

Editorial

Surveillance of Nosocomial Infections: A Fundamental Ingredient for Quality

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Nosocomial infections have been recognized for over a century as a critical problem affecting the quality of health care and a principal source of adverse healthcare outcomes. Today, nosocomial infections affect over 2 million patients annually in the United States, at a cost in excess of \$4.5 billion.¹ Among all major complications of hospitalization, nosocomial infections account for 50%; the remaining are medication errors, patient falls, and other noninfectious adverse events.²

A key tenet of the ongoing revolution in health care is the need to provide quality services while responsibly controlling costs. As fee-for-service reimbursement increasingly is replaced by capitated or other fixed-cost payments, dollars saved through prevention of nosocomial infections directly affect the financial well-being of healthcare institutions.¹ Several articles in this issue of the journal remind us of the importance of surveillance of nosocomial infections and its place in assessing and improving the quality of medical care.

THE VALUE OF SURVEILLANCE OF NOSOCOMIAL INFECTIONS TO ASSESS THE QUALITY OF CARE

Surveillance of nosocomial infections can be used to assess the quality of care in the hospital. Further, surveillance sometimes leads us down new

paths that indirectly aid in the understanding of the causes of nosocomial infections. For example, the article by Mulin and colleagues in this issue of the journal suggests that *Acinetobacter baumannii* is transmitted by cross-infection in an intensive-care unit and that the transmission can be interrupted by using isolation rooms.³ In another article in this issue, Stroud and his colleagues showed that primary bloodstream infection was the most common site of nosocomial infection among HIV-positive patients.⁴ However, this is a secondary use of surveillance data. If surveillance data are to be useful to improve quality of care, the hospital should focus on its most important and predominant problems and use surveillance methodology that adheres to sound epidemiological principles.

Evidence for this approach comes from the landmark Study on the Efficacy of Nosocomial Infection Control (SENIC) Project.⁵ In that study, highly trained data collectors evaluated over 338,000 patient records from a probability sample of US hospitals in order to calculate infection rates. The hospital's programs for surveillance, and for prevention and control, also were evaluated. The SENIC Project found that hospitals with the lowest nosocomial infection rates had strong programs both for surveillance and for prevention and control. Thus, the SENIC Project provided the strongest scientific basis to date for the assertion that surveillance is an essential ele-

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ment of an infection control program that improves the outcomes of patients. Other studies have suggested that surveillance has a strong scientific basis as well. For example, in all published studies to date, the collection, calculation, and dissemination of surgeon-specific surgical-site infection (SSI) rates to surgeons was found to lower the SSI rates.^{6,7} Indeed, the surveillance of nosocomial infections has a stronger scientific basis and a greater experience than that for any other adverse healthcare outcome.⁸ The principles of surveillance of nosocomial infections are strikingly similar to the principles developed by W.E. Deming for quality improvement in manufacturing.⁹ However, in order to use infection rates as a basis for measuring quality of care, these rates must be meaningful for comparison, either within a hospital over time or from one hospital to another. A comparable rate is one that controls for variations in the distribution of major risk factors associated with an event so that the rate can be meaningfully compared internally within the hospital or to an external standard. This process requires uniform definitions and protocols; methods of risk adjustment, dissemination, and comparison of nosocomial infection rates; and evaluation of the quality of the database. The Centers for Disease Control and Prevention (CDC)'s National Nosocomial Infections Surveillance (NNIS) System has provided an approach for this process.¹⁰

WHY IS THE VALUE OF SURVEILLANCE OF NOSOCOMIAL INFECTIONS OFTEN OVERLOOKED?

First and foremost, surveillance takes time and therefore costs money. In a 1995 survey of hospitals participating in the NNIS System, infection control practitioners (ICPs) reported spending a substantial portion of their time (approximately 45%) performing surveillance. Approaches to reduce the time investment will make surveillance of nosocomial infections more attractive to hospitals. Another offering in this issue suggests an approach to reduce this time investment.¹¹ Through automated data entry employing optical scanning technology, the authors reported that they reduced the time for data collection for SSI surveillance, particularly for demographic and risk factor information. Unfortunately, the most difficult part of the process, case-finding of the SSI, was not discussed fully by the authors.

