Readers' Forum

Surveillance for Surgical Site Infections: The Uses of Antibiotic Exposure

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ABSTRACT

Conventional methods of surveillance for surgical site infections are resource intensive, thus creating an incentive to develop simpler alternatives. Antibiotic exposure may serve as a satisfactory marker for a physician's belief that infection is present and, therefore, may be a more efficient, and perhaps more accurate, measure than identification of an explicit diagnosis in the medical record. Surveillance strategies that use antibiotic exposure may provide resource-efficient adjuncts for surveillance of surgical site infections or be used in selected circumstances as substitutes for conventional surveillance methods *(Infect Control Hosp Epidemiol* 1994;15:717-723).

BACKGROUND AND SIGNIFICANCE OF NOSOCOMIAL INFECTIONS

The importance of surveillance for nosocomial infections is widely acknowledged. Its goals include determining baseline risks of infections, identifying clusters of infections, assessing the effect of control measures, reducing rates of nosocomial infections, and providing data for comparisons within and across institutions, groups of patients, providers, and time periods.

A number of studies have suggested that active surveillance programs result in lower rates of nosocomial infections, including surgical site infections. In 1974, the Study of the Efficacy of Nosocomial Infection Control (SENIC) was established by the Centers for Disease Control and Prevention (CDC) with the objectives of estimating the magnitude of nosocomial infections in U.S. hospitals, describing the extent to which hospitals had adopted the infection surveillance and control program approach, and determining the effectiveness of this approach in reducing nosocomial infection risks. This study was motivated in large part by a growing concern over the cost effectiveness of infection control activities. The initial results of the SENIC project were published in 1985 and suggested that the combination of ongoing surveillance of infections that included a system for reporting surgical wound infection rates back to surgeons, active control efforts, and qualified staff could prevent up to 35% of surgical wound infections among high-risk patients and 41% among low-risk patients.[1] Olson et al[2,3] described a 5-year prospective study and 10-year follow-up of surgical wound infections involving monthly dissemination of information to all involved surgeons, associated with a significant decline in wound infection rates and an estimated cost savings of $3 million during a 10-year period. Cruse and Foord[4] conducted a lo-year prospective study of surgical wound infections, including regular reporting of infection rates to surgeons, and found a significant reduction in wound infection rates within 6 months of instituting surveillance. These studies suggest that reporting of infection risks is associated with reduced rates of surgical site infections, although the presence of confounding factors limits interpretation of these findings. Surveillance data now are used routinely by

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hospitals to develop strategies for preventing and controlling surgical site infections.

Surveillance data also are useful for accreditation and quality improvement/quality assurance organizations as indicators of the quality of patient care. In 1964, the Joint Commission on Accreditation of Healthcare Organizations made infection surveillance a responsibility of the medical staff, and in 1976 incorporated a detailed surveillance system into their standards for accreditation.[5]

Despite general agreement regarding the importance of surveillance, there is a lack of consensus over which surveillance methods are best for obtaining infection information. In order to support the functions described above, surveillance data must use uniform and meaningful definitions that can be applied efficiently to the entire target population. Conventional surveillance for surgical site infections, arguably the infection toward which the greatest effort is directed, is limited by inherent variability in the source data, most importantly on its usual dependence on a physicians assigning a diagnosis of infection, a designation that either may be omitted from the medical record or provided inappropriately. In addition, conventional surveillance also requires substantial commitment of skilled practitioner resources. Because of these limitations, there is a need for alternative surveillance systems that depend on objective data that can be collected with less time and effort.

We believe analysis of the timing and duration of postoperative antibiotic exposure may be a useful and efficient tool for identifying events of interest, including classically defined surgical site infections, other problems with wound healing, unusual patterns of antibiotic use, potential problems in hospitals' medical record diagnosis coding systems, and pharmacy dispensing records. We discuss below the advantages and disadvantages of conventional surveillance methods and consider the potential use of antibiotic surveillance to achieve many of its goals.

