Hospital adoption of automated surveillance technology and the implementation of infection prevention and control programs

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Background: This research analyzes the relationship between hospital use of automated surveillance technology (AST) for identification and control of hospital-acquired infections (HAI) and implementation of evidence-based infection control practices. Our hypothesis is that hospitals that use AST have made more progress implementing infection control practices than hospitals that rely on manual surveillance.
Methods: A survey of all acute general care hospitals in California was conducted from October 2008 through January 2009. A structured computer-assisted telephone interview was conducted with the quality director of each hospital. The final sample includes 241 general acute care hospitals (response rate, 83%).
Results: Approximately one third (32.4%) of California's hospitals use AST for monitoring HAI. Adoption of AST is statistically significant and positively associated with the depth of implementation of evidence-based practices for methicillin-resistant *Staphylococcus aureus* and ventilator-associated pneumonia and adoption of contact precautions and surgical care infection practices. Use of AST is also statistically significantly associated with the breadth of hospital implementation of evidence-based practices across all 5 targeted HAI.
Conclusion: Our findings suggest that hospitals using AST can achieve greater depth and breadth in implementing evidenced-based infection control practices.
Key Words: Hospital-acquired infections; hospitals; infection control; automated technology; surveillance.

Accurate and timely infection surveillance is critical in the control and prevention of hospital-acquired infections (HAI). Within the context of HAI, surveillance is defined as the ongoing and systematic collection, analysis, interpretation, and dissemination of data that are essential for prevention and control of HAIs. Such data are important in estimating the scope, spread, and location of an infection in a hospital, monitoring change over time, evaluating and improving prevention and control measures, and evaluating and improving hospital policy and practices and for facility planning and public reporting.[1,2]

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However, until recently, hospital infection surveillance methods have relied almost exclusively on the manual review of laboratory data and patient records, which are time-consuming, costly, and subject to human error.[3] In addition, manual surveillance limits the amount of time infection control staff have for educational and quality improvement efforts. Whereas some hospitals began experimenting with computerization of hospital microbiology data to produce epidemiologic reports as early as the 1970s, it was not until the 1990s that commercial vendors began to market and sell automated surveillance technology (AST) to hospitals for infection control.[4] There are presently several leading vendors offering AST products available on the market, including the following: CareFusion's MedMined, AICE software, Hospira's Theradoc, Premier's SafetySurveillor—Infection Control, MEDITECH's HealthCare Information System, and MIDAS+ Care Management—Infection Control. In addition, many hospitals have adopted stand-alone automated systems developed by private consultants or have developed their own in-house systems.

Automated surveillance of HAI requires the linking of several databases and development of analytic software to detect and track infection trends in real time.

These systems may use different databases but they generally include 1 or more of the following[5]:

- Laboratory information systems (for microbiology culture data and identification of organisms);
- Admissions-transfer-discharge databases (primarily for patient demographics, location, and diagnosis codes);
- Pharmacy databases (ordering and administration of antimicrobial agents); and
- Electronic medical records (notes from history taking and physical examination and other clinician entries in the record).

The evidence on the effectiveness and efficiency of using AST for identifying HAI is strong, with high levels of sensitivity and specificity, particularly for systems that combine pharmacy and admissions-transfer-discharge data (sensitivity, 59%-96%; specificity, 95%-99%).[6] A review of the evidence from research suggests that AST increases access to timely and important information, saving time spent on surveillance activities by infection control staff, reducing errors, and enhancing the hospital's surveillance capacity.[7,8] The AST systems that have been found to be the most effective for hospitals combine laboratory, discharge, and pharmacy databases.[3] AST can produce alerts for sentinel events or organisms and produce routine and ad hoc data reports to support hospital infection control.

The purpose of this research is to identify the characteristics of hospitals in California that have adopted AST and to analyze the relationship between use of AST and the depth of implementation of evidence-based infection prevention and control practices. It is our hypothesis that hospitals using AST will have made more progress in the implementation of their infection prevention and control programs than hospitals that still rely only on manual surveillance.

METHODS

Baseline study of California's acute care hospitals

To test our hypothesis, we conducted a baseline study of all general, acute care hospitals in California, funded by the Blue Shield of California Foundation, from October 2008 through January 19, 2009, just prior to the implementation of the new state mandatory reporting requirements for HAI.

The baseline study collected information on patient safety policies and procedures to reduce HAI and on relevant process and outcome measures at general, acute care hospitals licensed by the state. A structured, computer-assisted telephone interview was conducted with the quality director of each hospital (or their designate) to gain a better understanding of how quality and patient safety processes are being implemented to prevent HAI. Each interview was scheduled in advance and completed in 45 minutes on average.

Survey sample

In October 2008, a list of all hospitals licensed to operate in California was obtained from the California Office of Statewide Health Planning and Development. Those hospitals that were identified as general, acute care hospitals with an average length of stay of less than 30 days and with 20 or more beds were deemed eligible to be in the sample. Hospitals that are specialty hospitals (eg, psychiatric, pediatric, surgery only, and others) were not included. The final universe was 320 general, acute care hospitals. Multiple attempts were made to schedule an interview with the quality director of each hospital. However, 13 hospitals were determined not to be eligible because the facility had closed (2), their phone number was a duplicate in the sample (4), their number was not in service (3), or there was no one on staff designated as having responsibility for quality (4). Of the total eligible universe of 303 hospitals, 241 hospitals completed the survey for a final response rate 79.5%.

Questionnaire

A computer-assisted telephone interview survey instrument was developed in consultation with the California Hospital Association and with the full endorsement of the California Department of Public Health, the California Institute for Health Systems Performance, the Integrated Healthcare Association, the Pacific Business Group on Health, and the UC Berkeley and UCLA Schools of Public Health, with funding provided through a grant from the Blue Shield of California Foundation. The questionnaire included items addressing whether it had adopted AST (0,1) where 1 = use AST and 0 = do not use AST; the extent to which each hospital had adopted formal, written evidence-based practices for infection control; and the extent to which they were applying the practices and monitoring adherence to the practice. The hospitals were asked about infection control practices for specific organisms and infection portals such as methicillin-resistant *Staphylococcus aureus* (MRSA), *Chlostridium difficile*, catheter-associated urinary tract infections (CAUTI), ventilator-associated pneumonia (VAP), and central line-associated bloodstream infections (CLABSI) as well as several broadly applicable infection control processes such as appropriate hand hygiene, use of contact precautions, and compliance with the surgical care improvement project (SCIP).