compliance being 56% in ICUs compared with 23% in non-ICUs. We also showed that type of contact influenced hand hygiene performance: superficial contacts were associated with lower compliance. Lipsett and Swoboda[28] showed that lower hand hygiene compliance was found in low-risk situations.

Use of hand hygiene products changed, showing an increase in AHR use and a reduction in chlorhexidine use. This could be related to increasingly wider promotion of AHR by the WHO.[4]

Our approach included administrative support. In 2003, Rosenthal et al[13] showed that higher hand hygiene adherence was associated with administrative support. We also included supplies availability. In 2000, Bischoff et al[29] demonstrated the effect of easily accessible AHR dispensers and revealed that the more dispensers per bed, the higher the hand hygiene compliance. We also included education and training, which were other basic independent interventions identified to foster adequate hand hygiene performance. As shown in 1990 by Dubbert et al,[20] an educational intervention including routine classes improved hand hygiene compliance by 97% over 4 weeks. Likewise but within the context of limited-resource countries, Rosenthal et al[13] showed that education of HCWs improved hand hygiene adherence and that compliance increased further if performance feedback was also imple-

mented. We also included reminders at the workplace. In 1989, Conly et al[16] showed the importance of reminders to raise the awareness of HCWs regarding the relationship between correct hand hygiene performance and HAI reduction.

We measured almost 150,000 opportunities for hand hygiene. Every month, the ICT provided performance feedback to HCWs of each ICU. This is a very motivating aspect of the IMHHA for HCWs. Knowing the outcome of their efforts reflected by the measurement of their practices and HAI incidence can be a most rewarding or consciousness-raising factor to ensure the IMHHA's effectiveness. Providing continuous feedback to industrial workers of the results of monitoring the quality of the final product to improve product quality stems from the epochal contributions of Deming.[30] Beginning in 1998 in Argentina[3,13,31-33] and in 2002 internationally,[7-11] the INICC has introduced process surveillance and performance feedback as a means to raise quality in health care to a new level, monitoring and providing continuous feedback not only of outcome data (rates of HAI) but also of the results of process surveillance (rates of hand hygiene compliance and other simple but highly effective evidence-based infection control practices), and it has shown that combining education with feedback of surveillance can bring about quantum reductions in the risk of life-threatening HAIs in ICUs.[3,13]

In this study of a large and remarkably diverse ICU population from 51 cities of 19 countries, we have shown that implementing the above-described 6 measures of the IMHHA in each ICU was followed by very substantial improvements in hand hygiene practices. Through the last decade, the INICC has undertaken a global effort in America, Asia, Africa, the Middle East, and Europe to respond to the burden of HAIs and has achieved extremely successful results by increasing hand hygiene compliance, improving compliance with other infection control interventions as described in several INICC publications, and consequently reducing the rates of HAI and mortality. Since 2002, in adult ICUs in 15 countries, the INICC has reduced the rate of central line–associated bloodstream infection (CLABSI) by 54%,[34] of catheter-associated urinary tract infection (CAUTI) by 37%,[35] of ventilator-associated pneumonia (VAP) by 56%,[36] and of mortality by 58%.[34] In pediatric ICUs in 5 countries, the INICC has reduced the rate of CLABSI by 52%,[37] of CAUTI by 57%,[38] of VAP by 31%,[39] and of mortality by 31%.[37] In neonatal ICUs in 10 countries, the INICC has reduced the rate of VAP by 33%.[40]

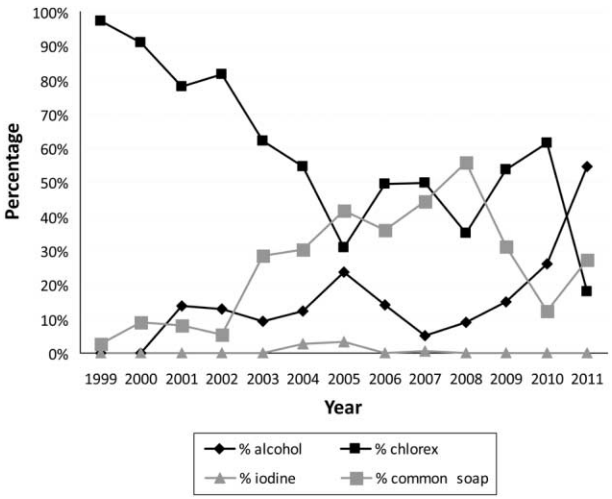

FIGURE 1. Type of product used for hand hygiene over the years of participation.

There are several limitation to this study, such as the INICC not measuring the My 5 Moments for Hand Hygiene as advised recently by the WHO. This is because the INICC started the IMHHA in 1998 in Argentina[3,13] and in 2002 internationally,[7] several years before the recommendation of the WHO was published in 2009; however, since 2009 the INICC has included the WHO's My 5 Moments for Hand Hygiene in its process surveillance forms and manuals.[4] In addition, it should be noted that this study used an observational, before-and-after methodology, which generates less strength and quality of evidence than other study designs. Direct ob-

TABLE 5. Hand Hygiene (HH) Improvement by Year of Participation

Time since joining INICC	No. of HH observations	No. of ICUs included	HH % (95% CI)	Adjusted OR
First 3 months (baseline)	11,267	99	48.3 (47.6–49.0)	1.0
Second 3 months	7,214	99	61.2 (60.5–61.9)	1.72 (1.65–1.81)
Third 3 months	5,511	89	67.2 (66.4–67.8)	2.10 (1.99–2.2)
Fourth 3 months	4,639	81	69.4 (68.6–70.1)	2.21 (2.10–2.33)
Second year	8,190	69	71.4 (70.9–71.9)	3.07 (2.92–3.23)
Third year	5,573	45	69.1 (68.4–69.7)	3.03 (2.84–3.22)
Fourth and fifth year	4,278	32	81.2 (80.1–81.6)	3.30 (3.07–3.52)
Sixth and seventh year	1,120	15	86.0 (85.2–86.8)	2.87 (2.57–3.19)
Considering time since follow-up as a continuous variable per year of participation	149,727	99	68.0 (67.8–68.3)	1.27 (1.25–1.28)

NOTE. Comparisons were made using only intensive care units (ICUs) with follow-up. That is, for comparison of hand hygiene compliance with baseline for the third year, only hospitals with at least 3 years of follow-up were included, and so on for the following periods. CI, confidence interval; INICC, International Nosocomial Infection Control Consortium; OR, odds ratio.

servation of adherence typically involves a Hawthorne effect, represents only a sample of all opportunities, and has inherent weaknesses, including assuring interobserver reliability, especially given the broad scope of this research in terms of facilities and countries. It should also be noted that the quality of hand hygiene technique is hard to capture, and we were not able to include many details in this investigation. Finally, we did not include in this study information on HAI and mortality rates, since there are several INICC publications focusing in these topics in relation to hand hygiene.

In conclusion, it has been demonstrated that the IMHHA improved hand hygiene compliance in limited-resource countries of 4 continents and contributed to the reduction of HAI rates and mortality rates.[11,34,36,37,39,40] It is the INICC's primary objective to foster infection control practices by freely facilitating elemental and inexpensive resources and tools to tackle this problem effectively and systematically, leading to greater and steady adherence to infection control programs and guidelines, such as hand hygiene compliance, and to the correlated reduction in HAIs and their consequences, such as mortality and extra cost.

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