SURVEILLANCE METHODS FOR DETECTION OF SURGICAL SITE INFECTIONS

The most widely applied definition for surgical site infection is that used by the CDC for the National Nosocomial Infections Surveillance (NNIS) system.[11] This definition includes clinical and laboratory data as well as physician diagnosis. The NNIS system, for example, requires as criteria for superficial surgical site infection that "infection occurs within 30 days after the operative procedure and involves only skin and subcutaneous tissue of the incision, and patient has at least one of the following: a) purulent drainage from the superficial incision, b) organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision, c) at least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is deliberately opened by surgeon, unless incision is culture negative, or d) diagnosis of superficial incisional surgical site infection by the surgeon or attending physician." Similar definitions have been developed for deep and organ space surgical site infections.

Several sources, including microbiology data, clinical ward rounds, medical records, and physician and nursing reports, must be used to determine the presence or absence of these elements. The effectiveness of methods that use these data to identify nosocomial infections can be assessed by comparing several components of each method, including informativeness of the data obtained, accuracy and consistency of the information, resources needed to obtain the data, and significance of the infections identified in terms of excess morbidity and cost. These factors also affect the feasibility of interhospital comparisons of nosocomial infection rates.

The most rigorous surveillance for nosocomial infections uses a specially trained physician who examines each patient, each hospital record, and all nursing care plans and verifies all microbiologic information.[7-9] The difficulties of maintaining such a system in routine practice are obvious. NNIS criteria use clinical data and physician's diagnosis, often based on chart review, in conjunction with microbiology culture data to identify patients with nosocomial infections. These data elements are both inherently variable and difficult to monitor in routine practice because of the intensity of labor required. The components of this surveillance system and the problems associated with these components are discussed below (Tables 1 and 2).

Physician's Diagnosis

Although physician diagnosis of surgical site infection is not a requirement, it is one criterion that satisfies the NNIS definitions for surgical site infections. The sensitivity of physician diagnosis used alone to detect surgical site infection is unclear. Retrospective review of medical charts for diagnoses has shown substantial variability among physician documentation.[7,10] Eickhoff et al[11] examined the use of physician self-report forms as compared with prevalence studies involving medical record review of all hospitalized patients and found a sensitivity of only 14% to 34% for detecting infections. The information obtained from a positive diagnosis of nosocomial infection documented by a physician may be informative; however, there is little published information

TABLE 1
SENSITNITY OF SURVEILLANCE METHODS

Method	Infection Type	Sensitivity	Reference
Physician self-report forms	All nosocomial	0.14-0.34	11
Routine ICP surveillance without direct exam	SSI	0.84	
Retrospective chart review	SSI	0.73-0.80	10
Microbiology reports	All nosocomial	0.33-0.71	13, 15
Integrated computer-based surveillance	All nosocomial	0.90	16
Antibiotic use	All nosocomial (cesarean section)	0.81	22

Abbreviations: ICP = Infection control practitioner. SSI = Surgical site infection

addressing this issue. Obtaining this information is labor intensive because it requires review of the medical records or systematic queries to physicians.

Examination of Surgical Site

A number of studies[2,4,12] have included daily examination of the surgical site as a component of their gold standard surveillance methodology. Freeman and McGowan[7] used a surveillance system including examination of all patients by a specially trained physician as their gold standard method for comparison with other surveillance methods. Wenzel et al[13] noted that physicians found 1.1 times as many infections after examination of patients as were detected by prospective medical record review. Direct examination of all postoperative wounds, however, is very time and labor intensive.

Medical Chart Review

Chart review allows access to a broad range of information, including microbiology and clinical data, as well as physician's diagnosis. The sensitivity of chart review for identifying any nosocomial infections was examined in a pilot project for SENIC[10] and was found to range from 66% to 80%, with a specificity of 94% to 99%, compared with intensive prospective surveillance. The average sensitivity of this method to detect surgical site infections was 76%.

