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Wrong-Record, Wrong-Data Errors with Health IT Systems

Leadership

DATA INTEGRITY FAILURES: A TOP 10 PATIENT SAFETY CONCERN

In the two years that ECRI Institute PSO has published its list of the top 10 patient safety concerns confronting healthcare organizations, it has identified data integrity failures from incorrect or missing data in records stored in health information technology (IT) systems among the chief issues. Our top 10 reports encourage healthcare organizations to examine their health IT-related events to identify the underlying issues contributing to data failures and to implement strategies to improve health IT safety.

To assist healthcare organizations with this vexing issue, we are using this issue of the *PSO Navigator* to look at health IT events reported to ECRI Institute PSO and its partner patient safety organizations (PSOs) to provide suggestions for preventing data integrity failures.* The findings build on the

* In addition to the review provided by ECRI Institute PSO's Advisory Council, ECRI Institute PSO acknowledges the input provided by Christoph U. Lehmann, MD, FAAP, FACMI, professor, pediatrics and biomedical information, Vanderbilt University, Nashville, Tennessee, and Dean F. Sittig, PhD, professor, School of Biomedical Informatics at the University of Texas, Health Sciences Center at Houston.

Preventing Data Integrity Failures

- Use a computer-user interface that is visible, readable, understandable, and consistent.
- Clearly display all patient information on all computer screens.
- Limit the number of patient records displayed on a screen at one time.
- Require a patient identification check at various points in the care process.
- Provide evidence-based order sets for common tasks and conditions.
- Minimize free-text entry of orders.
- Minimize interruptions from alerts to high-risk, high-priority conditions.
- Fully test a health IT system, including any upgrades and system improvements.
- Provide comprehensive training to health IT system users.
- Support event reporting and other methods to identify and address health IT problems.

analysis of health IT safety issues in our 2012 Deep Dive analysis of health IT. Refer to "ECRI Institute Guidance" for information on accessing the report.

We define data integrity failures as events that result in incomplete, inaccurate, or out-of-date information entered in or retrieved from a patient record. In many situations, they are the result of human error, provoked by systems issues, such as a chaotic environment or a poorly designed computer interface. As an example, a clinician might select the wrong patient record and, without verifying the identity of the patient whose record was selected, enter another patient's information into the record. Other data integrity failures may be the result of technology or software glitches that interfere with the transmission of data from one computer system to another. The focus of this issue of the *PSO Navigator* is on data integrity failures at the human-computer interface.

Promises and Pitfalls

Published evidence of health IT increasingly suggests that the technology can provide ready access to complete patient information in any setting and improve patient safety and quality (Jones et al.). Yet shortsighted approaches to health IT in the planning, implementation, and ongoing use of the systems can lead to unintended consequences like incomplete, inaccurate, or out-of-date information or data (ECRI Institute PSO).

Data integrity failures can result in delayed or missed diagnoses, incorrect treatment, and possible patient harm. While similar wrong-entry or wrong-record errors previously occurred with paper medical records, errors in the electronic environment can have more far-reaching consequences if the faulty data is exchanged with other computerized systems and devices within the organization. An electronic error can also be more difficult to eliminate. It's not just a matter of crossing out a wrong entry in a record; if it is replicated elsewhere, the faulty data must be corrected wherever it has been copied.

Hospital adoption rate of EHRs, 2008 to 2013.
Learn more on page 10.

ECRI Institute Guidance*

- ECRI Institute's 2015 Top Ten Patient Safety Concerns: <https://www.ecri.org/patientsafetytop10> (Top 10 materials also include a video and poster.)
- ECRI Institute PSO Deep Dive: Health Information Technology: <https://www.ecri.org/components/PSOCore/Pages/DeepDive0113.aspx>
- Electronic Health Records (guidance): https://www.ecri.org/components/HRC/Pages/MedRec1_1.aspx
- Implementing Computerized Provider Order Entry (guidance): <https://www.ecri.org/components/HRC/Pages/Pharm6.aspx>
- Patient Identification (guidance): <https://www.ecri.org/Components/HRC/Pages/RiskQual16.aspx>

* For information on obtaining ECRI Institute resources, contact ECRI Institute PSO at psohelpdesk@ecri.org.

