Spotlight on Electronic Health Record Errors: Paper or Electronic Hybrid Workflows

Erin Sparnon, MEng
Senior Patient Safety Analyst
Pennsylvania Patient Safety Authority

ABSTRACT

In a previous Pennsylvania Patient Safety Advisory *article, analysts read 3,099 narrative reports relevant to health information technology (HIT) from the Pennsylvania Patient Safety Authority's database and tagged each report using a previously published classification taxonomy developed specifically for HIT. In the course of that review, analysts identified 85 reports of a specific type of error: errors related to miscommunication arising from dual use of electronic and paper documentation. The use of a hybrid workflow, in which both electronic and paper systems are used for documentation, is often found in care areas transitioning from a paper-based to fully electronic (i.e., electronic health record [EHR]) documentation procedure. Hybrid workflows may occur as a planned transitional step during the implementation of an EHR system or may arise as a workaround in which paper is used to supplement electronic systems. This article describes the type of events related to the use of a hybrid workflow and provides recommendations on reducing the use of hybrid workflows. (Pa Patient Saf Advis 2013 Jun;10[2]:55-8.)*

INTRODUCTION

The Pennsylvania Patient Safety Authority published an analysis of patient safety events related to the use of electronic health records (EHRs) reported through the state's mandatory reporting system in the December 2012 issue of its *Pennsylvania Patient Safety Advisory*.[1] This research was motivated in part by the 2011 Institute of Medicine (IOM) report *Health IT and Patient Safety: Building Safer Systems for Better Care*,[2] which noted a lack of hazard and risk reporting data on health information technology (HIT). The IOM report considered this lack of reporting data to be a hindering factor in ongoing efforts to improve the safety of HIT systems. The *Advisory* article identified EHR-related events reported through the Authority's Pennsylvania Patient Safety Reporting System database and applied a previously published classification taxonomy specific to HIT.[3]

In the course of manually reviewing EHR-related reports in the Authority's database, analysts identified several general error types and trends that warranted further study. In this article, analysts focus on errors related to hybrid medical records workflows, in which a mix of paper and electronic media is used to maintain the medical records for a single patient. These errors largely include omission and duplication of tasks due to miscommunication among caregivers and can pose serious risk to patients.

METHODS

The 85 cases used in this analysis were identified from a prior data set of 3,099 EHR-related incident reports queried for the December 2012 *Advisory* article. Shortly after beginning the manual review of queried event reports for the December article, analysts noticed several reports that dealt with miscommunication due to dual use of electronic and paper documentation practices, an error type that did not neatly fit into any one category of the Magrabi et al. error classification taxonomy used in the December analysis.[3] Analysts then created a tag for this type of hybrid-workflow error and considered it for each of the 3,099 manually reviewed reports that were deemed relevant to EHRs, identifying 85 reports relevant to hybrid workflows.

RESULTS

Classification by Harm Score

Of the 85 identified reports, 77 (91%) were reported as "event, no harm" (i.e., an error did occur, but there was no adverse outcome for the patient) and 7 (8%) were reported as "unsafe conditions" that did not result in a harmful event. Only one report involved temporary harm to the patient related to receiving the wrong dosage form (extended-release instead of standard tablets) of a narcotic:

> *Physician ordered "Oxycodone 30 mg PO q 4 h [by mouth, every four hours]." At 0600, that order was entered in [the computerized order entry (CPOE) system] as "Oxycodone ER [extended release] 30 mg PO q 4 h" and verified in Meditech by RN [registered nurse]. That was then administered by nine different nurses. The paper MAR [medication administration record] that pharmacy viewed and verified was actually done correctly stating "Oxycodone 30 mg PO q 4 h." The order in [the CPOE system] was never verified by pharmacy.*

In this case, it appears that the pharmacy did not have access to the electronic order, and the solution would be to redesign workflow so that the pharmacy verifies orders printed from the CPOE. Overall, the harm score pattern for reports related to hybrid paper and electronic workflows closely resembled the harm score pattern for all EHR-related reports identified in the December 2012 article.

Classification by Event Type

Of the 85 identified reports, the most commonly used event type assigned by reporters was "medication error" (n = 63, or 74% of reports). Within medication errors, the most commonly used event type classification was "wrong medication" (22%), followed by "dose omission" (19%) and "extra dose" and "other" (each with 13%).