Cardo et al[12] compared surgical site infection data obtained by infection control practitioners using routine surveillance techniques, primarily involving medical chart review (discussions with patients' nurses and physicians and examination of the surgical site were performed only for cases for which the diagnosis was unclear), with data obtained by a hospital epidemiologist who, in addition to reviewing each patient's medical record, examined each patient's wound on a daily basis and found comparable sensitivity and specificity.

Wenzel et al[13] retrospectively reviewed the medical charts of all patients admitted to a hospital during a l-month period and found a sensitivity to detect any nosocomial infection of 90%, at the cost of many hours of work. However, use of nursing care plan (Kardex) information, to identify patients most likely to have nosocomial infections, reduced time spent on chart review significantly. The amount of information gleaned from review of medical charts can be variable and depends on the completeness of medical records and the experience of the reviewer. Thus, considerable variability among reviewers and institutions can be seen.[14]

Microbiology Data

The sensitivity of microbiology culture data for detecting infections varies among studies. Laxson et al[15] reviewed a random sample of medical charts and found that 71.4% of the 70 patients identified as having evidence of nosocomial infections had at least one positive culture; this figure represented a sensitivity of 84% when patients admitted for terminal care were eliminated. They also reviewed the charts of 100 randomly selected patients with positive cultures and found a specificity for identifying nosocomial infections of 48%. The sensitivity and specificity for detecting surgical site infections in particular were not determined.

Evans et al[16] used a computer system with a broad database and a knowledge base of programmed medical logic to develop an infectious diseases monitor in which microbiology and pharmacy data were used to identify patients with infections, including those meeting NNIS and SENIC criteria for nosocomial infection. During a 2-month period, 155 patients with nosocomial infections were identified by routine or computer surveillance. Computer surveillance identified 90% of these patients, compared with routine surveillance, which identified 76%. Both methods had a false-positive rate of about 20%. Surgical wound infections were not reported separately. Evans et al[16] also found that routine surveillance required 138 hours to obtain these data, while computer surveil-

TABLE 2
ADVANTAGES AND DISADVANTAGES OF VARIOUS SURVEILLANCE METHODS FOR DETECTION OF SURGICAL SITE INFECTIONS (SSI)

Data Source	Advantages	Disadvantages
Physician's diagnosis	Reflects physician's assessment of infection	Inconsistent documentation Subjective Usually requires medical chart review
Medical chart review	Broad range of information	Labor-intensive Dependent on completeness of records Reauires exoerienced reviewer
Microbiology data	Resource-efficient Can be integrated with other hospital databases to yield high sensitivity and specificity	Variable sensitivity and specificity when used alone Variability of culture practices Low yield from culture of cellulitis Difficult to distinguish colonization from infection Computerized systems integrated other databases require complex programming
Antibiotic exposure	Resource-efficient Automated pharmacy databases available in many hospitals May identify more clinically relevant infections May correlate better with physician's belief than other documentation	Depends on in-hospital pharmacy data Misses patients treated solely with drainage procedures Identifies patients treated with antibiotics for reasons other than SSI Unusual antibiotic prescribing or errors in record keeping will distort results

lance required 8.6 hours and an additional 45.5 hours for physician review. Although this system of computer-based surveillance was more sensitive and efficient than conventional surveillance methods, it requires implementation of complex computerized medical decision logic that integrates automated microbiology test results with other sources of automated data, requirements that generally are not available within hospitals.

Broderick et al[17] found the number of days on which wound cultures were obtained to be an independent risk factor for infection as detected by a combination of intensive prospective and retrospective surveillance, with a relative risk of 2.92 (95% confidence interval [CI_{95}], 1.76 to 4.84) for 1 day and 3.49 (CI_{95}, 1.60 to 7.59) for more than 2 days.

A major disadvantage contributing to the inconsistency of results obtained through use of microbiology data is that the likelihood of obtaining cultures of wound specimens may vary by service and institution,[18] as well as the fact that cellulitis often does not yield positive cultures.[19,20] The accuracy of microbiology data depends on the laboratory, culturing techniques, and the methods used to record the information. The effort required to obtain microbiology data depends on the data system used and the availability of automated laboratory data. In addition, interpretation of wound culture results (ie, indicating infection versus colonization) often is difficult.

