

# Characteristics of hospitals and infection control professionals participating in the National Nosocomial Infections Surveillance System 1999

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The National Nosocomial Infections Surveillance (NNIS) system is the oldest and largest monitoring system for health care-acquired infections in the United States. This report describes both the characteristics of NNIS hospitals compared with those of US hospitals with 100 beds or more and their infection control programs. Overall, NNIS hospitals tend to have more hospital beds than the average for-comparable US hospitals. The majority of NNIS hospitals have affiliations with academic medical centers, and most have substantial intensive care units. Even though infection control professionals in NNIS hospitals spend most of their time in inpatient settings, 40% of their time is also spent in a variety of other settings, including home health, outpatient surgery or clinics, extended care facilities, employee health and quality management, and other clinical or administrative activities. As described in this report, the infrastructure of the NNIS system offers a national resource on which to build improved voluntary patient safety monitoring efforts, as outlined in the recent Institute of Medicine report on medical errors. (*Am J Infect Control* 2001;29:400-3.)

For more than 30 years, nosocomial infection surveillance has been the foundation on which performance improvement and infection prevention strategies have been built.<sup>1,2</sup> Recently, the landmark Institute of Medicine (IOM) report on medical errors identified nosocomial infection surveillance as a model for voluntary patient safety reporting systems.<sup>3</sup> In addition, substantial declines in infection rates in intensive care units (ICUs) and surgical patients at hospitals in the Centers for Disease Control and Prevention's (CDC) National Nosocomial Infections Surveillance (NNIS) system during the last decade serve as evidence that infection control efforts can substantially reduce adverse events (ie, infections), as described in the IOM report.<sup>4</sup>

The NNIS system is the nation's largest and oldest performance measurement system devoted to hospital-

acquired infections. The NNIS system has grown dramatically since its inception with 62 hospitals in 1970. The key personnel at participating hospitals who ensure the timely collection of accurate data are the hospitals' infection control professionals (ICPs). Participation in the NNIS system is limited to hospitals with 100 or more beds that meet minimum requirements for infection control staffing (ie, a minimum of 1 full-time equivalent [FTE] ICP for the first 100 occupied beds and 1 FTE for each additional 250 beds).

To better understand the composition and representativeness of the NNIS system, we conducted a survey of NNIS hospitals. This report presents the results of the survey, which includes characteristics of NNIS hospitals as compared with all US hospitals with 100 or more beds, the ICP workforce at NNIS hospitals, and the range of infection control activities performed.

## METHODS

In March 1999, we conducted a survey of ICPs at participating NNIS hospitals with a mailed, self-administered questionnaire. At each NNIS hospital, the survey was completed by the primary ICP contact. The survey contained items on hospital characteristics, ICU characteristics, and ICP work activities. For specific ICP work activities, only those surveys with complete

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**Table 1.** Total hospital beds and average daily census (comparison of National Nosocomial Infections Surveillance [NNIS] hospitals with all US hospitals with 100 or more beds)

Characteristic	N	Median	Interquartile range
Total hospital beds*			
NNIS system	227	360	250-500
US hospitals†	3321	210	141-333
Average daily census*			
NNIS system	221	239	150-218
US hospitals†	3321	133	82-350

\*P value ≤ .0001.

†US hospital data for hospitals with 100 or more beds from the American Hospital Association Annual Survey, 1997.

reporting for all ICPs at the hospital were included for analysis. After an initial mailing in March, nonrespondents were contacted by telephone or e-mail, and a second mailing was sent, if needed.

Completed surveys were mailed to the CDC, where data were entered into a computerized database for analysis. In addition to descriptive statistics, selected NNIS hospital characteristics were compared with those of US hospitals overall with use of data from the 1997 American Hospital Association Annual Survey.<sup>5</sup> Statistical analysis was performed with the  $\chi^2$  test (categorical variables) and the Kruskal-Wallis test (continuous variables).