Further, if unaddressed, health IT system hazards can contribute to medical malpractice claims. A recent medical malpractice claims analysis identified 147 cases, asserted over a five-year period, in which health IT systems were a contributing factor, representing \$61 million in direct payments and legal expenses, or about \$415,000 per case. Incorrect information in the electronic record resulted in the most claims, or about 20% of the cases. (Ruder)

More than half (53%) of the medical professional liability companies participating in a survey about electronic health records (EHRs) said they have seen EHR-related claims. The survey of 43 companies was conducted in 2012 by PIAA, an association of medical professional liability insurers (PIAA).

Health IT Fast Track

Healthcare facilities have been on a fast track to implement health IT for the last several years. As of 2013, nearly 60% of U.S. hospitals had a basic EHR system, which includes functions for managing clinical information, ordering medications, and viewing test results. Refer to “Data Snapshot” to view the rate of EHR adoption in U.S. hospitals since 2008. Physician practices are also adding EHR systems, with about 48% of office-based practices reporting they have a basic system, up from 17% in 2008 (Hsiao and Hing).

Partly driving healthcare organizations’ investment in health IT is the incentive to receive federal payments if an organization can demonstrate that it has adopted and is using an EHR system that meets certain criteria to demonstrate “meaningful use” of the system. If healthcare facilities did not meet the criteria by September 2014, they could incur financial penalties in fiscal year 2015. (CMS)

But with the rapid proliferation of health IT also comes the risk that the incidence of health IT-associated events will increase unless all the stakeholders involved in health IT—healthcare providers, health IT developers, academic researchers, PSOs, professional societies, and patients—jointly address health IT-related safety issues.

To promote patient safety in health IT, ECRI Institute is taking the lead by convening a multi-stakeholder group, the *Partnership for Health IT Patient Safety*, whose purpose is to collaborate in making health IT safer. Under the operation of ECRI Institute PSO, the *Partnership* is working to collect, share, aggregate, and analyze health IT safety data; to disseminate findings and distribute best practices; and to educate stakeholders and the broader healthcare community. For more information, refer to “About the *Partnership for Health IT Patient Safety*.”

Health IT Champions

Unfortunately, data integrity failures are commonplace. For example, data entry errors occur “fairly frequently” at nearly every organization with a health IT system, says David Bates, MD, MSc, speaking at a September 23, 2014, meeting of the *Partnership*. Bates, senior vice president and chief innovation officer at Brigham and Women’s Hospital, Boston, is a member of the *Partnership*’s expert advisory panel. Entry errors can occur when health IT users think they have pulled up a certain patient record to enter an order when they have actually selected another patient’s record, perhaps that of another patient with a similar name. “That’s a problem we ought to do a much better job of solving,” says Bates.

But solving the challenges presented by health IT systems requires the commitment of a healthcare organization’s board of directors and senior leaders to provide the resources to support the safe use of their organization’s health IT system. Simultaneously, they must champion the ultimate goal of their health IT project: to use it to enhance patient safety and healthcare quality. The lessons learned from this issue of the *PSO Navigator* and other analyses to understand the unintended consequences of health IT can foster the development, adoption, and use of the safest systems for care. Refer to “Preventing Data Integrity Failures” for a summary of suggested health IT improvement strategies to reduce data integrity failures.

What We Are Seeing

POOR USER INTERFACE CONTRIBUTES TO ERRORS

About 4% of all events reported to ECRI Institute PSO and its partner PSOs are identified as involving health IT (Mardon et al.). PSOs collect event reports about health IT and other patient safety matters using a standardized language and format known as the Common Formats. The Common Formats were developed by the Agency for Healthcare Research and Quality (AHRQ), which oversees federally certified PSOs.

The latest version of the Common Formats, version 1.2, released in April 2012, collects specific information about health IT-related events from the event report form for medical-device-related events. The form is titled “Device or Medical/Surgical Supply, including Health Information Technology (HIT).” The previous version of the Common Formats (1.1), released in March 2010, asked only if health IT was implicated in an event. ECRI Institute PSO enhanced the report to include additional questions about health IT events. ECRI Institute PSO’s event reporting system converted to version 1.2 in 2012, although organizations were still able to use the earlier version of the Common Formats for reporting.