USE OF ANTIBIOTIC EXPOSURE DATA FOR DETECTION OF NOSOCOMIAL INFECTIONS

Postoperative antibiotic exposure, which is not a component of the NNIS criteria, is one measure of a physicians belief that infection exists, because physicians treat most clinically important infections with antibiotics and ordinarily intend to restrict nonprophylactic use to situations in which they believe infection is likely. As such, it may be a valuable alternative means of identifying nosocomial infections that is objective and less difficult to determine than many other data sources. Antibiotic exposure can be used as a screening method to identify patients likely to be infected for further review. Beyond use as a screening tool, antibiotic exposure may serve as a method of surveillance independent of other data sources.

Antibiotic exposure has been used as a screening tool in a number of studies. The sensitivity of this method, one measure of its informativeness, has varied. In 1979, Feldman et al[21] reviewed the medical records of patients receiving intravenous gentamicin for evidence of any nosocomial infection and compared the results with those of routine surveillance. Use of gentamicin identified 51 of 131 infections found by routine surveillance, plus an additional 48 cases not identified by routine surveillance but confirmed by medical record review. About half of these 48 patients had fever and neutropenia without an obvious source of infection identified, and half had clinically apparent infections not detected by microbiology data and therefore unidentified by routine surveillance.

Wenzel et al,[13] as part of a study of a surveillance system using nursing care plan (Kardex) information, reviewed the charts of patients who were hospitalized during a l-month period and who received any antibiotic. This method identified 57% of the patients with nosocomial infections found by routine surveillance; antibiotic use or fever identified 70% of patients with nosocomial infections. This study, which included patients from all services of their hospital, did not differentiate between surgical site infections and other types of nosocomial infections.

Based on intensive prospective and retrospective surveillance, Broderick et al[17] found the unadjusted relative risk for nosocomial infection associated with antibiotic use to be 5.61 (CI_{95}, 2.63 to 11.97) for 1 to 5 days of antibiotic exposure and 31.30 (CT,, 6.85 to 29.92) for more than 5 days of antibiotics. Stepwise logistic regression identified five significant risk factors for nosocomial infection, including number of days of antibiotics, suggesting that antibiotic exposure data could be used independently of other risk factors to identify patients at risk for infection. None of the preceding studies provided separate information for identifying postoperative infections.

Hirschhorn et al[22] assessed the use of postoperative exposure to antibiotics and coded discharge diagnoses of infection as markers of nosocomial infection after cesarean section compared with the results of retrospective medical record review. Exposure to at least 2 days of parenteral antibiotics after the first postoperative day most clearly distinguished infected from noninfected patients, with a sensitivity of 81% and a specificity of 95%. They also found that antibiotic exposure was approximately as efficient as coded discharge diagnoses for detecting nosocomial infection. Comparison of automated antibiotic exposure information and coded discharge diagnoses also provided an efficient screen for errors in discharge coding, unexplained antibiotic use, and infectious and noninfectious morbidity.

Surveillance based on antibiotic exposure information may provide a resource-efficient mechanism for identifying patients with surgical site and other postoperative infections. Wenzel et al[13] found that to encompass all hospitalized patients receiving antibiotics, the charts for 36% of all hospitalized patients had to be reviewed; they concluded that this method was less efficient than routine surveillance. However, they did not look specifically at the task of identifying surgical site infections. They also did not use antibiotic exposure thresholds to identify patients exposed to sufficient days of antibiotics or to explore the use of antibiotic exposure as a sufficient means of identifying patients with infection without the use of chart review.

The labor needed to identify antibiotic exposure also depends on the source of data. In hospitals with automated pharmacy systems, relatively little time and effort are required to obtain this information; even in hospitals without such computerized systems, review of antibiotic use is less labor intensive than traditional surveillance techniques.