## RESULTS

### NNIS hospitals

Overall, surveys from 229 (81%) of 280 hospitals participating in the NNIS system were completed. The vast majority of respondent hospitals were general medical-surgical hospitals (n = 195, 86%). Fourteen (6%) hospitals were children's or women's hospitals, and 17 (8%) were Veteran Affairs' or military hospitals. The majority of hospitals (58%) were academic medical centers, whereas fewer had graduate medical training only (11%), limited affiliation only (14%), or no academic affiliation (17%). Examples of special services provided in NNIS hospitals include allogeneic bone marrow transplantation in 62 (27%) hospitals and high-risk nurseries in 98 (44%) hospitals.

Compared with US hospitals with 100 or more beds, NNIS hospitals were larger in both total hospital beds (median, 360 vs 210;  $P = .0001$ ) and average daily census (median, 239 vs 133;  $P = .0001$ ) (Table 1). NNIS hospitals were similar in distribution to comparison US hospitals for most regions of the United States (ie, New England, East North Central, East South Central,

**Table 2.** Regional distribution (comparison of National Nosocomial Infections Surveillance [NNIS] hospitals with all US hospitals with 100 or more beds)

Regions*	US hospitals with ≥ 100 beds† (%) (n = 3290)	NNIS hospitals (n = 229) %	P value*
New England	4.9	4.4	NS
Mid-Atlantic	15.7	21.8	.02
South Atlantic	19.4	25.3	.03
East North Central	15.9	16.2	NS
West North Central	8.4	3.9	.02
East South Central	7.7	7.4	NS
West South Central	11.2	4.4	.001
Mountain	4.9	4.4	NS
Pacific	11.9	12.2	NS

NS, Not significant ( $P > .05$ ).

\*Regions = US Census regions (ie, New England [Maine, New Hampshire, Vermont, Connecticut, Massachusetts, Rhode Island; Mid-Atlantic [New York, New Jersey, Pennsylvania]; South Atlantic [Delaware, Maryland, Virginia, West Virginia, District of Columbia, North Carolina, South Carolina, Georgia, Florida]; East North Central [Ohio, Indiana, Illinois, Michigan, Wisconsin]; West North Central [Minnesota, Iowa, North Dakota, South Dakota, Nebraska, Missouri, Kansas]; East South Central [Kentucky, Tennessee, Alabama, Mississippi]; West South Central [Arkansas, Oklahoma, Louisiana, Texas]; Mountain [Idaho, Wyoming, Colorado, Utah, Montana, New Mexico, Nevada]; Pacific [Washington, Oregon, California, Alaska, Hawaii]).

†US hospital data for hospitals with 100 or more total hospital beds from the American Hospital Association Annual Survey, 1997.

Mountain, Pacific) (Table 2). NNIS hospitals are somewhat over-represented in Mid-Atlantic and South Atlantic states and under-represented in West North Central and West South Central states.

### Intensive care units

Overall, 227 (99%) respondents had ICUs (Table 3). Most hospitals reported having 1 to 3 ICUs. The most common types of ICUs were surgical, followed by coronary and neonatal ICUs. The median number of ICU beds per hospital was 38, with an interquartile range of 18 to 61. The largest units were neonatal ICUs. The smallest units were respiratory, burn, and neurosurgical ICUs.

### Infection control professionals

The median number of ICPs at NNIS hospitals was 2 (Table 4). The median number of occupied beds or average daily census per ICP was 115. The median number of hours worked by ICPs was 37. Of 229 hospitals, 127 (55%) returned complete information on ICP activities. Most ICP infection control activities (60%) were on acute inpatient wards. NNIS hospitals reported ICP activities in noninpatient areas such as home health (32/127, 25%), outpatient surgery (58/127,

**Table 3.** Intensive care unit bed size, National Nosocomial Infections Surveillance (NNIS) system, 1999

Characteristic	N	Median	Interquartile range
Total ICU beds	227	38	18-61
Specific ICU bed size			
Burn	17	8	7-10
Cardiothoracic	22	10	8-12
Coronary	78	10	8-12
Medical	73	12	10-14
Medical-surgical			
Major teaching	73	12	10-19
All others	77	15	11-18
Neonatal	79	30	18-40
Neurosurgical	34	8	6-10
Pediatric	63	9	6-16
Respiratory	3	6	5-8
Surgical	90	12	10-16
Trauma	13	10	10-12

46%), and extended care facilities (42/127, 33%). Most hospitals also reported that ICPs are involved in noninfection control activities such as employee health (62/127, 49%), quality management (66/127, 52%), and clinical or administrative activities (88/127, 69%).

