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Automated NHSN Reporting for Healthcare-Associated Infections:

Improving Consistency, Accuracy and Patient Safety

Susanne Miller, RN, MS,
Clinical Product Manager - TheraDoc

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Introduction

Preventable medical errors such as healthcare-associated infections (HAIs) significantly increase patient morbidity and mortality, and have an enormous financial impact on healthcare institutions.[1] The Centers for Disease Control and Prevention (CDC) estimates that each year 1.7 million patients develop an HAI, and 99,000 die as a result, adding $28–33 billion in healthcare costs.[2,3] At the individual hospital and payor levels, the costs are astonishing—Pennsylvania reported in 2006 that insurers paid an average of $53,915 in hospital costs for patients with HAIs, compared with just $8,311 for patients without an infection.[1]

Initiatives to help reduce these preventable errors include the collection, analysis, and reporting of hospital HAI data by state agencies and the CDC's National Healthcare Safety Network (NHSN). State mandated public reporting of HAIs is intended to enable consumers to make more informed healthcare decisions, as well as improve infection prevention measures and the quality of care through greater transparency.[1,4] To date, more than half the states require reporting of HAIs, and most others are considering such legislation.[5]

Importantly, many healthcare facilities report HAI data using the NHSN, whether or not they are located in "mandatory reporting" states. The NHSN is an online system that enables hospitals to share quality data for peer-to-peer benchmarking, analysis, and performance improvement. Currently, more than 3,000 U.S. hospitals utilize the NHSN for reporting infection data, and 22 states require HAI reporting through the system.[6]

Additional recent developments have increased pressure on healthcare facilities for reporting HAIs, including a move by the Centers for Medicare and Medicaid Services (CMS) that will put Medicare dollars on the line for hospitals that fail to report data on central line-associated blood stream and surgical-site infections via the NHSN.[7] Requirements for additional types of infections—as well as other types of medical errors—could potentially follow.

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While NHSN infection reporting has the potential to help hospitals improve the quality and safety of inpatient care, the processes involved in manually gathering data from a variety of sources within the hospital, cofirming HAIs, reviewing data for accuracy and standarized vocabulary (i.e., NHSN operative codes), and inputting data into the online NHSN system are labor intensive and time consuming. Manual data collection and entry are open to errors, and wide institutional variation has been observed in collecting and reporting infection rates, potentially undermining the goals of state and NHSN infection reporting goals.[8,9]

To address these barriers, an increasing number of hospitals of all sizes are turning to clinical decision support systems such as Premier's TheraDoc® to automate surveillance, collection, and NHSN reporting of critical infection data. TheraDoc has participated in CDC pilot programs to ensure streamlined reporting of infection data, and a number of hospitals have been successfully using the TheraDoc system for efficient, accurate NHSN reporting since November 2009.

The National Healthcare Safety Network (NHSN)

The NHSN allows healthcare organizations to share and access HAI data, while maintaining security and confidentiality. Specifically, facilities use the NHSN to:[10]

- Compare their infection rates to the CDC's national data using Standard Infection Ratio (SIR)
- Participate in state or national HAI prevention collaboratives
- Devise and implement HAI elimination strategies
- Evaluate immediate and long-term results of HAI-elimination efforts
- Refocus efforts or advance to different areas

While the NHSN was created for use by hospitals on a voluntary basis, beginning in 2011, hospitals must use the system to report their incidences of central line-associated blood stream infections in order to receive a full Medicare payment update for 2013.[7] A second CMS requirement calls for hospitals to report surgical-site infection data beginning in January 2012 in order to receive full reimbursement for 2014.[7] Failure to meet these requirements could have significant negative financial consequences for hospitals.