Antibiotic exposure may identify more clinically relevant surgical site infections than other, more traditional indices (such as culture data) because physicians may treat clinically significant infections with antibiotics even if they neither culture the wound nor document the presence of infection. One possible reason for the usefulness of antibiotic exposure as a marker for infection is suggested by Platt et al[23] in their randomized, double-blinded, placebo-controlled study of perioperative prophylaxis against wound infection following hemiorrhaphy or breast surgery. Postoperative antibiotic exposure was approximately as accurate a measure as modified NNTS criteria for assessment of the effectiveness of perioperative prophylaxis. This finding, which suggests that antibiotic use is highly correlated with the physicians diagnosis of infection, may provide the key to understanding the usefulness of antibiotic exposure data for detecting postoperative infections.

In contrast to NNIS, other studies have used antibiotic exposure as a component of the criteria for defining infection. The Israeli Study of Surgical Infections,[24] for example, used as a definition for wound infection "any continuous wound discharge on 2 or more days, together with at least two of the following: systemic treatment with antibiotics, local treatment such as drainage, and pure culture of the same pathogen on more than one occasion."

Use of antibiotic exposure as a substitute for traditional surveillance has not been well examined previously. The study by Hirschhom et al,[22] discussed above, suggests that the use of antibiotic exposure data, which many hospitals maintain in automated records, may provide a more rapid and efficient means of identifying patients with nosocomial infections than traditional surveillance activities and could take the place of more time-consuming and costly activities such as medical record review. This study involved a homogeneous group of patients cared for by physicians on the same specialty service of the same institution, who would tend to have similar patterns of antibiotic use and discharge coding practices. The generalizability of these findings can be established only through an assessment of the effectiveness of postoperative antibiotic exposure as a marker for nosocomial infections in different specialty patient populations and in different institutions.

CONCLUSIONS

Effective methods of surveillance that are more cost and time efficient than conventional surveillance are needed. The potential usefulness of antibiotic exposure as a marker for postoperative infection is suggested in the study by Hirschhorn et al,[22] in which at least 2 days of parenteral antibiotics after the first postoperative day was a sensitive and specific marker for postoperative infection among patients undergoing cesarean section. The effectiveness of this method of surveillance may stem from the fact that antibiotic use may be a more accurate indicator of a physician's belief that infection is present than is documentation of this fact in the medical record or the presence of microbiology culture data.

Another advantage of antibiotic exposure data is that it is relatively easy to obtain, particularly in hospitals with automated records. The advantage of use of antibiotic exposure data over a computerized system, as described by Evans et al,[16] is the relative simplicity of programming required and the reliance on pharmacy data alone rather than integration of information from multiple hospital databases. Even in hospitals where such computerized systems are not feasible, review of antibiotic use is less labor intensive than traditional surveillance methods. In any event, it usually is easier to obtain than diagnosis information and is less subject to variation in recording and detection. In addition, the results of Hirschhom et al's study suggest that the use of a "sufficient" amount of antibiotic may be useful for identification of uninfected patients with a complicated postoperative course or of unusual criteria for prescribing antibiotics, and for discovery of problems in assigning discharge diagnosis codes or tracking the use of antibiotics in hospitals.

Surveillance strategies that use antibiotic exposure provide resource-efficient adjuncts for surveillance of postoperative infections. For general comparisons, it might be sufficient to perform routine surveillance of antibiotic use to approximate the frequency of outcomes of potential interest or to perform routine comparisons across time and between institutions. When the proportion of these occurrences is small, it may be reasonable not to devote additional effort to these cases. When more detailed information is required, on either an ongoing or a temporary basis, additional evaluation of the reasons can be undertaken. In addition, quality improvement programs might monitor routinely the occurrence of discrepancies between antibiotic use and assignment of coded discharge diagnoses to identify potential problems in coding or drug dispensing records.

There are a number of potential disadvantages to surveillance systems based on in-hospital pharmacy data. In-hospital pharmacy data would be inadequate to identify infections that become manifest after discharge. However, surveillance methods for detecting these infections currently are lacking for most institutions. Outpatient antibiotic exposure information increasingly is available to managed care providers, offering the possibility that it can be used for postdischarge surveillance.

