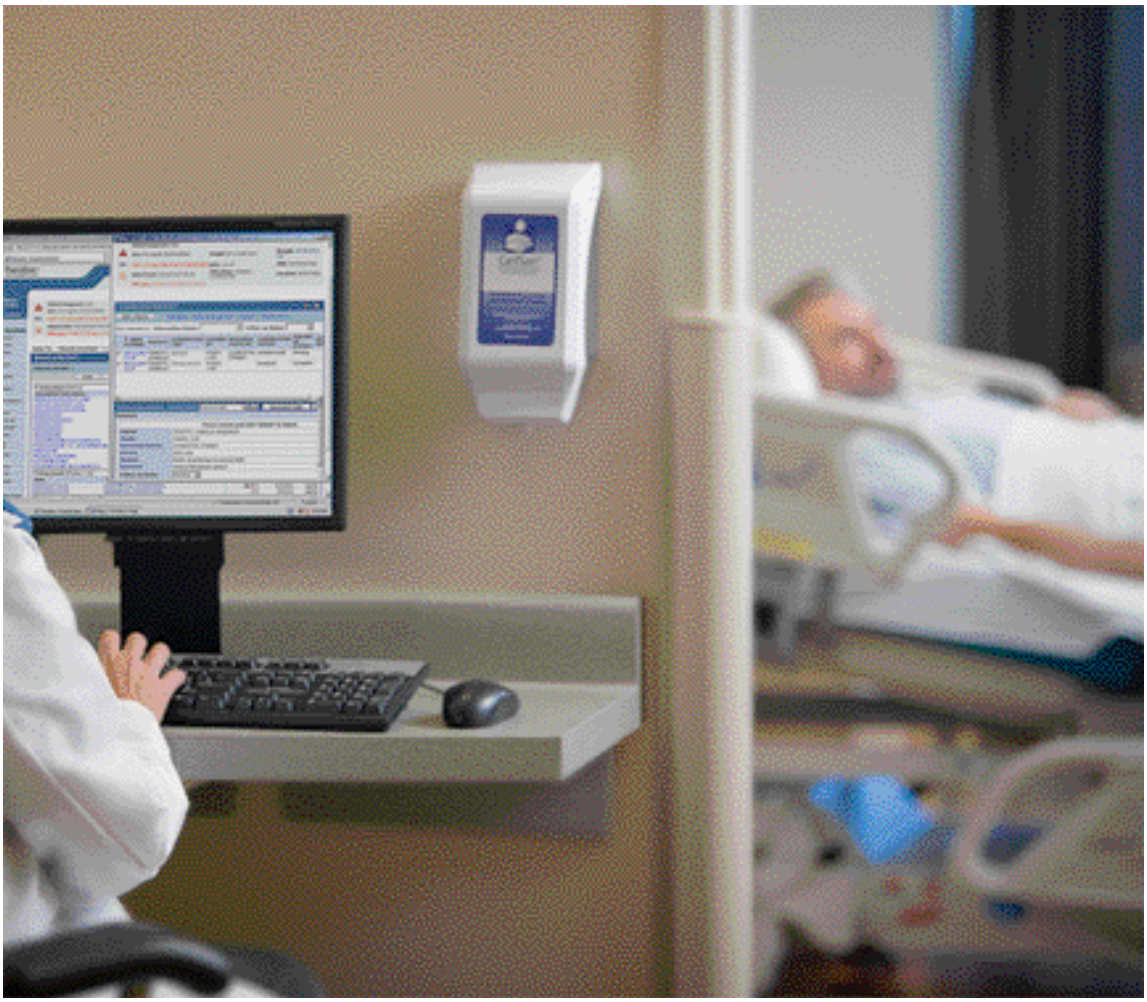
Computerized Infection Control Surveillance

Insights from the H1N1 influenza pandemic

by Laurie Griffith, BSN, MPH, CIC

The ongoing H1N1 influenza pandemic has provided a vivid reminder that hospitals are on the front lines of infectious disease monitoring, identification, and reporting in their communities. And, within hospitals, infection prevention professionals are key players—both in managing and coordinating the responses of their institutions to ongoing infectious disease challenges and in preparing for future outbreaks.

Though the current influenza outbreak in the United States so far has been less serious than originally feared, a recent report found that even the relatively mild outbreak overwhelmed the U.S. healthcare system. The June 2009 report from the Trust for America's Health, Robert Wood Johnson Foundation, and University of Pittsburgh's Center for Biosecurity found that communication between government agencies and healthcare providers was not well coordinated,



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and worried citizens flooded emergency rooms, among other problems.[1]

While the initial outbreak revealed serious gaps in the nation's preparedness, healthcare facilities across the United States are working to strengthen the public-health infrastructure and to be prepared in case the H1N1 influenza virus comes back in a more severe form later this year, as well as for future outbreaks. Hospitals are analyzing their responses with an eye toward bolstering their overall surveillance, monitoring, and communication capabilities and procedures. This includes infection preventionists who are using computerized infection surveillance systems to address these and other issues so that hospitals are better prepared to manage infectious disease outbreaks, reduce healthcare-associated infections (HAIs), and improve patient safety.

