Letter to the Editor

Nosocomial Infection Rates in an Italian Intensive Care Unit Using the National Nosocomial Infection Surveillance System

National Nosocomial Infection Surveillance (NNIS) System procedures (Centers for Disease Control and Prevention [CDC]) have been used worldwide to assess the incidence of nosocomial infections (NIs), particularly those related to invasive devices.[1-4] To assess the frequency of NIs in the intensive care unit (ICU) of the Catholic University in Rome, Italy, we conducted a prospective surveillance study from January 1995 through December 1998, after implementing the NNIS System.

Our ICU cares for all emergency and medical-surgical patients transferred from other units, except cardiac surgery, and had, by January 1995, 18 beds, which increased to 23 during 1996. The patient-to-nurse ratio was 3:1, with a bed-utilization rate of 98%. For this study, all patients were followed from the first day of admission to the ICU until 48 hours after transfer to another unit. The ICU staff was trained for the prevention of NIs according to the CDC guidelines. Intensive care unit fellows, together with their tutors, examined the patients and reviewed their charts and laboratory results on a daily basis and reported the cases to the same infectious diseases specialist over all the study years. The diagnosis of each type of NI and the criteria for determining the site of occurrence were based on CDC definitions (*NNIS Manual,* section XIII, May 1994). The data were collected by an infection control professional, who was trained in the NNIS methodology for diagnosis and case finding and who used the NNIS worksheet.

For each year of the study, the following rates were calculated according to the NNIS system: (1) the annual overall rate of exposure to invasive devices (number of device-days/number of patient-days); (2) device-associated NI rate per 100 patients (number of NIs at specific sites/number of patients at risk×100); (3) device-associated NI rate per 1,000 device-days (number of site-specific device-associated NIs/number of device-days×1,000); and (4) the annual rate of mortality (number of deaths/number of patients at risk). Statistics included a descriptive analysis performed with Epi Info (version 6.02; CDC, Atlanta, GA). Temporal trends over time were assessed by chi-square for trend analysis using the year 1995 as baseline. *P* values below .05 were considered statistically significant.

TABLE
ANNUAL RATE OF DEVICE-RELATED NOSOCOMIAL INFECTIONS

	1995	1996	1997	1998	Time Trend OR*	Time Trend *P*
Total bloodstream infection						
Total number	100	94	77	55	0.32	<.001
Rate×100 patients	14.49	10.44	7.65	5.08		
Rate×1,000 days central line	17.46	17.57	14.12	10.49		
Total pneumonia						
Total number	32	50	52	25	0.49	.005
Rate×100 patients	4.64	5.56	5.17	2.31		
Rate×1,000 days mechanical ventilation	6.20	10.71	9.19	4.49		
Total urinary tract infection						
Total number	60	54	60	55	0.56	.005
Rate×100 patients	8.70	6.00	5.96	5.08		
Rate×1,000 days urinary catheterization	9.32	7.94	8.00	7.21		
Primary bloodstream infection						
Total number	51	50	45	34	0.41	<.001
Rate×100 patients	7.39	5.56	4.47	3.14		
Rate×1,000 days central line	8.91	9.34	8.26	6.52		
Primary pneumonia						
Total number	17	29	29	16	0.59	.09
Rate×100 patients	2.46	3.22	2.88	1.48		
Rate×1,000 days mechanical ventilation	3.74	6.32	5.25	2.89		
Primary urinary tract infection						
Total number	27	18	26	32	0.75	.55
Rate×100 patients	3.91	2.00	2.58	2.95		
Rate×1,000 days urinary catheterization	4.61	2.64	3.46	4.19		

Abbreviation: OR, odds ratio.
* OR calculated for the year 1998.

Overall, 905 NIs developed in 463 (12.6%) of the 3,679 patients followed. We observed bloodstream infection (BSI) in 326 patients (36% of all NIs), pneumonia in 159 (17.6%), and urinary tract infection (UTI) in 229 (25.3%). Of the 905 total infections, 463 (51.2%) were primary infections, whereas 442 (48.8%) occurred in patients who already had a previous NI episode.

During the 4 years of the study, the number of patients observed and the overall days of ICU stay progressively increased from 690 to 1,083 and from 6,225 to 7,797, respectively, probably due to the increased availability of beds. The reasons for ICU admission, the severity of illness score for the unit as a whole, and the annual rate of mortality did not change over time, whereas the mean length of stay progressively decreased from 9.02 days in 1995 to 7.19 in 1998. Rates of exposure to

invasive device showed a progressive decline in the use of central lines (0.92-0.67) but not in the use of mechanical ventilation (0.73-0.71) or urinary catheterization (0.94-0.98).

The rates of NIs related to invasive devices are shown in the Table. The rate of infection progressively declined over time for BSI and, to a lesser but still highly statistically significant degree, for pneumonia and UTI. If we consider only first NI in a patient, the total number of BSIs significantly decreased, whereas pneumonia and UTI remained stable.

The most frequently isolated microorganisms were *Staphylococcus epidermidis, Staphylococcus aureus,* and *Candida* species for BSIs; *Pseudomonas aeruginosa, Candida* species, and *Escherichia coli* for UTIs; and *P aeruginosa* and *S aureus* for pneumonia.

Our study showed a progressive reduction of all site-specific infection rates that was more evident for BSI than for pneumonia and UTI. Indeed, it is likely that the high rate of BSI that was registered in our ICU at the beginning of the study was reduced by the decreased use of intravascular devices and the adoption of the CDC guidelines for the prevention of BSI. Comparing the results of the last year of our study with those of US ICUs,[1] we found that the rate of device-associated infections in our hospital was higher for BSI (10.49 vs 4.6) and for UTI (7.21 vs 5.1) but lower for pneumonia (4.49 vs 10.1). Of note, the use of devices in our patients was more frequent than in US hospitals (central line, 0.67 vs 0.47; mechanical ventilation, 0.71 vs 0.37; urinary catheterization, 0.98 vs 0.76), possibly depending on different patient characteristics (our ICU also cares for neurosurgical patients, which may not be represented in current NNIS rates). The lower incidence of pneumonia in our population could have been influenced by either an underreporting of cases due to the lack of standardized diagnostic methods in critical-care patients or to misclassification as clinical sepsis or laboratory-confirmed BSI.

Regarding etiologic agents, we found results similar to those observed in medical ICUs in the United States,[5] except for a less frequent isolation of enterococci as a cause of BSI (8% vs 16%). Finally, we found a high incidence (48.8%) of NIs in patients who already had a previous NI episode, confirming that a previous infection represents a relevant risk factor for a following one.

In conclusion, we found the NNIS System very useful to monitor device-related infection rates in our ICU. The epidemiological information achieved provided a starting point to improve the quality of infection control policies and to evaluate further the impact of such policies on outcome in critically ill patients.

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