In addition, beginning in January 2011, the NHSN must be used by facilities participating in the CMS Hospital Inpatient Quality Reporting (IQR) Program,[11] which provides consumers with quality of care information to make more informed decisions about healthcare options and encourages hospitals and clinicians to improve the quality of care. The IQR Program requires eligible hospitals to submit quality data for health conditions common among Medicare patients, such as catheter-associated bloodstream infections, and the information is available to consumers on the Hospital Compare Website. Hospitals that do not participate in the IQR program will receive a 2 percent reduction in their annual "market basket" Medicare payment update.[12]

Finally, many mandatory reporting states require the use of the NHSN for submission of HAI data, which avoids a duplication of efforts—submitting data separately to the state and NHSN—and increases consistency. Taken together, these developments illustrate the growing importance of the NHSN as a tool to help hospitals reduce preventable infections and improve the quality and safety of patient care.

Barriers to Successful NHSN Reporting

While participation in the NHSN provides a variety of potential benefits to hospitals, federal and state healthcare agencies, and the public, data collection and entry into the NHSN system is labor-intensive and time-consuming, especially for facilities with limited resources available for infection prevention and control.[1] Data accuracy and the issue of variability in infection surveillance also are major barriers that may limit the effectiveness of reporting and benchmarking efforts.[8, 9]

Data Collection

Data collection and HAI confirmation are the first steps in the process. Facilities utilizing manual infection surveillance methods must allocate staff resources to collecting and reviewing significant amounts of clinical data from a variety of data sources. In addition to infection, device (central lines, ventilators and Foley catheters), and procedure data, Infection Preventionists (IPs) are required to collect individual patient data, such as patient identifiers, gender, date of birth, location data, and other information.[13] Reports must be printed, information reviewed and organized, and HAIs verified.

A 2010 data analysis retrospective review by Hahnemann University Hospital in Philadelphia found that it took an average of 6 minutes per case to manually collect and organize the mandated procedures and essential data elements.[14] At that

rate, it would take an infection preventionist five hours to process 50 cases, assuming that every minute of every hour was devoted to surveillance, which is unlikely.

The review also found issues with accuracy—specifically, missed cases of infections when manual surveillance was used.[14] Problems with manual data collection were shown in two recent studies that found substantial variability in reported catheter-associated blood stream infections among hospitals, and that manual surveillance found significantly fewer infections than a computer algorithm (see Sidebar: Variability in Manual Surveillance).[8, 9] Data variability threatens the key goals of mandatory reporting of infections since inter-hospital comparisons of infection rates, benchmarking, and trend data are valid only if the methods of surveillance are uniform and reliable across institutions.

Data Reporting

The second step in the process—data entry into the NHSN system—is time-consuming. Data about each infection event must be entered individually, a process that involves inputting or selecting multiple fields (several of which are infection specific). Manual data entry also increases the opportunity for mistakes—a critical factor as just one data entry error could jeopardize the successful submission of all data entered. NHSN module protocols must be followed exactly, and facilities must pass quality control acceptance checks that assess the data for accuracy and completeness. Numerator and denominator data must be entered within 30 days of the end of each month, all of which place a significant burden on already over-stressed infection prevention staff members.

Impact on Critical Infection Prevention Activities

The significant time spent on manual data collection and reporting may detract from the IPs ability to monitor for infection trends and outbreaks, deploy interventions, and conduct staff education aimed at reducing the spread of HAIs. This burden of manual surveillance and reporting is even more significant considering the current decline in hospital infection prevention resources. According to the 2009 APIC Economic Survey, half of the respondents saw reductions in overall budgets for infection prevention resources, including staff, and nearly 40 percent had layoffs or reduced hours.[15] The survey also revealed that 90 percent of respondents have less than one full-time staff person for clerical or analytic support.[15] In response, the CDC recognizes that steps must be taken to streamline data collection and reporting, and it has highlighted the importance of electronic systems to address this challenge.[16] Electronic systems that access data directly from hospital information systems and interface with the NHSN online system to upload data have the potential to significantly lessen the burden on hospitals and IPs—and improve the quality, accuracy, and completeness of data reported via the NHSN.