Computerized Infection Control Surveillance

Computerized infection control surveillance is being used by a growing number of U.S. hospitals that have given up time-intensive manual surveillance techniques and use technology to monitor and help address HAIs and community-acquired infections, improve healthcare quality, and reduce costs. Surveillance technologies are computerized systems that automate the collection and analysis of data from different hospital information systems, allowing infection preventionists to quickly and efficiently identify and address infections within their facilities. It also allows more time for patient interventions and educational activities that are critical for preventing infections and improving patient safety. And, it facilitates public reporting of HAIs and other reportable infectious diseases.

Based on their ability to significantly improve patient safety, computerized infection control surveillance technologies recently were endorsed by the Association for Professionals in Infection Control and Epidemiology (APIC).[2] One such technology, developed by TheraDoc (Salt Lake City) is being used by more than 200 hospitals around the country for real-time, hospital-wide monitoring, prevention, and reporting of HAIs and other infectious diseases.

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How It Works

The patient safety surveillance and clinical decision support technology developed by TheraDoc provides infection preventionists with the necessary real-time information to rapidly identify, confirm, and document infections based on Centers for Disease Control and Prevention (CDC) guidelines. Using a core technology platform that receives patient data from multiple hospital information sources, the system normalizes the data and applies standard medical vocabularies so that consistent, reliable results are achieved. 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.

The infection tracking system continuously monitors lab orders and results, microbiology results, pharmacy data, patient demographics, ADT (admission, discharge, transfer) data, vital signs, and data from departments such as radiology and surgery, notifying clinicians about potential HAIs or changes in patients' conditions so that appropriate interventions can be made. For example, computerized surveillance can quickly flag patients entering the hospital with possible influenza and other infectious diseases such as Methicillin-resistant *Staphylococcus aureus* (MRSA) so that they can be isolated. There are extremely flexible measurement and reporting tools that provide benchmarking against CDC National Healthcare Safety Network data and/or hospital data as well. Importantly, all data remains within the hospital's information technology system, where it can be safeguarded.

The system's ability to deliver real-time information is critical. While some systems batch results and report them periodically throughout the day, true real-time information provides the best opportunity for intervention. For example, batch reporting may delay notification of H1N1 or MRSA results, preventing the opportunity for immediate isolation and risking the spread of infection.

Rather than hunting and gathering information from around the hospital and manually analyzing it—often weeks after an event occurs—computerized surveillance gathers data about potential infections and places it at the infection preventionist's fingertips on a computer monitor. Computer technology allows infection preventionists to conduct hospital-wide surveillance, clinically confirm infections, and document interventions. This powerful technology makes it easier to identify and analyze trends, implement control measures, and meet expanded mandatory reporting requirements quickly and accurately.

A key part of the system is the availability of a range of alerts designed to help identify and monitor infectious diseases, identify problems in the medication-use process, and improve patient safety. These surveillance tools help clinicians immediately identify and address new patient safety threats within their institutions, identify patients who require specific interventions, and document the actions taken in order to demonstrate compliance with performance indicators and core measures at a higher level. Customized alerts also can be quickly created, as was done by numerous hospitals across the country in the early days of the H1N1 influenza outbreak.

Clinical Experience

2009 H1N1 Outbreak

Early in the recent H1N1 outbreak, many hospitals turned to TheraDoc and its patient safety surveillance platform to help them quickly address this unexpected challenge and more effectively manage their responses. Healthcare providers needed to immediately identify and isolate potential cases and confirm positive cases of the H1N1 virus in order to reduce its spread. Clinicians and healthcare executives also needed to monitor the spread of the disease so they could better understand the scope and progression of the outbreak, and keep public health officials informed.

According to Alice Chan, IT clinical-applications manager at Memorial Healthcare System (MHS), the leadership and clinicians at the nonprofit healthcare provider in South Broward County, Fla., were very interested in being able to identify and track patients with positive H1N1 results. For example, MHS needed to ensure that it could seamlessly track pending lab tests and positive and negative results through its daily surveillance work lists. It also needed immediate help incorporating alerts for positive results of a new molecular screening test for influenza A as part of its respiratory viral panel. "I received calls from every corner of MHS asking if an alert for this organism could be made available in the TheraDoc system," Chan said.