## DISCUSSION

During the 1990s, the NNIS system grew substantially in size and scope.<sup>6</sup> The results of this study suggest that when compared with US hospitals overall, NNIS hospitals tend to be larger and are more likely to be academic medical centers. Overall, the distribution of NNIS hospitals approximates the distribution of all US hospitals with 100 or more beds, although NNIS hospitals are somewhat over-represented in the Mid-Atlantic and South Atlantic United States and under-represented in the West North Central and West South Central United States. These factors should be considered when interpreting results from the NNIS system.

Significant decreases in infections in ICU and surgical patients occurred at NNIS hospitals during the past decade.<sup>4</sup> Although the reasons for these decreases are multiple, well-trained and well-supported ICPs were a crucial factor in the reduction of infections at NNIS hospitals. Historically, the minimum infection control presence in hospitals associated with lower rates of hospital-acquired infections was 1 ICP per 250 beds.<sup>7,8</sup> Although there is no current consensus on what constitutes "adequate" numbers of ICPs in hospitals, NNIS hospitals have substantially more ICPs than the historical minimum. Probably more important than the ratio of ICPs to hospital beds is the role of ICPs within the hospital. Successful infection prevention efforts in both NNIS and non-NNIS hospitals often necessitate

**Table 4.** Activities of ICPs, National Nosocomial Infections Surveillance (NNIS) system, 1999

Characteristic	N	Median	Interquartile range
ICPs			
ICPs per hospital	228	2	1-3
Hospital beds per ICP	226	175	122-230
Average daily census per ICP	220	115	82-150
Total weekly ICP hours per hospital	228	80	56-105
Weekly hours per ICP	228	37	33-40
Infection control activities, total hours per week per hospital*			
Inpatient			
Acute inpatient	127	40	28-63
Other inpatient	64	5	2-9
Outpatient			
Surgery	58	2	1-4
Clinics	56	4	1-8
Dialysis	36	1	1-2
Other	8	2	1-2
Extended care	42	2	1-5
Home health	32	1	1-2
Physician offices	28	2	1-3
Noninfection control activities, total hours per week per hospital*			
Employee/occupational health	62	4	2-9
Quality management	66	6	3-13
Other activities	88	13	4-25

\*Only hospitals with complete reporting of infection control activities (n = 127) were included. Hospitals were excluded if no information on activities was given or if specific activity hour totals were not equal to total hours reported. For specific activity areas (eg, inpatient), N represents the number of hospitals reporting any ICP activity in the area.

that ICPs lead multidisciplinary teams, develop and implement interventions, and disseminate data to clinical staff.<sup>9,10</sup> Consequently, it is important to recognize that although the majority of ICPs at NNIS hospitals still perform inpatient infection control, the broad range of other activities listed in this report account for approximately 40% of ICPs' time. Maintaining a leadership role while navigating so many diverse health care settings will be an increasingly daunting challenge and opportunity for ICPs. Similarly, the NNIS system will also need to broaden the approaches to monitoring in settings outside the hospital and increase representation in areas currently under-represented. This study builds on previous work describing the broad work activities, educational background, and practice location of ICPs.<sup>11-13</sup>

Finally, as outlined in the IOM report, adverse health events such as medication errors and surgical injuries will also need substantial monitoring to improve

patient safety.<sup>3</sup> The infrastructure of the NNIS system offers a national resource on which to build some of these new monitoring efforts. The challenge will be to develop and implement these data-gathering and monitoring efforts while improving the capacity of trained professionals (eg, ICPs) to effectively respond when patient safety problems are identified.

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