TheraDoc Clinical Surveillance

In keeping with its priority of reducing the burden of NHSN reporting, the CDC undertook an 18-month pilot project to assess electronic surveillance and reporting, and hospitals are now able to complete NHSN reporting electronically using third-party software systems such as TheraDoc. The TheraDoc clinical surveillance system collects and validates data against NHSN requirements and allows IPs to create and export reports that meet NHSN specifications. A number of TheraDoc clients are using the system's NHSN export feature to export clinical document architecture (CDA) files consistent with the NHSN's specifications.

The Infection Control Assistant® within TheraDoc provides IPs with the necessary real-time information to help rapidly identify, confirm, and document infections based on CDC guidelines within their workflow. TheraDoc receives patient data from multiple hospital information sources, normalizes the data, and applies standard medical vocabularies. This vital step ensures that clinical and administrative data from diverse hospital systems—which may be entered using various terminology and codes—are captured accurately and comprehensively.

TheraDoc continuously monitors data such as lab orders and results, microbiology results, pharmacy data, patient demographics, ADT (admission, discharge, transfer) data, vital signs, and radiology, surgery, and device data (central lines, ventilators and Foley catheters), notifying clinicians in real time about potential changes in patients' conditions so that appropriate interventions can be made. Rather than hunting and gathering information from around the hospital and manually analyzing it—often weeks after an event occurs—TheraDoc places critical data at the IP's fingertips when they need it.

The Hahnemann data review showed that TheraDoc increases efficiency in infection surveillance, even for facilities with limited information system resources.[14] For example, TheraDoc helped Hahnemann University Hospital reduce by more than half the time it took infection preventionists to identify cohorts of patients with multi-drug resistant organisms (MDROs) for isolation.[17] Rhode Island Hospital reported that

infection control software could be invaluable not only for routine surveillance, but also for investigating suspected infection clusters and outbreaks. In a 2007 review of an infection outbreak in two intensive care units, Rhode Island Hospital IPs found that data collection and analysis for an eight-month period took just three days using TheraDoc.[18] In contrast, manual data collection and analysis for the 12-month period using paper microbiology reports took two weeks.[18]

Streamlining NHSN Reporting with TheraDoc

The NHSN accepts data exports only from electronic systems that have been cleared as being compliant with the NHSN requirements for communication of electronic data using the NHSN's CDA standard, including the TheraDoc Infection Control Assistant. TheraDoc HL7-standard software is configured to allow exportation of data to the NHSN by incorporating NHSN standards for case definitions, format, terminology, and business rules into its system for identifying and reporting infections. The data are then packaged for export consistent with NHSN standards. The TheraDoc system assesses whether the data it receives are valid, transforms the data correctly and consistently, and performs validation checks on the results. The result is accurate and timely reporting—imperative in order to meet the stringent requirements of the NHSN.

Because TheraDoc supports surgery interfaces, it helps facilities report surgical denominator data as required by the NHSN. Users can quickly retrieve surgical denominator data using the TheraDoc software and review those data to make sure they have all the required elements. IPs can link a surgery to a specific infection, document the attributes of the infection, and then easily export the information to the NHSN. This feature saves significant staff time, especially for facilities with large numbers of surgical procedures.

For NHSN reporting using the TheraDoc system, IPs complete their monthly surveillance, confirm infections, and review device and surgical denominator data — ensuring that appropriate fields are indicated, such as general anesthesia, wound class, and American Society of Anesthesiologists (ASA) score. When their review is done, they simply click "Export to NHSN." IPs can choose which records to export. The TheraDoc system then completes a series of validation processes, reviewing the data to ensure compliance with NHSN business rules. If errors are identified, the IP can go back into the record and add missing documentation. Once the validation process is done, data are available to be uploaded to the NHSN web site. Previously, IPs needed to manually collect data, generate reports, and re-enter the data in the NHSN system. Now, this simplified electronic reporting process reduces duplication of efforts, and increases productivity and accuracy.