Why does surveillance of nosocomial infections require such an investment of time? While some events in hospitals, eg, mortality, are relatively simple to identify, nosocomial infections often are difficult to identify and require substantial training to identify accurately. Because medical record abstractors per-

form poorly when attempting to find cases of nosocomial infection,¹² ICPs are positioned uniquely among hospital employees to determine whether a patient has a nosocomial infection. Standard definitions of nosocomial infections must be used so that consistency in data collection is maintained. This process should combine clinical findings and results of laboratory and other tests. There is no single source of information and no simple way of accurately determining the presence of a nosocomial infection without expending considerable time and effort, and this effort usually involves chart review at some point by a trained ICP. Unfortunately, progress in efforts to reduce the time involved in case-finding efforts has been slow. Despite its time-consuming nature, evidence suggests that accurate case-finding of nosocomial infections can be achieved. A recently completed study from the NNIS System suggests that the NNIS surveillance personnel at nine study hospitals were, in general, capable of providing accurate, quality data on nosocomial infections.¹³

A second reason for the apparent disregard of surveillance involves the historic use of the crude, overall nosocomial infection rate. As presently derived, this rate provides no means of adjustment for patients' intrinsic infection risk or extrinsic risks associated with exposures to medical interventions, eg, ventilator use that could lead to nosocomial pneumonia. Therefore, such a rate should not be used for inter-hospital comparison,¹⁰ and the CDC no longer recommends hospitalwide surveillance for this purpose. Indeed, using the crude overall rate, which may estimate, albeit poorly, the scope and magnitude of the problem of nosocomial infections, is counterproductive to quality improvement. While monitoring all areas of the hospital is appealing, the time-consuming effort to collect data on all patients acquiring nosocomial infections in hospitals is inefficient and often inaccurate. More importantly, the limited resources available to collect data on nosocomial infections may be better spent on a subset of patients for whom nosocomial infection data are more efficiently and accurately collected and for whom summary denominator data that adjust for infection risk can be collected.

INTRAHOSPITAL AND INTERHOSPITAL COMPARISON OF NOSOCOMIAL INFECTION RATES

The primary goals of intrahospital comparison are to identify areas within the hospital that may need further investigation and to measure the efficacy of interventional efforts. Because more than 90% of nosocomial infections do not occur in recognized epidemics,¹⁴ surveillance principally measures the

endemic rates of nosocomial infections. This is important to remember when one attempts to devise a prevention or control strategy to reduce the infection rate. If an outbreak occurs in a hospital, it often is because of failure of one prevention strategy over a short period of time. Because surveillance is ongoing and measures the endemic rate, efforts to lower a high endemic rate of infection usually require addressing multiple problems that have occurred over months or even years. Quantification of baseline nosocomial infection rates enables hospitals to objectively analyze the effect of intervention and follow the trends of their nosocomial infection rates. The report by Mulin and colleagues provides a superb example of this approach.³ Compared with interhospital comparison, intrahospital comparison of nosocomial infection rates provides better control of observer variation, particularly for nosocomial case-finding; frequency and technique of obtaining cultures; and case-mix. Unfortunately, comparison in a single hospital can be a major problem, because of sample size, especially when monitoring surgical procedures. This is one major reason to turn to multicenter studies, but there are others, too.

Interhospital comparison (or comparison to an external standard) entails comparing rates from one hospital with those of other hospitals participating in a multicenter surveillance system. Like intrahospital comparison, one of the main purposes of comparing infection rates of a hospital with those of other hospitals is to assess areas (or rates) that need further investigation. However, there are differences. The endemic infection rate may be very consistent within a hospital. Variation that signals an outbreak is usually absent. Without external comparisons, a hospital may not know if its endemic rate is high or, at least, at what area to direct the limited resources of the infection surveillance and control program. Indeed, comparisons across different surveillance systems can detect problems that would not have been uncovered by examining practices of hospitals within the same surveillance system.¹⁵