The company immediately began working with MHS and other hospital users to ensure that their systems were configured to provide specific alerts based on admissions data and/or lab orders and results for potential cases of the new flu strain. This included testing existing alerts to verify that H1N1 results would be captured, as well as quickly setting up and testing new alerts requested by hospitals. For example, alerts could identify patients based on admit diagnosis or chief complaint, such as respiratory symptoms. Once that information was entered into a hospital's ADT system, an alert would fire so that the infection prevention team could take appropriate actions, such as patient isolation, and monitor the patient during his or her hospital stay. Similar alerts could be generated to advise infection prevention staff members and other hospital personnel about lab orders and results for influenza A and the H1N1 subtype.

In cases where lab and microbiology departments had not developed specific lab codes to track the swine flu, customized computer "views" could be quickly set up to track all influenza cases and monitor all influenza A results, eliminating the need to contact individual departments for information. In some facilities, Notifiable Disease: Influenza Alerts also were used to track swine flu cases.

In addition to identifying and tracking individual patients, computerized surveillance provides a mechanism to monitor overall cases and understand the progression of the disease, vital for managing this and future outbreaks. The automated system and immediate access to real-time information also help facilitate communication among clinicians, hospital administrators, and local and national public health officials. For example, the unique Patient Trace function of TheraDoc's Infection Control Assistant® software allows infection preventionists to view all patients with a particular infectious disease, such as H1N1 or MRSA. With the click of a mouse, they can access a geographic timeline showing where the patient has been in the hospital in order to understand the transmission of the disease and identify other patients and staff who may be infected. This capability also helps nursing and infection prevention staff members coordinate care as shifts and personnel change, and as patients are moved throughout the facility.

During the H1N1 outbreak, speed in identifying and isolating infected patients and coordination among various hospital personnel and departments, as well as public health officials, were paramount. According to Jonathan Olson, TheraDoc's senior vice president of services, the company placed a high priority on its swine flu response, handling many requests within hours. It also proactively reached out to customers to ensure they had the proper alerts and reporting

tools in place to manage the current situation safely, quickly, and as efficiently as possible, and to be better prepared for future outbreaks.

2002 Winter Olympics

While computerized surveillance is helping many hospitals manage their H1N1 influenza response today, seven years ago at the 2002 Winter Olympic Games in Salt Lake City, health officials studied the novel surveillance technology for the rapid detection of disease clusters and agents of bioterrorism in the athletes' village and surrounding population. According to Adi Gundlapalli, MD, PhD, assistant professor of medicine at the University of Utah School of Medicine, the TheraDoc technology was instrumental in the early identification and management of a flu outbreak in the athlete's village.[3,4]

Clinical Experience Illustrates the Power of Computerized Infection Surveillance Technology*

- Rhode Island Hospital estimated that computerized surveillance allowed infection preventionists to reduce the amount of time they spend at their desks reviewing microbiology and other reports by up to 50 percent.
- Computerized surveillance helped Johns Hopkins Hospital reduce blood stream infection surveillance time by 80 percent and healthcare-associated infection confirmation time by 50 percent, with 98 percent accuracy. The hospital also improved identification of patients requiring isolation and timeliness of isolation for patients with 11 different drug-resistant bacteria and viruses by an average of 72 hours per patient.[8]
- Mayo Clinic, Jacksonville, Fla., reported prevention of five to six infection-related deaths per year and annual antibiotic drug cost savings equivalent to the annual license fees for the surveillance technology.[9,10]
- Using surveillance technology as part of a multi-pronged approach, the Hospital of the University of Pennsylvania achieved a sustained reduction in central line-associated bloodstream infections of more than 90 percent over three years. University clinicians said that the findings, which were presented at the 2009 meeting of the Society for Healthcare Epidemiology of America (SHEA), "provide a road map for cutting the deadly, costly toll of health-care-associated infections nationwide."
- In a CDC-sponsored randomized controlled trial, physicians randomized to TheraDoc decision support software achieved a 32 percent reduction in inappropriate antibiotic prescribing, compared with only a 5 percent reduction for an education-only group.[11]

* Computerized surveillance conducted using TheraDoc patient safety surveillance and clinical decision support technology.

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"The 2001 anthrax attacks had just occurred, and our goal for the Winter Olympics was to utilize an electronic surveillance system that would allow us to quickly identify infectious disease outbreaks and monitor for anthrax and other agents of bioterrorism," said Gundlapalli, a specialist in infectious diseases and bio-surveillance. "We worked with the TheraDoc team, whose members have a long history with the university, to rapidly design, develop, test, and deploy an electronic surveillance system to meet our monitoring and reporting needs for the Winter Games."

One aspect of the project involved monitoring the athletes and coaches in the Olympic Village Clinic for influenza-like illness using clinical and laboratory methods. "We found three clusters of influenza among these groups," he said. "This early detection allowed us to quickly identify the index cases—they were diagnosed within 8 to 12 hours. Those patients were given medication, and we were able to give the rest of the teams prophylactic medications to help contain the influenza outbreak."

