REVIEW & ANALYSES

1 Medication Errors Attributed to Health Information Technology
Nearly 900 medication error reports listed health information technology (HIT) as a factor contributing to the event submitted to the Pennsylvania Patient Safety Authority. The most common HIT systems implicated in the events were the computerized prescriber order entry system, the pharmacy system, and the electronic medication administration record.

9 Dislodged Gastrointestinal Tubes: Prevention, Recognition, and Treatment
Hospitals can decrease the risk for gastrointestinal tube complications by implementing best practices and risk reduction strategies to confirm proper positioning of gastrostomy tubes and to prevent, recognize, and manage dislodgement. Aside from peritonitis, sepsis, and death, other serious harm can result from even minor changes in gastrostomy tube position.

17 Handoff Communications: A Systems Approach
Handoffs are an integral part of care coordination and the delivery of safe patient care. Using handoff processes that incorporate critical thinking and reasoning skills to address patient needs and providing handoff training and education are strategies to improve patient handoff communications.

27 Retained Surgical Items: Events and Guidelines Revisited
Surgical items such as sponges, sharps, and instruments may be retained during surgery and can lead to serious patient harm. Detecting and reporting retained surgical items may help to determine patterns and root causes using a definition decided upon by the healthcare facility.

FOCUS ON INFECTION PREVENTION

36 Data Snapshot: Improving Influenza Vaccination Rates of Healthcare Personnel in Pennsylvania Long-Term Care Facilities
Influenza is a contagious respiratory illness that can cause mild to severe illness and can lead to death. Long-term care facilities can promote influenza vaccination each season by reducing barriers to healthcare personnel vaccination.

OTHER FEATURES

39 The Authority Celebrates Pennsylvania Healthcare Providers for Outstanding Patient Safety Efforts

42 Data, Data Everywhere… Not Any Time to Think!

44 Saves, System Improvements, and Safety-II
OBJECTIVE
The Pennsylvania Patient Safety Advisory provides timely original scientific evidence and reviews of scientific evidence that can be used by healthcare systems and providers to improve healthcare delivery systems and educate providers about safe healthcare practices. The emphasis is on problems reported to the Pennsylvania Patient Safety Authority, especially those associated with a high combination of frequency, severity, and possibility of solution; novel problems and solutions; and problems in which urgent communication of information could have a significant impact on patient outcomes.

PUBLISHING INFORMATION
The Pennsylvania Patient Safety Advisory (ISSN 1941-7144) is published quarterly, with periodic supplements, by the Pennsylvania Patient Safety Authority. This publication is produced by ECRI Institute and the Institute for Safe Medication Practices under contract to the Authority.

COPYRIGHT 2017 BY THE PENNSYLVANIA PATIENT SAFETY AUTHORITY
This publication may be reprinted and distributed without restriction, provided it is printed or distributed in its entirety and without alteration. Individual articles may be reprinted in their entirety and without alteration, provided the source is clearly attributed. Current and previous issues are available online at http://www.patientsafetyauthority.org.

SUBSCRIPTION INFORMATION
This publication is disseminated by email at no cost to the subscriber. To subscribe, go to http://visitor.constantcontact.com/d.jsp?1=11039081954&c=r=po.

INDEX INFORMATION

CONTINUING EDUCATION
The Pennsylvania Patient Safety Authority works with the Pennsylvania Medical Society to offer AMA PRA Category 1 Credits™ for selected portions of the Pennsylvania Patient Safety Advisory through the online module System in Patient Safety. Go to http://www.pamedsoc.org to find out more about patient safety continuing medical education opportunities. The Authority also works with the Pennsylvania State Nurses Association to offer nursing continuing education credits for selected portions of the Advisory. Go to https://www.pamedsoc.org/continuing-education/courses/ to view the course catalog.

CONSIDERATION OF SUBMITTED MANUSCRIPTS
Manuscripts consistent with the objectives of the Pennsylvania Patient Safety Advisory are welcome. For information and guidance about submission and instructions for authors, please contact the editor.

PATIENT SAFETY AUTHORITY
Board of Directors
Rachel Levine, MD, Chair
Rajesh Bharam M. Agrawal, MD
Jan Boxwinkel, MD
John Bulger, DO, MBA
Daniel Glum, MD
Arleen G. Kessler, PharmD, MBA, RPh
Mary Ellen Mannion, MRPE
Cliff Rieders, Esq.
Stanton Smullens, MD, FACS
Eric H. Weiss, Esq.