For this issue of the *PSO Navigator*, ECRI Institute PSO used a database of 671 health IT events compiled for a separate analysis, conducted for the Office of the National Coordinator for Health Information Technology (ONC), to evaluate the use of the Common Formats to capture information about health IT-related safety events. From a database of more than 300,000 events submitted to the PSO database from October 2009 through March 2014, the search first identified events indicating health IT involvement. A narrower subset of events was obtained by searching for events with keywords, such as “order,” “record,” and “document.” The results were then manually reviewed to identify the 671 events for the ONC analysis. Because the events are limited to those involving terms such as “ordering” and “documentation,” they do not represent all types of health IT events reported to ECRI Institute PSO and its partner PSOs.

Data Entry or Selection Errors

As illustrated in “Table. Common Formats Classification of Order- and Documentation-Related Health IT Safety Events: October 2009 to March 2014,” ECRI Institute categorized the events according to the data elements for health IT events in version 1.2 of the Common Formats. Human-computer interface errors associated with data entry or selections were the most common problems identified in the queried subset of health IT events and occurred in 65% of all the events analyzed. Because this subset of events was created by looking for reports of order and documentation problems, the preponderance of entry and selection errors is unsurprising.

Less than 1% of the health IT events in this analysis were identified as contributing to patient harm (Mardon et al.). In addition to the severity classification used in the Common Formats, (i.e., near miss, incident, and unsafe condition), ECRI Institute PSO’s event reporting system uses the National Coordinating Council for Medication Error Reporting and Prevention’s (NCC MERP) Index for Categorizing Medication Errors (Hartwig et al.) to identify the harm associated with an event. Originally designed for medication errors, the index—with its nine categories for harm labeled A through I—is often used for non-medication-related events to indicate the event’s effect on the patient (e.g., an error reaches the patient but does not cause harm, an error contributes to permanent harm, an error contributes to patient harm). Reports resulting in patient harm are those in categories E through I.

Although harm scores were provided for only about half of the analyzed events, the following event underscores the potential risk to patients when errors associated with data entry or selection escape detection. In this event, the patient received an intravenous (IV) solution, intended as a one-time dose, every hour for six hours instead:

The patient was to receive a 20 mL/kg IV bolus of 5% dextrose solution over eight hours. Due to an order entry error in the CPOE [computerized

About the Partnership for Health IT Patient Safety

The Partnership for Health IT Patient Safety, a private sector initiative, aims to make health IT safer through a collaborative multi-stakeholder effort. Convened by ECRI Institute PSO, the Partnership leverages the work of multiple PSOs, healthcare provider organizations, health IT vendors, an expert advisory panel, and numerous professional societies and organizations to create a learning environment that mitigates risk and facilitates improvement.

The Partnership has no regulatory or enforcement powers; rather, it seeks to establish a nonpunitive learning environment in which to share and learn from health IT-related adverse events, near misses, and hazards as well as to use health IT to provide enhanced, quality care.

Partnership participants recently met at ECRI Institute headquarters to identify challenges, barriers, and priorities for health IT improvement. The proceedings from the one-day meeting, *Partnering for Success: A Call to Action*, are posted on ECRI Institute’s website at https://www.ecri.org/components/HRC/Pages/RMRep0215_Focus.aspx.

provider order entry] system that was not detected during pharmacist order verification or nurse order review, the patient received 20 mL/kg each hour for six hours. The patient developed seizure activity, and intubation was required.

Among the concerns raised in the event report were the limitations of the CPOE system design. The report indicated that a confusing computer display and order entry method with the CPOE system may have made it difficult for the user to distinguish between a continuous and one-time infusion. In addition, the display to check the final order was difficult to view, according to the report. Similar order entry errors have been reported in the clinical literature (Horsky et al.).

Other examples of data entry or selection errors, along with order entry mistakes, are patient data entry errors, wrong-record selections, wrong-route selections for medication administration (e.g., IV instead of intramuscular), and mistakes in the data entry format. Sample scenarios from the event reporting database are described below.