Extra Dose or Overdose

Events classified by the reporter as "extra dose" (n = 11) , as well as 5 of the 19 events classified as wrong-medication errors, included reports of potential overdoses related to miscommunication as to whether a patient had already received a medication, such as the following:

> *Written order for Toradol [ketorolac tromethamine] 30 mg on patient's emergency room chart. Medication administered by nurse and documented in electronic medical record, not on paper emergency room chart. Second nurse also saw order and administered medication again.*

Dose Omission

Events related to dose omission medication errors (n = 16) included six reports related to orders or documentation written on paper but never entered into electronic systems and seven reports of electronic orders not being properly printed or written onto the paper medication administration worksheets (e.g., Kardex) used by clinicians. Examples of these two types of errors are as follows:

> *Orders in paper chart were not transferred to computer. These included "NPO till procedure completed, 1 gm Ancef [cefazolin] IV [intravenous] on call to OR [operating room] . . ., and VS q15 x 4." These had been written on paper chart at 1800. The Ancef was not profiled on MAR, and the rest of the aforementioned orders are also not present on [the CPOE system].*

> *[Patient] ordered heparin through PE/DVT [pulmonary embolism/deep-vein thrombosis] assessment order sheet. Med entered in pharmacy information system but not transcribed to Kardex or current MAR for administration. Dose overlooked. No harm reported.*

DISCUSSION

Hybrid workflows may arise by design as a necessary transitional state between all-paper and all-electronic workflows or as an unintended workaround. Although meaningful use incentives have increased EHR adoption projects in the last several years,[4] these projects do not always lead smoothly to fully electronic workflows.[5] Funding gaps, competing priorities, and a lack of industry education have left many facilities in extended or indefinite transitional periods in which both paper and electronic systems are maintained.[6] Even in a nominally all-electronic workflow, hybrid workflows can arise as a workaround if clinicians supplement use of an electronic system with handwritten notes as documentation aids.[7] The ways in which hybrid workflows are used are likely to be unique to each facility or care area, with differences arising from a combination of EHR functionality, local workflows, and organizational policies and procedures.[8]

Hybrid workflows raise the potential for medical error: if clinicians need to check for information in multiple locations, clinicians may be more likely to overlook some information.[4] Hybrid systems also pose logistical and legal challenges for facilities. A 2008 study of Indian Health Service (IHS) clinics in Billings, Montana, found that allowing providers to choose between using paper and electronic systems as they transitioned to an EHR system required health information management (HIM) staff to complete and compile the legal patient record from both paper and electronic sources at the end of every day, stressing HIM resources and doubling the time to perform release-of-information requests.[9] In order to meet the logistical and legal challenges of hybrid workflows, facilities need to create and maintain documentation of where different pieces of their medical records are stored.[10] In designing this documentation process, facilities may wish to conduct a comprehensive workflow analysis on the process of accessing all the data required to fulfill release of information requests.[11]

Avoiding the challenges of a hybrid system may include preventing one from developing: instead of lingering in a hybrid transitional state, facilities may wish to focus on finishing the transition from a wholly paper to a wholly electronic workflow as completely and in as short a time frame as possible. The American Health Information Management Association considers a complete transition from a paper to EHR system to be best practice and offers practical advice for ensuring the quality and integrity of a facility's legal health record throughout the transition period, including factors to consider when developing policies and procedures for when electronic information can be printed out in a hybrid environment:[6]

- Timeliness, as paper printouts will not contain updated electronic information.
- Money spent on generating, managing, securing, and destroying papers, compact discs, external storage drives, and other media could be better spent on making sure access to electronic information is pervasive.
- Risk of allowing users to make notes on paper copies, which would then need to be retained as part of the legal health record and could lead to confusion when the paper record and the electronic record contain different information.