Staff
Regina M. Hofman, MBA, BSN, RN, CPPS, Executive Director
Michelle Bell, BSN, RN, FSMP, CPPS, Director of Outreach and Education
Christina Hunt, MBA, MSN, RN, HCM, CPPS, Director of Collaborative Programs
Howard Newsard, JD, MBA, Finance Director/CIO
Megan Shetterly, MS, RN, CPPS, Senior Patient Safety Liaison JoAnn Adkins, BSN, RN, CIC, Infection Prevention Analyst
Jeffrey Bomboy, BS, RN, CPPS, Patient Safety Liaison
Kelly R. Gipson, BSN, RN, CPPS, Patient Safety Liaison
Rebecca Jones, MBA, BSN, RN, CP harm, CPPS, Patient Safety Liaison and Special Assistant to the Executive Director
Richard Kandravi, BS, Patient Safety Liaison
Christopher Mamrol, BSN, RN, Patient Safety Liaison Melanie A. Mots, MED, BSN, RN, CPPS, Patient Safety Liaison Catherine M. Reynolds, DL, ME, BSN, RN, Patient Safety Liaison
Terri Lee Roberts, BSN, RN, CIC, FAPIC, Infection Prevention Analyst
Robert Yonash, RN, CPPS, Patient Safety Liaison
Teresa Flesce, Office Manager
Karen McKinnon-Lipsett, Administrative Specialist
Sheila M. Meisel, Executive Director Assistant

Contact Information
1333 Market Street, Lobby Level
Harrisburg, PA 17120
Telephone: 717-346-0469
Fax: 717-346-1090
Website: http://www.patientsafetyauthority.org
E-mail: patientsafetyauthority@pa.gov

PENNSYLVANIA PATIENT SAFETY ADVISORY
Ellen S. Deutsch, MD, MS, FACS, FAAP, CPPS, Editor
John R. Clarke, MD, Editor Emeritus
William M. Marella, MBA, MMI, Program Director

Analysts
Theresa V. Arnold, DPM, Manager, Clinical Analysis
Sharon Bradley, RN, CIC
James Davis, MSN, RN, CCRN, CIC, FAPIC
Michelle Feil, MSN, RN, CPPS
Edward Finley, BS
Lea Anne Gardner, PhD, RN
Michael J. Gaunt, PharmD
Matthew Grissinger, RPh, FSMP, FACP
Mary C. Magee, MSN, RN, CP harm, CPPS
Christina Michalek, BSc Pharm, RPh, FAPIC
Susan C. Wallace, MPH, CP harm

Advisors
Rajesh Bharam M. Agrawal, MD

Production Staff
Jesse Murn, MBA, Managing Editor
Julia Barnsrd, MA
Eloise DeHaan, ELS
Susan Lafferty
Dawn Thomas
John Hall, Manager, Printing Services
Tara Kolbi, BFA, Manager, Media Services
Kristin Finger, BS
Suzanne R. Gehris
Benjamin Pauldine, MS

Contact Information
Mailing address: PO Box 706
Plymouth Meeting, PA 19462-0706
Telephone: 866-316-1070
Fax: 610-567-1114
E-mail: support_papsrs@pa.gov