Patient Data Entry Errors

Undetected problems at the user interface of health IT systems can contribute to patient data entry errors. Examples are as follows:

- ▶ A newborn’s data is mistakenly entered into the mother’s record because the baby’s new record has not been created.
- ▶ Outdated patient information automatically populates in various fields because the data was not updated with a patient’s recent admission.
- ▶ Incorrect patient data from a previous entry is copied and pasted into a new entry in the patient record.

- ▶ Incorrect data is keyed into the patient record (e.g., entering “66” instead of “6”)

In the following event, an incorrect patient weight was entered in the patient record and almost used to calculate a drug dose before the pharmacist double-checked the weight:

The patient’s weight was entered as 99 kg in the EHR system. When pharmacy called the care unit to confirm the weight to dose an antibiotic, the nurse stated that the correct weight was 49 kg. The correct weight was used to calculate the dose.

Although the reasons for the entry error were not given, a variety of factors could have contributed, such as a difficult-to-view computer display or a distracting environment at the computer workstation.

Ordering Mistakes

Like the serious wrong-dose order in the CPOE system described above, several data entry events illustrate errors in entering orders. Often a wrong selection is made from a drop-down menu listing—for example, medication names and doses, test options, and doctors’ names. In fact, selection errors with drop-down menus are the most common prescribing errors with CPOE systems, according to a recent study (Westbrook et al.). Other selection errors include selecting the wrong start date for a medication from a calendar display.

In the following event, a patient was exposed to additional radiation from redoing a computed tomography (CT) scan because the wrong CT exam was selected in the test ordering system. It is possible that the wrong CT exam was selected from a drop-down list:

The physician ordered a CT of the spine. The exam was electronically entered as a CT of the brain. The technologist failed to check the order in the chart, and an incorrect exam was performed. The error was identified by the ordering physician when trying to obtain results.

The autopopulate feature of computers can lead to ordering and entry mistakes when the user selects the option that the health IT system has automatically preselected even though it is not the option the user wanted. Although the following event does not describe an actual

Table. Common Formats Classification of Order- and Documentation-Related Health IT Safety Events: October 2009 to March 2014

Circumstances	No. of Reports* (N = 671)
Incompatibility	8
Equipment/device function	68
Loss or delay of data	23
Data does not match patient	32
Image measurement/corruption issue	1
Image orientation incorrect	0
Incorrect test results	5
Incorrect software programming calculation	1
Incorrect/inappropriate alert	3
Other equipment/device	3
Equipment/device maintenance	0
Hardware failure or problem	4
Network failure or problem	2
Ergonomics or user interface issues	448
Hardware location (e.g., awkward placement)	0
Data entry or selection	434
Information display or presentation	14
Alert/alarm fatigue	0
Other ergonomics or user interface issue	0
Security virus or other malware issue	2
Unexpected software design issue	8
Unknown circumstance	4
Other circumstance	3

* Not all health IT-related events had sufficient information to identify the circumstances of the event.

Source: Mardon R, Olinger L, Sparnon E, et al. Health information technology adverse event reporting: analysis of two databases [report online]. 2014 Nov 25 [cited 2015 Jan 30]. http://healthit.gov/sites/default/files/Health_IT_PSO_Analysis_Final_Report_11-25-14.pdf

ordering error, it describes a problem that could still occur with a medication order:

The nurse typed in “DIL” on the screen of the medication dispensing cabinet and Dilantin [phenytoin] came up at the top of the list. The nurse had intended to obtain Dilaudid [hydromorphone] for the patient’s pain but medicated the patient with Dilantin instead.

Wrong-Record Selections

Multiple events in the analysis involved selection of the wrong patient’s records. In the following event, the scheduling department pulled the record of the wrong patient, who was mistakenly called about an upcoming surgical procedure for another patient with a similar name.

The patient listed on the surgery schedule was contacted at home. The patient denies being scheduled for any procedure and is upset. I contacted surgery scheduling to clarify. The actual patient has a similar first and last name as the patient contacted. The name on the surgery schedule was changed.

