Patient Safety Tip of the Week

November 22, 2016

Leapfrog, Picklists, and Healthcare IT Vulnerabilities

In the past few months there have been multiple studies demonstrating that we still have a long way to go in bridging the human-computer interface, at least as far as electronic medical records go. The full potential of electronic health records and clinical decision support tools has yet to be realized.

First was a study of children's hospitals using the pediatric version of the Leapfrog Group's CPOE evaluation tool (Chaparro 2016). We like the Leapfrog tool as it applies to adult hospitals (see our previous columns for July 27, 2010 "EMR's Still Have a Long Way to Go", June 2012 "Leapfrog CPOE Simulation: Improvement But Still Shortfalls", March 2015 "CPOE Fails to Catch Prescribing Errors" and May 3, 2016 "Clinical Decision Support Malfunction"). The adult and pediatric tools assess the ability of a hospital's CPOE system to identify potentially problematic orders. It was used to evaluate 41 pediatric hospitals over a 2-year period, assessing overall performance as well as decision support categories (eg, drug-drug, dosing limits). CPOE systems at these hospitals overall were able to identify 62% of potential medication errors in the test scenarios, but ranged widely from 23-91% at individual institutions. The highest scoring categories included drug-allergy interactions, dosing limits, and inappropriate routes of administration. Looking at hospital performance longitudinally over time, they found that hospitals with longer periods since their CPOE implementation did not have better scores upon initial testing, but after initial testing there was a consistent improvement in testing scores of 4 percentage points per year. The latter exemplifies the ability of hospitals to learn from using the Leapfrog tool and improve their systems.

In our May 3, 2016 Patient Safety Tip of the Week "Clinical Decision Support Malfunction" we discussed the results of The Leapfrog Group's most recent report on how adult hospitals perform on their CPOE evaluation tool (Leapfrog 2016). To fully meet Leapfrog's standard, hospitals must:

- Demonstrate that the system alerts physicians to at least 50% of common, serious prescribing errors; and
- Order at least 75% of inpatient medication orders through a CPOE system.

In 2015 nearly two-thirds of hospitals (64%) fully met the standard, showing a considerable improvement compared to 14% in 2010. The hospitals also demonstrated improved performance in medication reconciliation. However, on the 2015 Leapfrog

Hospital Survey, hospitals' CPOE systems failed to flag 39% of all potentially harmful drug orders, or nearly two out of every five orders. The systems also missed 13% of potentially fatal orders.

Another recent, FDA-sponsored project analyzed medication errors potentially related to computerized prescriber order entry (CPOE). Amato and colleagues (Amato 2016) reviewed all patient safety medication reports that occurred in the medication ordering phase from 6 participating sites. They found that 51.9% of the medication error reports were related to CPOE. Of these, CPOE facilitated the error in 13.1% and potentially could have prevented the error in 86.9%. The most frequent CPOE issues involved transmission errors (eg. orders not being received in the appropriate place), erroneous dosing, and duplicate orders. These resulted in delays in medication reaching the patient, patients receiving duplicate drugs, or receiving a higher dose than indicated.

Also from the pediatric literature was a column on malpractice related to EHR's (Oken 2016). Oken cited a medical liability insurer's recent review of EHR-related malpractice claims showed that 42% were derived from system errors and 64% were from user factors. System errors include lack of interoperability of various systems and lack of clinical decision support in some systems. He notes that not all electronic prescribing programs in pediatric offices are able to validate the pediatric drug dosage, check drug interactions or include prescriptions from other physicians. Lack of pediatric functionalities in many EHRs, such as weight-based dosing, pose significant safety risks to children. On the user side, copying and pasting clinical information from previous medical encounters (sometimes known as "cloning") can be a major risk. And somewhere in between system and user error is the problem of failure to recognize and appropriately follow up on reports that come back to the EHR.

A recent systematic review on the effects of healthcare IT on patient outcomes was informative (Brenner 2016). Using quite rigorous criteria for inclusion of studies, the authors found that such studies in the outpatient or long-term care settings were scant. The majority of studies demonstrating a positive impact of healthcare IT on patient outcomes came from inpatient settings and were likely single-center studies. And only 36% (25 of the 69 studies meeting criteria for inclusion) actually showed a positive effect on patient outcomes for the primary outcome measured. The rest showed mixed effects or no effect on patient outcomes. And one study showed a negative effect. Quality of the included studies was variable and most studies were observational or cohort studies rather than randomized controlled trials. The review really emphasizes the need for high quality studies with better design and larger populations, particularly on the outpatient side where the majority of care is rendered.