Editorial Advisory Board
Mary Blanco, MSN, RN, CPHQ, Brandonwine Hospital
Lawrence M. Borland, MD,
Children’s Hospital of Pittsburgh of UPMC
Dorothy Borton, BSN, RN, CIC, Einstein Healthcare Network
Albert Bothe Jr., MD, Geisinger Health System
Mark E. Bruley, BS, CCE, ECRI Institute
Vincent Cowell, MD, Temple University
Frank M. Ferrara, MD, MBA, Wills Eye Surgery Center-Plymouth
Caprice C. Greenberg, MD, MPH, University of Wisconsin School of Medicine and Public Health
Daniel Haimowitz, MD, FACP, CMD
Mary T. Hofmann, MD, Abington Hospital-Jefferson Health
Janet Johnston, JD, MSN, RN
Sandra Kane-Gill, PharmD, MSc, FCCM, FCCP, University of Pittsburgh School of Pharmacy
Harold S. Kaplan, MD, Mount Sinai School of Medicine
Michael L. Kay, MD, Wills Eye Hospital, Thomas Jefferson University Hospital, Pennsylvania Hospital
John J. Kelly, MD, FACP, Abington Hospital-Jefferson Health
Curtis P. Langlotz, MD, PhD, University of Pennsylvania
Michael Leonard, MD, Gilder Permanente, Institute for Healthcare Improvement
James B. McClurken, MD, FACC, FCCP, FACS, Temple University
Patrick J. McDonnell, PharmD, FASHP Temple University School of Pharmacy
Dwight McKay
Francine Miranda, BSN, RN, FSHRM, Lehigh Valley Hospital
Dona Molynex, PhD, RN, Gwynedd-Mercy College
Gina Moore, BSN, RN, CPHQ, Christiana Care Health Services
Steve D. Osborn, Vice President, Saint Vincent Health Center
Christopher M. Perzi, MD, FACS, Abington Hospital-Jefferson Health
Eric Shekow, MD, Children’s Hospital of Philadelphia, University of Pennsylvania
Hyagriv N. Simhan, MD, MSCR, University of Pittsburgh
Dean Sittig, PhD, University of Texas
Amy B. Smith, PhD, Lehigh Valley Health Network
Nieufar Varjavan, MD, Drexel University
Debra J. Verne, MPA, RN, CP harm, Penn State Milton S. Hershey Medical Center
Linda Waddell, MSN, RN, CPPS, CICP, Donald D. Wolfit, Jr., Center for Quality Improvement and Innovation at UPMC
Harold C. Wiesenfeld, MD, University of Pittsburgh
Zane B. Wolf, PhD, RN, FAAN, LaSalle University School of Nursing and Health Sciences

ACKNOWLEDGMENTS
These individuals reviewed articles for Vol. 14, No. 1:
Albert Bothe, Jr., MD, Geisinger Health System
David Ebbing, MD, University of Pittsburgh
E. Robert Fendol, PharmD, FASHP, Johns Hopkins Hospital
Kathleen Fowler, MSN, RN, CMSRN, UPMC St. Margaret
Verna Gibbs, MD, University of California, San Francisco
Caprice C. Greenberg, MD, MPH, University of Wisconsin School of Medicine and Public Health
Lillian Harvey-Banchik, MSc, FNAS, CNAF, Hufstra University School of Medicine
Luke Petoa, MSc, HEM, HEM-CC, ECRI Institute
Eric Shelov, MD, FAAP, University of Pennsylvania
Children’s Hospital of Philadelphia
Dan Sheridan, MS, RPh, OhioHealth Marion General Hospital
Medication Errors Attributed to Health Information Technology

INTRODUCTION
In 2009 under the Health Information Technology for Economic and Clinical Health (HITECH) Act, billions of dollars were offered in incentives for healthcare providers to adopt an electronic health record (EHR). The hypothesis was that an EHR could prevent errors, enhance patient safety, and improve efficiency. It would accomplish this by eliminating transcription errors due to illegible orders or poor quality faxes, using clinical decision support to detect possible contraindications to therapy based on allergies or drug interactions, and making all patient records available in one centralized location. Technologies that target each point of the medication-use process have been developed to reduce the likelihood of errors reaching the patient. These technologies include computerized prescriber order entry (CPOE) systems, pharmacy information systems, automated dispensing cabinets (ADCs), barcode medication administration (BCMA), and “smart” infusion pumps, which incorporate dose error reduction systems with comprehensive drug libraries containing information on usual concentrations, dosing units, and dose limits.

Unfortunately, the introduction of technology to improve patient safety has led to new, often unforeseen types of errors. Between January 2010 and June 2013, 120 health information technology- (HIT-) related sentinel events were reported to the Joint Commission. The majority of errors were attributed to the human-computer interface (33%), workflow and communication (24%), and clinical content (23%).

The use of technology in the healthcare setting has increased dramatically in the past decade. In a survey of pharmacy directors in U.S. hospitals, more than 97% of the 325 respondents indicated their hospitals had implemented either a partial or complete EHR, 84.1% use CPOE systems, and 93.7% have BCMA technology.

Sittig and Singh describe four main causes of errors due to health information technology: the system is unavailable (e.g., downtime), the system malfunctions, the system is used incorrectly, or the system does not interact properly with another system component. Patient safety is not improved by merely implementing HIT. The technology is part of a larger sociotechnical system, which relies not only on hardware and software functionality but also people, workflow, and processes. For this reason, it is important to design a system with an intuitive user interface to minimize the risk for human error. Users should be able to easily enter and retrieve data and share information with other healthcare professionals. When systems are designed without these considerations in mind, patients are subject to undue risk.