In addition to the similar names, the years in which the two patients were born had the same numbers, although in a different order. There was no harm other than the emotional distress to the individual mistakenly contacted about the upcoming surgical procedure.

Other events underscore the potential risks to patient care when the wrong patient’s record is selected and used to document another patient’s care. Although there was no harm to the patient in the following event, the reporter comments on potential patient safety risks when a wrong patient record is used:

The patient arrived at the ED [emergency department] by ambulance. The driver gave the patient’s name. The ED clerk selected the wrong patient record in the EHR. The actual patient had the same name but a different date of birth than the patient whose record was selected. The patient was banded, labs were drawn, an EKG was done, etc., all based on the wrong patient information. The ambulance driver questioned the patient’s age listed in the record. The clerk went back into the system and located the correct record. Unknown harm. If medications were given, for example, did the actual patient have any known drug allergies?

Not all wrong-record selections occur with patients with similar names. In the following event, a nurse was performing multiple tasks (i.e., giving an end-of-shift report and documenting in patients’ records). Upon returning to the charting tasks, the nurse entered information about a medication order in the record open on the screen. It was the wrong patient record:

During a shift change, the outgoing nurse was giving a report on two patients. The incoming nurse was working at a computer but left to take care of a patient in another room. The outgoing nurse finished charting but entered the patient’s information in the wrong record, already opened on the screen by the incoming nurse. The patient whose record was open was later found to have two infusions of the same blood pressure medication. One infusion had been started in the ED. The other infusion was discontinued when it was discovered. The patient became hypotensive.

Wrong-patient record selections can also contribute to violations of the privacy provisions of the Health Insurance Portability and Accountability Act. In one event, a patient was discharged from the ED under the name of another patient in the ED who was to be admitted to a patient care unit. The outgoing patient received discharge instructions with the incoming patient’s information. Because the IT systems for the ED and admissions were linked, the ED patient awaiting admission could not be admitted to the care unit until the mistake with the discharged patient was corrected. In addition to noting the delays in providing patient care, the event report indicated the hospital was also handling the incident as a patient privacy violation and was addressing the unauthorized disclosure.

Entry Format Mistakes

Errors can also occur when information is improperly entered in the record. Improper placement of important information may lead to multiple problems, such as confusion about a patient’s care, communication breakdowns, and order transmission failures. In the following event, a transfusion order was completed incorrectly and never reached the hospital’s blood bank. The patient died before receiving a fresh frozen plasma transfusion. It is unclear from the event narrative whether the patient’s death was

attributed to the delay in processing the transfusion order or to other causes:

The doctor ordered four units of fresh frozen plasma while the patient was in the ED. After the patient was admitted, the blood bank informed us that the order did not transfer because the number of units must be specified in multiple sections in the record. This resulted in a delay in starting the infusion. The patient coded and died by the time the order was completed.

In another event, important dosing information about a medication order was entered in the doctor’s instructions but omitted from the field for recording the total dose. The text entry could not be viewed by the pharmacist:

The doctor ordered five doses of Toradol, but the five-day stop date did not appear in the electronic

medication administration record. The correct method for entering this order in the CPOE is for the prescriber to enter the number of doses in the field for total doses. The field was left blank for this order. The doctor’s order for five doses appears in the instructions section of the order, which is not visible to the pharmacist. The nurse knew to stop at five doses.

A 2009 study found that about 5% of electronic medication orders contain free-text comments. Some of these entries can contribute to inconsistent communication about the order, such as the drug dose, which can lead to patient harm. The study estimated an overall rate of errors from inconsistent communication at 1% for all electronic drug orders. (Singh et al.)

Lessons Learned

STRATEGIES TO PREVENT DATA INTEGRITY FAILURES

Given the frequency with which entry and selection errors were identified from a targeted analysis of order- and documentation-related health IT events reported to ECRI Institute PSO and its partner PSOs, it is not surprising that risk management and legal professionals at healthcare organizations also identify these type of events among their top EHR-related safety concerns. In a recent survey sent to members of the American Society for Healthcare Risk Management and the American Health Lawyers Association, the 369 respondents, asked to identify their EHR-related safety concerns, listed among them incorrect patient identification, incorrect selection from a list of items, and open or incomplete orders (Sittig and Singh). All of these concerns are reflected in the events summarized in this issue of the *PSO Navigator*.