A recent AHRQ Web M&M case (McGreevey 2016) illustrated a CPOE-related problem that appeared after the transition from paper order sets to computer-based order sets. In the old paper-based world order sets for electrolyte replacement or correction included segments for hypokalemia and hypomagnesemia in close approximation (hypomagnesemia often occurs in patients who are hypokalemic). However, when the order sets were converted to the electronic format, attempts were made to simplify the

information provided on individual computer screens. As a result, order options for magnesium no longer appeared on the same screen as those for potassium. In the case presented there was failure to address the hypomagnesemia when the patient's hypokalemia was addressed. Loss of the visual cue to prompt assessment of the magnesium levels was considered contributory to the adverse outcome in the case.

That case highlights a problem we've previously discussed. The **vulnerability of CPOE systems when changes are made** to various components or files was also noted in our May 3, 2016 Patient Safety Tip of the Week "Clinical Decision Support Malfunction". There we discussed a study from Brigham and Women's Hospital (BWH) in Boston, which probably has the most robust CDSS of any healthcare organization anywhere (Wright 2016) and found several errors that were often very difficult to detect. They identified several contributing factors:

- EHR software updates
- Changes to data codes or clinical terminology
- Inadvertent changes to logic for the rules

The studies collectively demonstrate that it is never enough to simply implement a CPOE system or e-prescribing system with clinical decision support systems and assume your patients will be safe from medication errors. Clearly, ongoing evaluation and assessment using validated tools are important to identify vulnerabilities that may be unexpected. We, of course, should expect better design and function from our IT vendors. The Wright study clearly shows that problems may arise even when the initial design and implementation were good yet changes to systems or files result in gaps that may go unidentified for long periods.

Other studies reinforce some other common errors related to computer order entry. Another recent AHRQ Web M&M case (Wears 2016) illustrated **the "picklist" error** (also known variously as the mouseclick error, drop-down list error, cursor error, stylus error, or juxtaposition error depending upon the setting and device being used) that we so often continue to see. A physician intending to order a CT scan of the abdomen and pelvis with oral contrast but without IV contrast mistakenly clicked on the CPOE order for a CT scan that included IV contrast. The patient subsequently developed a rise in serum creatinine, consistent with contrast nephropathy. Also, truncation of some items in picklists may lead to errors when physicians fail to scroll fully side-to-side or up-and-down.

Timely in this regard is a new report prepared for the Office of the National Coordinator for Health Information Technology on the safe use of picklists in ambulatory care settings (Rizk 2016). The report really focuses on two key issues:

- Wrong-patient errors
- Wrong-medication errors

While many wrong-patient errors occur from having multiple patient charts open simultaneously, picklist errors remain an important contributing factor to wrong-patient errors. The authors note that simply having adjacent items in a list can predispose to

picklist errors but other design factors, such as pick list length and organization of the items in the list, may also contribute. They note that **personalizing the list** of patients to those that the provider has seen and allowing for **sorting, filtering, and/or grouping** the patients into categories can result in a shorter list of patients from which the provider can select, thus increasing the likelihood of selecting the correct patient.

We've done multiple columns on patient identification errors. You'll find links to most of them and links to the literature in our January 19, 2016 Patient Safety Tip of the Week "Patient Identification in the Spotlight". That includes discussions on the "**ID-verify alert**", the "**ID-reentry function**", and use of patient **photographs** that are also discussed in the new ONC report as ways to force active verification of patient identity.

List length is one factor contributing to wrong-medication errors. Obviously, the similarity of drug names is another. We've done many columns on **LASA** (look-alike, sound-alike) drug errors and the use of **Tall Man lettering** to help minimize these (see, for example, our December 1, 2015 Patient Safety Tip of the Week "TALLman Lettering: Does It Work?" and our July 2016 What's New in the Patient Safety World column "ISMP Updates TALLman Lettering List").

Allowing ordering providers to **customize lists** of medications they most commonly use is another way to reduce wrong-medication errors. But keep in mind that **unanticipated changes to lists** can also be a source of errors. We've seen cases where a physician is used to choosing the first item from a medication category and then a vendor updates the software and a different medication is now first on the list. If the physician is not paying careful attention, he/she may just click on that first item.

