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# Pharmacy Automation and Technology

# Clinical Surveillance: Another Tool in the Pharmacist's Armamentarium

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This month we discuss a type of software tool to support the pharmacist's efforts to ensure safe and efficacious medication therapy. The tool utilizes data within separate components of an individual hospital's information system, pulling the data together to compare it to a set of criteria. The criteria can be designed to look for medication-related problems and opportunities, as defined by the user. Appropriate action can be taken based on patient-specific needs.

Medication therapy monitoring is a key step to ensuring safe and effective medication-related outcomes. This monitoring can take many forms, including relatively simple dose assessments based on patient-specific parameters, determining antibiotic appropriateness based on culture and sensitivity results, and recognizing the use of specific medications as potential indicators of adverse drug events. Medication therapy monitoring is also an important step to demonstrate compliance with accreditation standards as well as compliance with national standards for safe medication usage. To perform these activities, pharmacists have traditionally relied on a manual process of comparing the patient's medication profile to a variety of other information sources—frequently laboratory results. This manual process, both paper and electronic in nature, has been a part of pharmacy practice for decades, and although it is effective, it is time intensive. Today, a class of software applications known as "clinical surveillance tools" offers dramatic enhancements to the way pharmacists monitor medication therapy.

Pharmacists have traditionally relied on a mix of paper and electronic information sources to monitor medication therapy. In an environment dominated by paper, pharmacists traditionally went to patient care areas to review patient charts to identify necessary information. Or, pharmacists used medication orders as indicators of potential problems. Although these activities did increase the visibility of pharmacists as patient care providers, the process was very time-consuming. As hospitals became increasingly digital environments, pharmacists were able to access the necessary information through their health system's computer databases; saving time spent searching through paper-based charts. Even though this is an improvement, the process still relied on pharmacists actively searching for the necessary information.

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Clinical surveillance tools are a type of clinical decision support system (CDSS), providing pharmacists with patient information that has been filtered according to predefined criteria and is presented at appropriate times to enhance patient care. These tools pull data from 3 sources—admission/discharge/transfer (ADT), laboratory, and pharmacy—and use clinical rules to analyze the data and alert the user of instances that meet the rules' criteria. Though there is some variability in methods across the different vendors' products, these Web-based applications generally function by interfacing (HL7) with the hospital's information systems to securely pull the data to the vendor's server where the data are analyzed against a set of clinical rules. Some vendors allow the client to build their own rules, some provide a foundational set of rules, and others do not allow user-defined rules. This is an important distinction to make when evaluating the different applications.

The construction of clinical rules is straightforward and can be something as simple as, "identify all patients with a new order for diphenhydramine." Rules are not constructed in sentence form, but instead use structured language based on Boolean terms. For example, the preceding sentence would be conceptualized as: "IF medication order = diphenhydramine AND start date = any, THEN activate the alert." The clinical instance, if it

meets the criteria, will be presented to the user for further analysis. This rule would identify any patients receiving diphenhydramine at any time during their hospital stay. While this rule would have a high capture rate, by identifying everyone with an order for diphenhydramine, it would likely have a low predictive value for instances of allergic reactions, if the clinician's purpose for the rule was identifying only true cases of allergies associated with the selected drug. Elimination of such false positives is a primary challenge for clinical surveillance tools that can often be addressed through rule construction. For example, the previous rule could be modified to exclude patients with a diphenhydramine order anytime in the last 7 days, or to exclude patients with concurrent orders for transfusions or paclitaxel, both of which are scenarios in which diphenhydramine is frequently given to patients.

So how are these tools being used in hospitals today? Similar to the previous example, rules can be constructed to alert of potential adverse drug events, such as the use of naloxone indicating a potential opiate overdose. Rules can identify instances in which intravenous to oral conversion is possible or when a patient older than 65 years of age is receiving amitriptyline. Other rules can pull laboratory values for drugs such as digoxin and phenytoin where drug blood level monitoring is critical for safety and efficacy. Also in the realm of safety, a rule can be constructed to identify when vitamin K is ordered for a patient receiving warfarin.

Another area of major use of clinical surveillance tools is antimicrobial stewardship and utilization. Alerts can be constructed to identify instances of decreasing creatinine clearance in the presence of specific medications, drug levels that are not consistent with positive outcomes, a methicillin-resistant *Staphylococcus aureus* culture, use of specific medications outside of authorized locations, and use of medications to which a bug is resistant.

Hospitals are increasingly being held accountable to performance metrics for quality and safety. Clinical surveillance tools have been successfully used to help institutions meet these measures through the creation of reports. For example, patients can be identified who have had an apparent acute myocardial infarction (as determined through lab values) and are not receiving a beta-blocker, aspirin, or an angiotensin receptor blocker (or ACE inhibitor). The Joint Commission's National Patient Safety Goals also specify measures hospitals should take to ensure patient safety. For example, goal 3E addresses patient harm associated with the use of anticoagulation. Clinical surveillance tools can identify changes in platelet and hemoglobin values, missing laboratory values (like activated partial thrombin time), the use of vitamin K in a patient receiving warfarin, whether daily international normalized ratio values are being tested, and a host of other related information.

With the ability to capture patient-specific demographics, medication profiles, and laboratory data in real time, clinical surveillance tools offer significant promise to ensuring safe and effective therapy. Compared with other health information technologies, these tools can be considered "low hanging fruit" in that their cost and time to implementation are significantly less (often less than 2 to 3 months). Pharmacists frequently take the lead in adoption and implementation of clinical surveillance tools because the tools are closely aligned with medication usage. Pharmacist involvement can include rule definition, investigation of the alerts, action when appropriate, and documentation of events. Other hospital departments, such as Infection Control and Quality, find value in the tools and work with pharmacy to optimize the tool for the institution's needs.

If you are interested in learning more about this topic, we encourage you to check out the following applications and their Web sites: *SafetySurveillor* (http://www.premierinc.com/quality-safety/tools services/performance-suite/safety surveillor.jsp), *Sentri7* (http://www.sentri7.com), *TheraDoc* (http://www.theradoc.com), and *VigiLanz* (http://www.vigilanzcorp.com). We also recommend that you visit the American Society of Health-System Pharmacists Learning Center at http://www.softconference.com/ashp/sessionDetail.asp?SID=142272 for a presentation on this topic from the 2009 Summer Meeting. This presentation provided supporting information for this article. As always, we encourage you to contact us with any comments or questions: Brent Fox (foxbren@auburn. edu) or Bill Felkey (felkebg@auburn.edu). ■