Listed below are suggested strategies to prevent these types of data integrity errors with health IT systems. Given that many data entry and selection errors occur at the human-computer interface, the strategies are limited to those that influence a user’s interaction with the system. In addition to the recommendations available in ECRI Institute PSO’s Deep Dive on health IT, others are drawn from guides released last year by ONC to optimize the safety and safe use of EHR systems. Called

the SAFER (Safety Assurance Factors for EHR Resilience) Self Assessment Guides, they are tools to assist healthcare facilities evaluate their approaches to health IT in known problematic areas, including areas addressed in this issue of the *PSO Navigator*, such as poorly designed user interfaces, patient identification errors, and order entry mistakes (Sittig et al.). The guides provide recommended best practices for each of these areas from evidence-based research. Other areas covered by the guides include organizational policies, the system’s configuration, system-wide integration, and more. For more information, refer to “SAFER Guides for Health IT.”

Identifying strategies to promote safe health IT use requires multidisciplinary input. In addition to the IT department’s input, those who will be using the system—for example, nurses, physicians, pharmacists, lab technicians, and others—must be involved in any decision making that affects the health IT system’s operation. Other departments, such as clinical engineering, admissions, and risk management and quality improvement, should also be consulted as needed.

Usability

Poor usability of a health IT system can jeopardize patient safety, as suggested by several of the

events from the data analysis of events reported to ECRI Institute PSO and its partner PSOs. Users may select the wrong item from a drop-down list, record data in the wrong record, or select the wrong drug for a medication order, to name just a few of the errors that can occur.

To ensure patient safety, the user interface should be intuitive and simplify tasks. As recommended in the SAFER guides, the computer-user interface should ensure that information is visible (e.g., columns are wide enough to view critical data), readable (e.g., appropriate font sizes and contrast are used), understandable (e.g., only standardized abbreviations are used), and consistent (e.g., similar functions have similar labels) (ONC “High Priority Practices”). Additionally, user input about a system’s ease of use should be sought in making purchase decisions.

Among the desirable features for a user interface are the following (ECRI Institute PSO):

- ▶ Information on the display screen is organized and clear.
- ▶ Critical information is available and easily seen without requiring the user to search for it or perform extra steps to find it.
- ▶ Text is easily readable at a normal viewing distance.
- ▶ Input fields are large enough to enter the necessary information.
- ▶ Menu displays are designed to prevent errors (e.g., drop-down lists are fully visible, items in the list are grouped contextually rather than alphabetically).
- ▶ Actions can easily be reversed. For example, if a mistake occurs in data access, retrieval, storage, or deletion, there are intuitive ways to reverse the actions without losing the data.

Accurate Patient Identification

Numerous event reports describe instances of entering data into a record that is associated with the wrong patient. Strategies to ensure accurate patient identification in health IT can prevent this problem as long as they seamlessly fit into staff workflow and staff are provided adequate training in the required safe practices.

An entire SAFER guide is devoted to patient identification safety practices for health IT systems. Among the recommended practices are the following (ONC “Patient Identification”):

- ▶ Verifying and updating patient demographics upon admission.
- ▶ Allowing users to electronically select patient records based on specific criteria, such as user, location, or service. This practice generates a short list of relevant patients and reduces the risk of selecting the wrong patient.
- ▶ Clearly displaying patient information (e.g., last name, first name, date of birth, calculated age, gender, medical record number, recent photograph) on all computer screens to reduce the risk of wrong-patient errors.
- ▶ Displaying patient names on adjacent lines in a visually distinct manner, such as in different font colors, to reduce the likelihood of selecting the wrong patient name.
- ▶ Warning users when they create a new record or look up a record for a patient whose first and last name are the same as another patient to reduce the risk of mistakenly pulling the record of another patient with a similar name.
- ▶ Limiting the number of patient records that can be displayed on the same computer at one time to prevent wrong-record entries.
- ▶ Limiting copied-and-pasted entries from one record to another and requiring identification of any information that is copied and pasted.
- ▶ Requiring a check of the patient’s identification at various points in the care process, such as vital sign recording, order entry, medication administration, and discharge, to support correct patient identification. For example, before completing an order, the user is shown a picture or name, gender, and age of the patient and must verify the information before proceeding with the order.