Impact of Automated NHSN Reporting

A number of hospitals are using TheraDoc for NHSN reporting, and data are emerging that demonstrate the system's value. The Hahnemann University Hospital study found that TheraDoc reduced the time required to gather and organize surgical procedure denominator data to enter into the NHSN System.[14] Investigators attributed this reduction to the system's user queries, which automatically identify cases of interest, provide needed calculations, and allow the user to enter additional data elements required by state law. They also found that the system could minimize the human error that may occur when scanning printed reports—TheraDoc found additional cases that were missed by manual surveillance.[14]

Warren Hospital in Phillipsburg, New Jersey, participated in an early pilot of TheraDoc NHSN reporting with positive results and continues to use the system. Lori McSorley, an IP at the hospital, said using TheraDoc significantly reduces the time it takes for NHSN data collection and reporting. "Before TheraDoc, it would take 10–15 minutes per patient to collect and review surgical site infection data before inputting it into the NHSN system," McSorley said. "Now, information on all of our surgeries, including the start and stop time, class of surgery, and patient ASA score, can be obtained automatically from the TheraDoc system. I just click on a surgery, and the data are immediately available for review and exporting to NHSN. I can report information on 10 patients in the time it took me to report one using manual methods."

Conclusion

Improving patient safety is one of the country's most critical priorities, and a number of financial incentives and penalties have been implemented to focus providers on preventing medical errors and improving the quality of care. For instance, Medicare and many private insurers no longer pay for additional costs of treating "never events" such as certain HAIs.[7] As a result, reducing the incidence of these preventable infections is a matter of both clinical and financial urgency.

Clinical decision support technology is one of the most promising means for improving the quality and safety of healthcare, including winning the battle against HAIs. In addition to helping facilities filter vast sums of data in order to find actionable information, decision support technology makes it easier for facilities to participate and comply with initiatives such as the CDC's NHSN. The CDC has placed a high priority on automating data collection in the NHSN, including recent efforts to allow information to be imported using commercial systems. By supporting standards for automated NHSN reporting of HAIs, TheraDoc helps improve the quality and efficiency of NHSN reporting, while allowing IPs to shift their attention from data collection and reporting to valuable infection prevention and education activities.

TheraDoc makes it easy for hospitals to comply with current reporting mandates. However, the platform also provides facilities with flexibility for a future in which additional reporting requirements may be added, such as antibiotic use and resistance reporting, and adverse drug events. Increased adoption of clinical decision support systems such as TheraDoc will help bring healthcare providers closer to the goal of eliminating preventable infections, improving the quality of healthcare, reducing costs and, most importantly, saving lives.

Variability in Manual Surveillance

Interhospital comparisons of infection rates are valid only if the methods of surveillance are uniform and reliable across institutions, but there is growing evidence that manual infection surveillance is plagued by inconsistency. Two 2010 studies, for example, found substantial variability in reported catheter-associated blood stream infections among hospitals, and that manual surveillance found significantly fewer infections than a computer algorithm.[8,9] Lin and colleagues reported in JAMA that, "The center-specific variation markedly affected the rank order of institutions, such that the medical center with the lowest rate as reported by infection preventionists had the highest rate by the computer-algorithm reference standard."[8] This problem threatens the key goals of mandatory reporting of infections providing patients with information to make healthcare decisions and providing benchmarking and trend data to assist hospitals in improving the quality of care. And hospitals may be penalized, and their reputations damaged, for more accurately identifying and reporting infections. This situation raises a host of issues, especially since patients rely on the data to make important healthcare choices for themselves and their families.

In light of the enormous effort and resources being devoted to mandatory reporting by state and federal agencies, the issue of surveillance variability must be addressed in order for public reporting initiatives to meet key goals. In reality, it is not a question of using a person or an electronic system but of equipping IPs with the tools they need to perform accurate, timely infection surveillance and reporting. There is growing evidence that electronic systems such as TheraDoc are critical for improving accuracy and consistency in HAI reporting.

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