External comparisons, while very attractive, are more difficult in practice than intrahospital comparisons. Interhospital comparisons imply that a large number of hospitals are collecting data in the same manner. Differences in rates among hospitals are assumed by many to represent differences in the healthcare worker or in institutional practices in preventing nosocomial infections. A low nosocomial infection rate may be interpreted as an indication that the hospital's infection control program is effective in preventing nosocomial infections; however, the low rate simply may be the result of poor case-finding. An

infection rate found to be relatively high compared with that of other hospitals may suggest a potential problem in the hospital; it does not, however, establish that the problem is one of infection control, because there may be overzealous or inaccurate case-finding or the denominator data may be inaccurate. Even if the data are accurate, care has to be taken when interpreting the aggregated data from multiple hospitals. Monnet and colleagues in this issue showed the effect of the "influential data point"; that is, a single hospital's data, while accurate, deviates substantially from the other hospitals' data and influences the aggregated data set.¹⁶ Because of these uncertainties, interhospital comparisons, at present, should be used only as an initial guide for setting priorities for further investigation.

CHALLENGES FOR THE FUTURE

The use of interhospital comparison of nosocomial infection rates faces a variety of challenges in the era of healthcare reform.¹⁷ For example, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has announced that its ORYX initiative will integrate outcomes and other performance-measurement data into the accreditation process (see www.jcaho.org/perfmeas/oryx/oryx_frm.htm). For the first time, accredited organizations will be required to collect performance data related to outcomes of patient care and to submit those data to the JCAHO on a continuing basis. By December 31, 1997, each accredited hospital and long-term-care organization must choose a performance-measurement system that best meets its needs. Accredited organizations may choose from among 60 performance-measurement systems that have contracted with the JCAHO. Hospitals will be required to begin submitting data to the JCAHO no later than the first quarter of 1999. Nosocomial infection rates are included in a number of these performance-measurement systems. The CDC's NNIS System was among the 71 systems initially reviewed and approved by the JCAHO's Council on Performance Measurement. However, the NNIS System presently is not one of the 60 systems that are under contract with the JCAHO. For the NNIS System to participate in the JCAHO's Performance Measurement System, the contract sent by the JCAHO would need to be revised to be consistent with federal law, Section 308(d) of the Public Health Service Act and CDC policy. Section 308(d) of the Public Health Service Act states that the identity of NNIS hospitals must remain confidential. The CDC's Office of General Counsel currently is reviewing several options for CDC participation.

One aspect of interhospital comparison of infection rates that is particularly troubling is demand for data that are publicly available. The recently completed NNIS Evaluation Study has suggested that, while data on nosocomial infections generally are reported accurately, sensitivity (underreporting of infections) was a more serious problem than other measures of accuracy such as predictive value positive or specificity. When the added pressure of publicly available data is added to a process that already has a tendency to miss cases of nosocomial infection, the possibility of serious underreporting of infections becomes cause for ardent concern. While the ORYX initiative currently does not provide for public access of data, pressure nonetheless may exist to underreport adverse events because the JCAHO is, effectively, the regulator of hospitals. Validation of data is difficult and time-consuming, but will be essential if data from performance-measurement systems are to be credible. Because of the uncertainties in interhospital comparisons, several members of the Society for Healthcare Epidemiology of America plan to meet this summer with members of the JCAHO in an attempt to help examine the benefits of the ORYX initiative to hospitals.

QUALITY IMPLICATIONS

The challenges of interhospital comparison of nosocomial infection rates are many, but evidence from the NNIS System suggests that such comparisons can help reduce the rate of nosocomial infections.¹⁸ Many NNIS hospitals have reported using the aggregated NNIS data as a useful benchmark for internal quality improvement.¹⁸ Demonstrating the value of surveillance data to both the hospital's patient-care personnel and administration is essential. However, it is most important that patient-care personnel perceive value in the data; if they do, they will rely on the data for decisions and alter their behavior in ways that should reduce the incidence of nosocomial infections. By changing the behavior of caregivers, surveillance of nosocomial infections can improve the quality of patient care.

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