SAFER Guides for Health IT

ONC’s nine SAFER guides are designed to help healthcare organizations assess and optimize health IT system safety. Each guide addresses a different critical area associated with the safe use of EHRs through a series of self-assessment checklists, practice worksheets, and recommended practices. The topics addressed in the guides are high-priority practices, organizational responsibilities, patient identification, CPOE with decision support, review of test results and follow-up, clinician communication, contingency planning, system interfaces, and system configuration. The SAFER guides are available as both downloadable PDFs and interactive web-based tools at <http://www.healthit.gov/safer/safer-guides>.

Education Teaser

Which of the following *is not* a technology used to improve medication safety?

- a. CPOE
- b. Automated dispensing units
- c. Pharmacy information systems
- d. Bar-coded medication administration
- e. None of the above. They are all used.

Which of the following *is not* a way that the use of CPOE systems may increase the risk of medication errors occurring?

- a. Faulty computer interfaces
- b. Human errors caused by inexperience and distractions
- c. Lack of adequate decision support
- d. b and c only
- e. None of the above. They are all ways the use of CPOE systems can lead to medication errors.

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Accurate Order Entry

In ECRI Institute PSO's Deep Dive analysis of health IT events, we found that as many as one in four of the events analyzed were associated with data input errors, such as wrong order entries or data missing from the entry (ECRI Institute PSO). One of the SAFER guides provides recommended practices for CPOE systems with clinical decision support to reduce the risk of these and other errors. Among the strategies to prevent order entry errors are the following (ONC "Computerized"):

- ▶ Create reminders to enter information about patients' allergies before entering medication orders.
- ▶ Provide evidence-based order sets for common tasks (e.g., orders for certain medications, diagnostic tests, procedures) and conditions (e.g., chest pain management), and ensure they are updated regularly.
- ▶ Facilitate the user's ability to cancel and acknowledge receipt of orders for the laboratory, radiology, and pharmacy.
- ▶ Minimize free-text entry of orders.
- ▶ Display all pertinent patient information on the order entry screen.
- ▶ Minimize interruptions from alerts to those that are for high-risk, high-priority conditions.
- ▶ Conduct usability testing of the system and any upgrades, and ensure users are informed when changes are made to the system.
- ▶ Require users to demonstrate competency with basic CPOE skills before permitting them to use the system.

Of course, clinicians cannot become totally dependent on technology and ignore their critical-thinking and clinical skills to detect possible safety concerns. If, for example, a patient has a known allergy to aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs), the clinician should be aware that ketorolac is also an NSAID that is contraindicated for the patient—even if the clinical decision support program fails to give a warning.

Organizational Policies

Organizational practices to promote the safe use of health IT systems are essential in minimizing errors. Among the most critical of these practices are the following (ONC "Organizational"):

- ▶ Fully testing a health IT system, including any upgrades and system improvements, for any unintended consequences before wide-scale adoption. The system should also be retested periodically.
- ▶ Providing comprehensive training to health IT system users before they use the system, when they are first using the system, and before any changes are made to the system. Users should be made aware of common problems with health IT systems, such as wrong-record selection and order entry mistakes, so they are vigilant about preventing them.
- ▶ Ensuring that system users can obtain help immediately when they need it.
- ▶ Providing processes and procedures to facilitate data entry after a system has been down.
- ▶ Partnering with the organization's health IT system vendors to be kept informed about changes, updates, and newly identified hazards and to work together to find solutions to the identified problems.

Event Reporting

One of the greatest limitations to making improvements to a health IT system is not knowing about any incidents that occur, including those that are caught before causing any patient harm. Improvements cannot be made if problems are not identified.

Healthcare organizations need to enlist their staff to identify and report health IT events by educating them to recognize health IT events and near misses and showing them how event reporting can improve patient safety. What may seem like a medication error when a health IT system user selects the wrong dose for a medication from a drop-down menu may lead to changes in the user-computer interface if it is evaluated as a health IT issue as well. Sharing stories of how an event report can lead to health IT system

improvements will provide the necessary feedback to reinforce staff members' reporting efforts.

