Patient Safety Tip of the Week

June 19, 2018 More EHR-Related Problems

For being long-time advocates of healthcare IT as an important patient safety tool, it sure seems we write a lot about the unintended consequences of that same IT! See the numerous columns listed below for some of the issues we've discussed. Some more unintended consequences recently made the medical literature.

One involved a problem arising from use of an order set for acute MI (Gupta 2018). That order set included beginning a beta-blocker, which happened to be contraindicated in the actual patient for whom it was ordered. Its use led to worsening acute heart failure and cardiogenic shock in this patient.

The patient was a 58-year-old man who had a STEMI. He underwent PCI, during which an elevated left ventricular filling pressure was noted. Following the procedure, bradycardia, atrial fibrillation, and complete heart block on the ECG were noted. He was admitted to the coronary care unit and the admitting physician placed orders via the electronic medical record using the "STEMI admission order set". The patient developed worsening shortness of breath, bradycardia (lowest heart rate, 40/min), and hypotension (lowest blood pressure, 93/63 mm Hg), with crackles noted on auscultation of the lung fields consistent with developing cardiogenic shock.

Note that this order set had been developed 5 years earlier and had been reviewed and updated annually. House staff were encouraged to use this "opt in" order set for patients with STEMI. The order set included use of a beta-blocker because such use was originally a performance measure on admission and discharge (the hospital did not change the order set when it had later abandoned that performance measure). Also, though the admission note indicated the physician would withhold beta blockers because of heart failure and complete heart block, the "carvedilol" option on the order set was selected because it was the first and most visible option in the beta-blocker ordering window. The admitting physician also noted he was influenced by the clinical decision support (CDS) message stating that administering beta-blockers was a performance measure.

There were likely also communication errors between the interventional cardiology team and the inpatient cardiology team, resulting in the orders being given before the inpatient team knew all relevant information about the patient.

In the accompanying editorial (Shah 2018) Shah and Cifu note we are often slow to abandon outdated medical practices that are not based upon robust evidence.

Our May 3, 2016 Patient Safety Tip of the Week "Clinical Decision Support Malfunction" highlighted a study from Brigham and Women's Hospital (BWH) in Boston about some disturbing findings on malfunctions of CDSS alerts (Wright 2016). Alarmingly, they found that the alert malfunctions were often very difficult to detect and some had eluded detection for long periods of time (weeks or even years!). Moreover, the causes for the malfunctions were sometimes even more difficult to elucidate. They were, however, able to identify several contributing factors:

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

These cases serve as a reminder that you must have a very active multidisciplinary team the oversees your clinical decision support systems (CDSS), even if you contract with an outside vendor for CDSS services. Each time you introduce a new clinical decision rule you need to review its use and impact within several weeks. You are looking primarily to see how often that rule is overridden or ignored and the reasons for that so you can determine whether or not to keep the rule. But once you've decided to keep the rule, you need to review it periodically. That should be at least annually and at any time there is a change in the evidence base. The vendors that most hospitals currently contract with for CDSS may issue updates every 6-12 months, but they often do not respond immediately when there is a change in the evidence base that might impact a specific rule. That is why you need to have your own active multidisciplinary team to act when there is a change in the evidence underlying the rule(s). The same applies to order sets. When there is a significant change or new finding in the evidence base, you need to review your standardized order sets that might be impacted by those changes. That means you need to have in place a detailed **inventory** of items from every order set. For example, let's say the FDA comes out with a warning about a particular drug. You need to be able to readily identify any of your existing order sets that contain reference to that drug. So you need to have an easily **"searchable" library of your order sets**.

The Gupta case also highlights the problem that order sets often harbor items that are otherwise hard to detect. A good example of buried items comes from our discussions on inappropriate abbreviations (see our Patient Safety Tips of the Week for July 14, 2009 "Is Your 'Do Not Use' Abbreviations List Adequate?" and December 22, 2015 "The Alberta Abbreviation Safety Toolkit"). In that column we noted we had found pre-existing standardized order sets were a hidden source of many dangerous abbreviations.

In yet another study from Brigham and Women's Hospital and Partners Healthcare, Wong and colleagues analyzed data on medication-related CDSS overrides in the ICU (Wong 2018). They found the overall appropriateness rate for overrides was 81.6% and varied by alert type. More potential and definite ADE's (adverse drug events) were identified following inappropriate overrides compared with appropriate overrides (16.5 vs 2.74 per 100 over-ridden alerts). However, inappropriate overrides were over six times as likely to be associated with potential and definite ADE's, compared with appropriate overrides (OR 6.14). They suggest that further efforts should be targeted efforts such as suppressing alerts that are appropriately over-ridden.

We have echoed the advice of many others that, in order to avoid alert fatigue, you limit the number of alerts your CDSS system triggers for clinicians and focus on those that are most important from a patient safety perspective.

We've also often emphasized that it's important to rout alerts to the person most likely to intervene. That may not always be the physician. Often sending an alert to a pharmacist, who may then intervene with the ordering physician and suggest alternatives, may be the most appropriate routing of some clinical decision rules.

Howe and colleagues (Howe 2018) analyzed patient safety reports from the Pennsylvania Patient Safety Authority database from 2013 through 2016. They found 557 reports (0.03% of all reports) which had language suggesting the EHR potentially contributed to patient harm: potentially required monitoring to prevent harm (84%, n = 468), potentially caused temporary harm (14%, n = 80), potentially caused permanent harm (1%, n = 7), and could have required intervention to save a life or could have resulted in death (<1%, n = 2). They defined 7 categories of "usability factors", with the following distribution of reports:

- Data entry 27%
- Alerting 22%
- Interoperability 18%
- Visual display 9%
- Availability of information 9%
- System automation and defaults 8%
- Workflow support 7%

Regarding clinical processes, errors occurred during order placement (38%), medication administration (37%), review of results (16%), and documentation (9%).