Second, many postsurgical patients without nosocomial infection receive postoperative antibiotics. It may be possible, however, to determine antibiotic exposure threshold values based on the timing and duration of antibiotics administered that best discriminate between patients with and without surgical site infections. Hirschhom et al,[22] for example, found that an antibiotic exposure threshold of at least 2 days of antibiotics after the first postoperative day provided optimal sensitivity and specificity for patients undergoing cesarean sections.

Third, surgical site infections treated with drainage procedures but without antibiotics will be missed using this method. It is unclear how often such management occurs. Addition of microbiology data or International Classification of Diseases, 9th Edition, discharge code screening to antibiotic exposure surveillance may increase the sensitivity of detecting such cases, albeit at the cost of requiring more complex computer programming.

In order to determine the usefulness of antibiotic surveillance, either as an adjunct to conventional surveillance or as a replacement in selected circumstances, it will be necessary to develop procedure-specific quantitative definitions of the amount of antibiotic that correlates with outcomes of interest and to conduct a rigorous assessment of the performance of these definitions in a wide array of hospitals.

REFERENCES

1. Haley R, Culver D, White J, et al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *Am J Epidemiol* 1985;121:182-205.
2. Olson M, O'Connor M, Schwa&k Surgical wound infections: a 5-year prospective study of 20,193 wounds at the Minneapolis VA Medical Center. *Ann Surg* 1984;199:253-259.
3. Olson M, Lee J. Continuous E-year wound infection surveillance. Results, advantages, and unanswered questions. *Arch Surg* 1990;125:794-803.

4. Cruse P, Foord R. A 5-year prospective study of 23,649 surgical wounds. Arch *Surg* 1973;107:206-210.
5. Joint Commission on Accreditation of Hospitals. ***Accreditation Manual for Hospitals.*** Chicago, IL: Joint Commission on Accreditation of Hospitals; 1976.
6. Horan T, Gaynes R, Martone W, Jarvis W, Emori G. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infect Control* Hosp *Epidemiol* 1992;13:606-608.
7. Freeman J, McGowan J. Methodologic issues in hospital epidemiology. I. Rates, case-finding, and interpretation. Rev *Infect Dis* 1981;3:658-667.
8. McGowan J, Finland M. Infection and antibiotic usage at Boston City Hospital: changes in prevalence during the decade 1964 1973. *J Infect Dis* 1974;129:421-428.
9. Freeman J, Rosner B, McGowan J. Adverse effects of nosocomial infection. *J Infect Dis* 1979;14:732-740.
10. Haley R, Schaberg D, McClish D, et al. The accuracy of retrospective chart review in measuring nosocomial infection rates: results of validation studies in pilot hospitals. *Am J Epidemiol* 1980;111:516-533.
11. Eickhoff T, Brachman P, Bennett J, Brown J. Surveillance of nosocomial infections in community hospitals. I. Surveillance methods, effectiveness, and initial results. *J Infect Dis* 1969;12:305-317.
12. Cardo D, Falk P, Mayhall G. Validation of surgical wound surveillance. *Infect Control Hosp Epidemiol* 1993;14:211-215.
13. Wenzel R, Osterman C, Hunting K, Gwaltney J. Hospital-acquired infections. I. Surveillance in a university hospital. *Am J Epidemiol* 1976;103:251-260.
14. Bimbaum D, King L. Disadvantages of infection surveillance by medical record chart review. *Am J Infect Control* 1981;9:15-17.
15. Laxson L, Blaser M, Parkhurst S. Surveillance for the detection of nosocomial infections and the potential for nosocomial outbreaks. I. Microbiology culture surveillance is an effective method of detecting nosocomial infection. *Am J Infect Control* 1984;12:318-324.
16. Evans R, Larsen R, Burke J, et al. Computer surveillance of hospital-acquired infections and antibiotic use. *JAMA* 1986;256:1007-1011.
17. Brodetick A, Motomi M, Nettleman M, Streed S, Wenzel R. Nosocomial infections: validation of surveillance and computer modeling to identify patients at risk. *Am J Epidemiol* 1990;131:734-742.
18. Haley R, Culver D, Morgan WM, White J, Emori TG, Hooton T. Increased recognition of infectious diseases in US hospitals through increased use of diagnostic tests, 1970-1976. *Am J Epidemiol* 1985;121:168-181.
19. Hook E, Hooton T, Horton C, Coyle M, Ramsey P, Turck M. Microbiologic evaluation of cutaneous cellulitis in adults. *Arch Intern Med* 1986;146:295-297.
20. Duvanel T, Auckanthaler R, Rohner P, Harms M, Saurat J. Quantitative cultures of biopsy specimens from cutaneous cellulitis. *Arch Intern Med* 1989;149:293-296.
21. Feldman L, Lamson M, Gallelli J, Bennett J. Surveillance of nosocomial infections by antibiotic monitoring. *JAMA* 1979;241:2806-2807.
22. Hirschhom L, Currier J, Platt R. Electronic surveillance of antibiotic exposure and coded discharge diagnoses as indicators of postoperative infection and other quality assurance measures. *Infect Control Hosp Epidemiol* 1993;14:21-28.
23. Platt R, Zucker J, Zaleznik D, et al. Prophylaxis against wound infection following herniorrhaphy or breast surgery. *J Infect Dis* 1992;166:556-560.
24. Simchen E, Wax Y, Pevsner B, et al. The Israeli Study of Surgical Infections (ISSI): I. Methods for developing a standardized surveillance system for a multicenter study of surgical infections. *Infect Control Hosp Epidemiol* 1988;9:232-240.