The process for reporting health IT-related issues should be free of barriers that make reporting difficult. Can a staff member easily report the problem without too many interruptions to their other tasks? Additionally, organizations must support a safety culture wherein event reporting is viewed as a tool for patient safety improvements and not for singling out or punishing those who make mistakes because a poor user interface or other system-related issues set them up for failure.

Organizations should not limit their search for health IT-related issues identified in event reports. Other sources of information might

include help desk requests to the IT department, user alerts from the health IT staff, and the health IT system vendor's feedback about problems encountered by other users of their systems. Routinely analyzing data in the health IT system, such as reviewing medication orders with missing administrations, may also result in detection of health IT-related problems.

Finally, any needed modifications to the health IT system, identified from event analysis and investigation, should be thoroughly tested to verify that the system behaves as expected, with no unintended impact on clinician workflow, and that the improvement objectives are met. The organization does not want to unintentionally introduce new problems when changes are made to the system.

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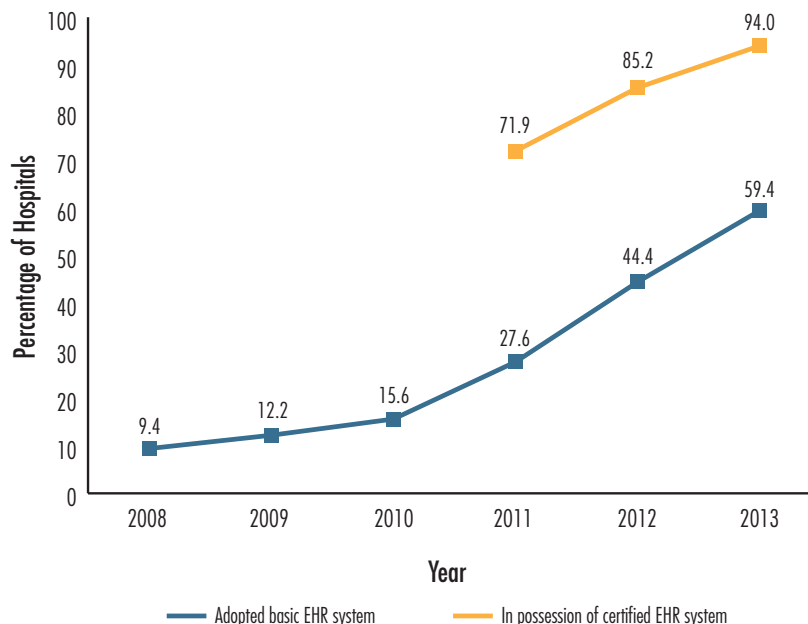
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Data Snapshot

Hospital Adoption of EHR Systems Increases More Than Five-Fold since 2008

By the end of 2013, about 60% of U.S. hospitals had adopted a basic EHR system. A basic system includes functions for managing clinical information, ordering medications, and viewing test results. Additionally, by the end of 2013, 94% of U.S. hospitals indicated they were in possession of a certified EHR system, meaning they had a legal agreement with an EHR vendor but had not necessarily adopted the system by then. Certified EHR systems meet federal requirements for some or all of the objectives of the federal government's incentive program for EHR adoption.



Note: Basic EHR adoption requires the system to have a set of EHR functions for managing clinical information, ordering medications, and viewing test results. A certified EHR system has been certified as meeting federal requirements for some or all of the hospital objectives of the Centers for Medicare and Medicaid Services' EHR Incentive Program. Possession means that the hospital has a legal agreement with the EHR vendor; possession is not equivalent to adoption.

Source: Charles D, Gabriel M, Furukawa MF. Adoption of electronic health record systems among U.S. non-federal acute care hospitals: 2008-2013 [online]. Office of the National Coordinator for Health Information Technology (ONC) Data Brief No. 16. 2014 May [cited 2015 Jan 30]. <http://www.healthit.gov/sites/default/files/oncdatabrief16.pdf>

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