One potential limitation of the study is that it only included reports which identified one of the top five EHR vendors/products.

Thoughtful design of order entry screens and standardized order sets is important in helping physicians make correct choices and avoid less optimal ones. A recent editorial by Vaughn and Linder (Vaughn 2018) discusses how "**nudges**" may be helpful. They note some designs provide a stimulus to do the wrong thing. For example, simply providing a checkbox may nudge a physician to check that checkbox. Providing the brandname of a drug may nudge the physician to order the more expensive formulation rather than a generic equivalent. And allowing a test to be ordered repetitively (eg. "daily CBC") may lead to inappropriate testing.

They suggest the following questions be asked during design of order sets or order entry screens:

- When a new order set is created, is influence on clinician behavior considered?
- Which options are listed for testing and treatment? All options? Or just clinically appropriate ones?

- How are they listed? Alphabetically? Numerically? Or are recommended and less-expensive options listed first?

They stress the strong effect of using appropriate default settings. They cite a study that successfully reduced inappropriate urine cultures in an emergency room (Munigala 2018) by changing the default option from "urinalysis with reflex to urine culture" to "urinalysis with reflex to microscopy". (See also our Patient Safety Tips of the Week for July 7, 2009 "Nudge: Small Changes, Big Impact" and February 18, 2018 "Nudged, But Who Nudged Who?" for examples of use of "nudges" in healthcare.)

And the issue of **wrong patient events related to the EHR** just won't go away. We've discussed this in numerous columns. A 54-year old man died following routine knee surgery due to medications prescribed in the EHR that were intended for a different patient (Minion 2018). An anesthetist in Australia, while attending a new patient in the OR, opened the record of a previous patient to prescribe fluids necessary to "keep the line open" for intravenous antibiotics that had earlier been forgotten. But he forgot to close that patient's electronic medical record. The anesthetist then prescribed doses of fentanyl meant for the patient currently in the OR but entered these by mistake in the open record of that previous patient. Apparently the HER did present multiple alerts while he was prescribing but all were overridden by the anesthetist, selecting 'consultant's decision' and entering his password each time.

Interestingly, several of the key features of EHR's that we have previously described (see our May 20, 2008 "CPOE Unintended Consequences – Are Wrong Patient Errors More Common?") do not seem to have played a role in the error(s) in this case. The patient's name was apparently displayed on all screens in this case. There was nothing to suggest juxtaposition errors or truncation errors. And it does not appear that two patient records were open at the same time or that 2 different applications were open at the same time. But the last feature we highlighted, **failure to log off**, was obviously the major problem here. We suspect that interventions such as those developed by Adelman and colleagues, including the ID-verify alert (prompt with name, age, gender and MD must verify) and ID-reentry function (MD must re-enter patient's initials, age, gender) might have prevented the patient misidentification in the current case (see our August 1, 2017 Patient Safety Tip of the Week "Progress on Wrong Patient Orders").

Lastly, it's important to remember that EHR upgrades or conversions from one EHR to another represent times of vulnerability to errors. The Brigham and Women's Hospital has had one of the most robust and most studied EHR's from the standpoint of patient safety. Several of our columns (including references above in today's column) have pointed out how it's clinical decision support tools and alerts have been fine-tuned to reduce low-impact alerts and help avoid alert fatigue. But recently the system converted from their existing legacy EHR to a commercial EHR and some unintended consequences were found (Wright 2018). Though the knowledge base and content of drug-drug interaction (DDI) alerts was substantially the same between the two systems, the researchers found a striking drop off in the acceptance rates for DDI alerts after the conversion. Overall interruptive DDI alert burden increased by a factor of 6 from the

legacy EHR to the commercial EHR. The acceptance rate for the most severe alerts fell from 100 to 8.4%, and from 29.3 to 7.5% for medium severity alerts. After disabling the least severe alerts, total DDI alert burden fell by 50.5%, and acceptance of Tier 1 alerts rose from 9.1 to 12.7%. The researchers felt that the decrease in acceptance rates could not be fully explained by differences in the clinical knowledge base or by alert fatigue associated with increased alert burden. Instead, they felt that workflow factors played an important role. These included timing of alerts in the prescribing process, lack of differentiation of more and less severe alerts, and features of how users interact with alerts.

Information technology remains one of our most important patient safety tools. But there are important lessons learned in all these cases that can help us all avoid unintended consequences of our IT interventions.

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"
- January 24, 2012 "Patient Safety in Ambulatory Care"
- 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 2016 "Name Confusion in the Pharmacy"
- 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"
- November 22, 2016 "Leapfrog, Picklists, and Healthcare IT Vulnerabilities"
- January 2017 "Joint Commission Thinks Twice About Texting Orders"
- February 28, 2017 "The Copy and Paste ETTO"
- March 2017 "Yes! Another Voice for Medication e-Discontinuation!"
- April 2017 "How Much Time Do We Actually Spend on the EMR?"
- June 27, 2017 "Texting – We Told You So!"
- August 1, 2017 "Progress on Wrong Patient Orders"
- January 2018 "Can We Improve Barcoding?"
- January 16, 2018 "Just the Fax, Ma'am"
- January 30, 2018 "Texting Errors Revealed"

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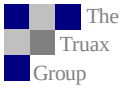

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