CDC Releases Strategic Plan for Emerging Infectious Diseases

by Gina Pugliese, RN, MS
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The Centers for Disease Control and Prevention (CDC) has released ***Addressing Emerging Infectious Disease Threats: A Prevention Strategy for the United States.*** The executive summary of this plan was published in the ***Morbidity and Mortality Weekly Report.***[1] The report summarizes the experience with a number of diseases posing serious threats to public health, such as the newly recognized hantavirus linked to a highly fatal pulmonary syndrome; the intestinal parasite, *Cryptosporidium,* causing the largest recognized outbreak of waterborne illness in U.S. history; an increasing incidence of drug resistance in community-acquired pneumococcal infections, linked to childcare centers and prior antibiotic use; and a newly described toxigenic *Vibrio cholerae 0139* that emerged in southern Asia.

Three recent reports from the National Academy of Science's Institute of Medicine point out that the ability of the U.S. public health system to deal with emerging infectious disease prob lems is in serious jeopardy.[2-4] To detect and prevent emerging infections effectively, significant improvements are needed in the public health systems, program design, and infrastructure. Because meeting this challenge requires cooperation among a wide range of public and private organizations, the CDC has developed its prevention strategy in partnership with other federal agencies, state and local health departments, academic institutions, professional societies, international organizations, and experts in public health, infectious disease, and medical microbiology.

The CDC plan contains four critical goals: surveillance, applied research, prevention and control, and public health infrastructure. Single cop ies of the plan are available from the CDC's National Center for Infectious Disease, Office of Program Resources—EP, Mailstop C-14, 1600 Cliion Rd. NE, Atlanta, GA 30333.

REFERENCES

1. Centers for Disease Control and Prevention. Addressing emerging infectious disease threats: a prevention strategy for the United States: executive summary. *MMWR* 1994;43(RR-5).
2. Institute of Medicine. *Emergency Infections: Microbial Threats to Health* in *the U.S.* Washington, DC: National Academy Press; 1992.
3. Institute of Medicine. *The* U.S. *Capacity to Address Tropical Infectious Disease Problems.* Washington, DC: National Academy Press; 1987.
4. Institute of Medicine. *The Future of Public Health.* Washington, DC: National Academy Press: 1988.