Barriers and facilitators for EHR adoption can arise from many factors, including system, user, organizational, and environmental attributes, as well as support from others.[12] Technical design of the system is key, as usability and usefulness can significantly impact staff acceptance and use.[13]

However, the nontechnical details of the implementation of a new electronic system (e.g., policy development, management of the workflow changes required for the transition) may be just as important as the design of the system itself,[14] and a review of best-practice literature for technology implementation identified several key components for the successful design and implementation of new electronic systems:[15,16]

- Identifying a single person who is responsible and accountable for the implementation's success
- Selecting an EHR technology platform that can meet workflow needs, configuring its user interface to permit users to safely and efficiently grasp a complex process, and populating the EHR system with content that is relevant to clinical practice
- Studying current, pre-electronic workflows to determine what changes will be needed when moving to an electronic workflow
- Designing and carrying out pilot testing in enough clinical locations so that the results can be applied to the remainder of the facility
- Seeking appropriate participation from end users (e.g., nurses, physicians, other caregivers) in all phases of the implementation
- Continually evaluating the safety and effectiveness of implemented systems, including error reporting and incident investigation

Additional resources for successful EHR implementation planning are available from many groups, including the Healthcare Information Management Systems Society,[17] the United Kingdom's National Health Service,[18] the Office of the National Coordinator for Health Information Technology's regional extension offices for support of small rural and critical access hospitals,[19] and the Agency for Healthcare Research and Quality (AHRQ).[20] Specific AHRQ resources relevant to this article include a report on mitigating the unintended consequences of EHR implementation,[21] a toolkit for workflow assessment in HIT,[22] and a searchable knowledge library.[23]

Limitations

The provenance of the data set used as the basis of this report may have shaped the type of reports included: they were selected during manual review of reports identified through a query intended to identify EHR-related events. There are likely many more reports in the Authority's database related to miscommunication while using hybrid paper and electronic workflows; however, this type of error is a complex issue not amenable to simple query searching.

CONCLUSIONS

This analysis indicates that hybrid workflows contribute to medical errors reported to the Authority. Use of a hybrid workflow can lead to miscommunication among caregivers when orders and administration information differ between paper and electronic systems. This miscommunication can lead to medication errors like dose omissions and extra doses, which can cause serious harm to patients. Therefore, facilities should consider the implications of hybrid documentation workflows, especially if they are facing a recent or planned implementation of EHR systems. Facilities that have transitioned to EHR systems may wish to periodically monitor clinical workflow to determine whether hybrid workflows are developing in response to user challenges with the electronic system.

NOTES

1. Sparnon E, Marella WM. The role of the electronic health record in patient safety events. Pa Patient Saf Advis [online] 2012 Dec [cited 2013 May 1]. http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2012/Dec;9(4)/Pages/113.aspx.
2. Institute of Medicine. Health IT and patient safety: building safer systems for better care [report online]. 2011 Nov 8 [cited 2013 Jan 18]. http://www.iom.edu/Reports/2011/Health-IT-and-Patient-Safety-Building-Safer-Systems-for-Better-Care.aspx.
3. Magrabi F, Ong MS, Runciman W, et al. Using FDA reports to inform a classification for health information technology safety problems. *J Am Med Inform Assoc* 2012 Jan-Feb;19(1):45-53.
4. Sittig D, Singh H. Electronic health records and national patient-safety goals. *N Engl J Med* 2012 Nov 8;367(19):1854-60.
5. Chavis S. Pulling double duty [online]. For the Record 2011 Sep 26 [cited 2013 Feb 19]. http://www.fortherecordmag.com/archives/092611p24.shtml.
6. American Health Information Management Association. Managing the transition from paper to EHRs [practice brief online]. 2010 Nov [cited 2013 Apr 12]. http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_048418.hcsp?dDocName=bok1_048418.
7. Park SY, Lee SY, Chen Y. The effects of EMR deployment on doctors' work practices: a qualitative study in the emergency department of a teaching hospital. *Int J Med Inform* 2012 Mar;81(3):204-17.
8. Magrabi, Farrah (Senior Research Fellow at the Centre for Health Informatics, Australian Institute for Health Innovation). E-mail to: Erin Sparnon. 2013 Apr 24.