Requiring input of the **indication for each medication** ordered is something we've long advocated. That helps, for example, when you accidentally click "digoxin" rather than "Dilantin". Your clinical decision support tool would alert you that digoxin does not meet the indication of "anticonvulsant" that you entered. But one problem, particularly in hospitalized patients, is that you may not know the indication for which a patient had been started on previously and many medications (eg. beta blockers) have multiple different indications. But we still feel requirement of an indication is a useful safeguard in many cases.

Providing **summaries of the orders entered in a session** is another way to have the ordering provider review the orders and potentially catch errors.

The ONC report has several appendices that contain the recommendations and best practices to reduce the likelihood of picklist errors. Use them! They provide details for each of the following recommendations:

1. Design functionality to improve picklist-related patient identification error.
2. Adhere to a set of common guidelines to standardize the safe identification of medications when developing e-prescribing drug names.
3. Implement best practices for organization, design and configuration of all pick lists.

4. EHR systems should display a summary review screen prior to completion of an order, with appropriate training and policies to ensure proper uses.
5. EHR systems should provide easy-to-use "retract-and-reorder" functionality and ability for staff to review data regularly.
6. Visit summaries provided to patients should clearly indicate which medications are indicated for which diagnoses.

There is also a self-assessment form you can utilize to help identify your vulnerabilities. The report is replete with examples of various types of picklist errors and has excellent references.

The government incentives and "meaningful use" requirements have achieved the enviable goal of extending electronic health records to the vast majority of medical practices and hospitals. But the proliferation of systems has led to widespread variability of performance and multiple flaws that have impacted patient outcomes. Fortunately the ONC (Office of the National Coordinator for Health Information Technology) has just published a federal rule that will provide the ONC more authority to regulate and oversee the EHR tools that get certified via the Certified EHR Technology (CEHRT) program (DHHS 2016). The new rule basically focuses on catching flaws in EHRs already being used by providers and will address some of the usability, patient safety, and workflow design flaws found in the current generation of health IT tools. That is a welcome addition that should benefit patients, physicians, hospitals, and a whole host of stakeholders.

It's time for us to begin realizing the full potential benefits that the world of healthcare IT promises.

See some of our other Patient Safety Tip of the Week columns dealing with unintended consequences of technology and other healthcare IT issues:

- June 19, 2007 "Unintended Consequences of Technological Solutions"
- May 20, 2008 "CPOE Unintended Consequences – Are Wrong Patient Errors More Common?"
- June 17, 2008 "Technology Workarounds Defeat Safety Intent"
- August 26, 2008 "Pattern Recognition and CPOE"
- September 9, 2008 "Less is More….and Do You Really Need that Decimal?"
- December 16, 2008 "Joint Commission Sentinel Event Alert on Hazards of Healthcare IT"
- February 2009 "Healthcare IT The Good and The Bad"
- March 3, 2009 "Overriding Alerts…Like Surfin' the Web"
- October 2009 "A Cautious View on CPOE"
- November 24, 2009 "Another Rough Month for Healthcare IT
- April 20, 2010 "HIT's Limited Impact on Quality To Date"
- March 22, 2011 "An EMR Feature Detrimental to Teamwork and Patient Safety"
- June 26, 2012 "Using Patient Photos to Reduce CPOE Errors"

- June 2012 "Leapfrog CPOE Simulation: Improvement But Still Shortfalls"
- July 17, 2012 "More on Wrong-Patient CPOE"
- January 2013 "More IT Unintended Consequences"
- April 30, 2013 "Photographic Identification to Prevent Errors"
- October 8, 2013 "EMR Problems in the ED"
- March 11, 2014 "We Miss the Graphic Flowchart!"
- October 2014 "Ebola Exposes Fundamental Flaw"
- January 2015 "Beneficial Effect of EMR on Patient Safety"
- March 2015 "CPOE Fails to Catch Prescribing Errors"
- March 31, 2015 "Clinical Decision Support for Pneumonia"
- August 2015 "Newborn Name Confusion"
- December 2015 "Opioid Alert Fatigue"
- January 12, 2016 "New Resources on Improving Safety of Healthcare IT"
- January 19, 2016 "Patient Identification in the Spotlight"
- February 9, 2016 "It was just a matter of time…"
- April 5, 2016 "Workarounds Overriding Safety"
- May 3, 2016 "Clinical Decision Support Malfunction"
- May 24, 2016 "Texting Orders – Is It Really Safe?"
- August 23, 2016 "ISMP Canada: Automation Bias and Automation Complacency"

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