Simultaneously, for the technology project, the TheraDoc system was developed and run at the University of Utah for influenza surveillance. During this period, the software showed a spike in patient visits to the emergency department for respiratory illness, which quickly alerted the hospital to a possible flu outbreak. These data corresponded to a community-wide increase in flu activity during the Utah winter season. Fortunately, there were no unusual events or diseases detected during the Olympic Games. The TheraDoc system, which has undergone significant enhancements and upgrades over time, continues to be used at the University of Utah for infection control surveillance.

In a 2002 Health Sciences Report about the project, Kurt T. Hegmann, MD, MPH, research associate professor of family and preventive medicine at the University of Utah School of Medicine, compared the electronic surveillance system with previous systems used to track the spread of infectious diseases. According to Hegmann, "The prior systems were much inferior. People would go to the ER with a computer, or pad of paper, and enter data from paper logs. You were counting on no errors and no lost patients in the logs. There were problems not only with manpower, but timeliness. You're talking typically days—not hours—to analyze data."[5]

HAIs and Antibiotic-Resistant Infections

Computerized surveillance for influenza dovetails with overall efforts of infection preventionists to protect patients from other threats such as HAIs and antibiotic-resistant infectious diseases—two of today's most critical healthcare challenges.

The CDC estimates that 2 million patients each year, or 6 percent of admissions, develop an HAI, and 90,000 die as a result. According to a 2007 prevalence study published by APIC, MRSA has an infection rate eight times higher than previously estimated,[6] and the incidence of other drug-resistant infections is on the rise as well, due in part to suboptimal use of antimicrobial drugs. The CDC reports that more than 70 percent of bacteria that cause HAIs are resistant to at least one of the drugs most commonly used to treat the infection.[7]

Infection preventionists are on the front lines of these efforts as well, charged with the early detection of infectious diseases, preventing their spread, monitoring the scope and progression of disease outbreaks, communicating with key hospital personnel and executives, educating staff, monitoring trends in antibiotic resistance, and meeting regulatory reporting requirements. In these efforts, computerized surveillance technologies such as the TheraDoc system are playing an increasingly important role.

In addition, active screening requirements for multi-drug resistant organisms (MDROs) such as MRSA, vancomycin-resistant Enterococcus (VRE), and others, are an ongoing challenge for infection preventionists and nurses. For example, many facilities are required by state regulation or hospital guidelines to swab patients who may be infected with an MDRO within a specific window of time. To facilitate active screening compliance, TheraDoc has created an MDRO tool that provides immediate access to information about patients requiring screening, the specific window of time available for screening, and whether the requirement has been met. The customizable system allows facilities to monitor compliance, compare performance among hospital units, and take steps to improve compliance with this important requirement.

As the prevalence, impact on patients, and cost of treating infectious diseases continue to rise, it is becoming increasingly clear that a collaborative approach among a range of healthcare personnel, clinicians, hospital executives, and public health officials is required to meet this complex healthcare challenge. For example, infection preventionists should coordinate with pharmacy staff on monitoring and prevention efforts aimed at combating the problem of drug-resistant infectious diseases. To aid in these efforts, many facilities utilize TheraDoc technology as a cornerstone of their antibiotic stewardship programs, helping to ensure appropriate drug selection, dosing, and duration to cure infections while minimizing toxicity and conditions for emergence of resistant bacterial strains.

According to APIC, "As infection prevention programs are faced with competing priorities—including expectations for expanded surveillance from internal, regulatory, or public sectors—the demands on the infection preventionists' time may divert efforts away from prevention activities such as education, observation and behavior modification. To enhance the role of the infection preventionist to one in which the primary objective is that of prevention, surveillance must absorb fewer human resources."[2]

Conclusion

In the United States and across the globe, influenza—including the new H1N1 strain—healthcare-associated infections, and drug-resistant bacteria are some of the most critical patient safety issues in hospitals today. And while HAIs cost more than $20 billion annually, infection-prevention programs are facing serious reductions due to the current economic downturn. In addition, as more clinical and patient data become available based on the federal government's push toward electronic health records, the torrent of information will grow and, along with it, the need to replace cumbersome manual surveillance techniques with more effective and efficient computerized surveillance technologies.

A June 2009 *Managing Infection Control* poll reported that only 13 percent of hospitals surveyed agreed that their facilities are "adequately prepared" to cope with the challenges that could arise from a greater H1N1 influenza pandemic. As has been demonstrated during the current H1N1 outbreak, computerized surveillance systems provide a key tool to address these challenges, offering a flexible platform for efficiently coordinating hospitals' evolving patient safety challenges, as well as a mechanism for enhanced communication among clinicians, staff, administrators, and public health officials. Information technology also holds the key to more active leadership roles for infection preventionists, as well as more active participation in overall hospital efforts to address a range of infectious disease and patient safety challenges. ✛

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