9. Hall T. Minimizing hybrid records. Tips for reducing paper documentation as new systems come online. *J AHIMA* 2008 Nov-Dec:79(11):42-5.
10. Dimick C. Record limbo. Hybrid systems add burden and risk to data reporting. *J AHIMA* 2008 Nov-Dec;79(11):28-32.
11. Roop ES. ROI in a hybrid environment [online]. For the Record 2012 Apr 23 [cited 2013 Feb 19]. http://www.fortherecordmag.com/archives/042312p14.shtml.
12. Holden, RJ. What stands in the way of technology-mediated patient safety improvements?: a study of facilitators and barriers to physicians' use of electronic health records. *J Patient Saf* 2011 Dec;7(4):193-203.
13. Carayon P, Cartmill R, Blosky MA, et al. ICU nurses' acceptance of electronic health records. *J Am Med Inform Assoc* 2011 Nov-Dec;18(6):812-9.
14. Lorenzi NM, Riley RT. Managing change: an overview. *J Am Med Inform Assoc* 2000 Mar-Apr;7(2):116-24.
15. Karsh BT. Beyond usability: designing effective technology implementation systems to promote patient safety. *Qual Saf Health Care* 2004 Oct;13(5):388-94.
16. Sittig D, Singh H. Eight rights of safe electronic health record use. *J Am Health Inform Management Assoc* 2009 Sep 9;302(10):1111-3.
17. Healthcare Information Management Systems Society. EHR adoption, engagement, and implementation [online]. [cited 2013 May 1]. http://www.himss.org/resourcelibrary/TopicList.aspx?MetaDataID=961&navItemNumber=13310.
18. Clinical safety. In: NHS connecting for safety [website]. [cited 2013 May 1]. Leeds (UK): National Health Service. www.connectingforhealth.nhs.uk/systemsandservices/clinsafety/key.
19. US Department of Health and Human Services. Implementation support for critical access hospitals and other small rural hospitals [online]. [cited 2013 May 1]. http://www.healthit.gov/providers-professionals/implementation-support-critical-access-hospitals-and-other-small-rural.
20. Health information technology: best practices transforming safety, quality, and efficiency [website]. [cited 2013 May 1]. Rockville (MD): Agency for Healthcare Research and Quality. http://healthit.ahrq.gov.
21. Jones SS, Koppel R, Ridgely MS, et al. Guide to reducing unintended consequences of electronic health records [online]. Prepared by the RAND Corporation under contract no. HHSA290200600017I, task order #5. Agency for Healthcare Research and Quality pub. no. 11-0105-EF. 2011 Aug [cited 2013 May 1]. http://www.ucguide.org.
22. Agency for Healthcare Research and Quality. Workflow assessment for health IT toolkit [online]. [cited 2013 May 1]. http://healthit.ahrq.gov/portal/server.pt/community/health_it_tools_and_resources/919/workflow_assessment_for_health_it_toolkit/27865.
23. Agency for Healthcare Research and Quality (AHRQ). Knowledge library [website]. [cited 2013 May 1]. Rockville (MD): AHRQ. http://healthit.ahrq.gov/portal/server.pt/community/knowledge_library/653.

PENNSYLVANIA PATIENT SAFETY ADVISORY

This publication is disseminated via e-mail. To subscribe, go to http://visitor.constantcontact.com/d.jsp?m=1103390819542&p=oi.

To see other articles or issues of the Advisory, visit our website at http://www.patientsafetyauthority.org. Click on "Patient Safety Advisories" in the left-hand menu bar.

THE PENNSYLVANIA PATIENT SAFETY AUTHORITY AND ITS CONTRACTORS

PATIENT SAFETY AUTHORITY
An Independent Agency of the Commonwealth of Pennsylvania

The Pennsylvania Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error (Mcare) Act. Consistent with Act 13, ECRI Institute, as contractor for the Authority, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the Pennsylvania Patient Safety Authority, see the Authority's website at http://www.patientsafetyauthority.org.

ECRI Institute
The Discipline of Science. The Integrity of Independence.

ECRI Institute, a nonprofit organization, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for more than 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research. More than 5,000 healthcare organizations worldwide rely on ECRI Institute's expertise in patient safety improvement, risk and quality management, and healthcare processes, devices, procedures and drug technology.

ISMP
INSTITUTE FOR SAFE MEDICATION PRACTICES

The Institute for Safe Medication Practices (ISMP) is an independent, nonprofit organization dedicated solely to medication error prevention and safe medication use. ISMP provides recommendations for the safe use of medications to the healthcare community including healthcare professionals, government agencies, accrediting organizations, and consumers. ISMP's efforts are built on a nonpunitive approach and systems-based solutions.

Scan this code with your mobile device's QR reader to subscribe to receive the Advisory *for free.*