In 2015, a new question was added to the Pennsylvania Patient Safety Reporting System (PA-PSRS) reporting form: “Did Health IT cause or contribute to this event?” Pennsylvania Patient Safety Authority analysts had not previously explored HIT-related medication events identified by answers to this question. With this analysis of HIT-related medication errors reported to the Authority, analysts sought to characterize contributing factors and identify appropriate system-based risk reduction strategies to help facilities identify and mitigate risk and minimize potential patient harm.

METHODS
The HIT-related question was introduced into PA-PSRS in April 2015. Based on data from the Pennsylvania Patient Safety Authority 2015 Annual Report, a 45% increase occurred in the number of HIT-related medication error reports received between the second (n = 274) and fourth quarters (n = 397) of 2015. In light of the changing nature of facility usage and completion of these questions during 2015, the latest six-month period of data available was evaluated, including data from January 1 through
June 30, 2016 (n = 889). The reporting facilities provided the following information regarding the event: medication name, event type, harm score (adapted from the National Coordinating Council for Medication Error Reporting and Prevention [NCC MERP] harm index), event description, HIT systems involved, equipment or device function, and ergonomic factors that may have caused or contributed to the event.

RESULTS

HIT-related errors occurred during every step of the medication-use process (Figure 1). The majority of errors, 69.2% (n = 615 of 889), reached the patient (harm score C through I; Figure 2). Eight (0.9%) errors resulted in patient harm (harm score E through I), with three of these reports involving high-alert medications, medications that bear a heightened risk of patient harm if used in error. More than one-third of all the reports (35.2%, n = 313 of 889) involved medications on the ISMP List of High-Alert Medications in Acute Care Settings. Insulin, anticoagulants, and opioids, which are all considered high-alert medications, comprised three of the top five drug categories involved in events (Figure 3).

Of the 889 events, the three most commonly reported event types aside from “other,” which accounted for 20.9% (n = 186) of events, were dose omission (13.8%, n = 123), wrong dose/over dosage (10.9%, n = 97), and extra dose (10.7%, n = 95). According to an analysis of the event descriptions, the most common cause of omissions was that the system did not work as expected or was unavailable due to downtime (8.1%, n = 10 of 123). The following is an example of a reported error resulting from an unplanned downtime of HIT:*

During an extended, unplanned downtime, the nurse missed giving a midnight dose of medication. The nurse was unfamiliar with paper MAR [medication administration record] and handwritten documentation.

The most common cause of wrong dose/over dosage events was an incorrect weight documented (11.3%, n = 11 of 97). For example:

Determined that the patient’s weight was incorrect. It was entered as 148 kg; after asking nurse to verify, the corrected weight was entered on [the following day] as 46 kg. [It was] realized that a one-time weight-based Lovenox® [enoxaparin] dose was given [based on] the incorrect weight.

Free-texted instructions in a separate field from the sig or instructions field may be overlooked by other practitioners and may lead to communication of contradictory instructions. Prescribers free-texting instructions as either a communication order or as a component within a medication order describing when to hold or discontinue a medication (11.6%, n = 11 of 95) was the most common cause of patients receiving extra doses of medication, as can be seen in the following example:

[The patient’s] INR [international normalized ratio] was elevated at 4.0. The physician was notified and a message was entered, but the warfarin was not discontinued. Medication given prior to receiving report from the nurse and prior to orders being verified by the nurse. The medication dose was not discontinued in MAK [medication administration check] [system] d/t [due to] order being entered as message. 

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.
Analyzing the reports classified as “other,” analysts found that 22.6% (n = 42 of 186) were either a delay or omission in therapy.

Reporters were able to select the HIT component involved in the event. Half (50.4%, n = 448 of 889) of the event reports listed the CPOE system as a contributing factor, while the pharmacy system and the eMAR were each mentioned in just over a quarter of the event reports (Figure 4). Other EHR components, including the clinical documentation system and clinical decision support system, were implicated in 13.8% of events.

The CPOE system was cited most often as an HIT component that contributed to the top three error event types. It contributed to more than half of dose omissions, extra doses, and wrong dose/over dosage events (Figure 5). The pharmacy system and eMAR were also frequently involved in these events. With respect to ergonomics, data entry or selection errors accounted for almost half (48.9%, n = 219 of 448) of all CPOE events.

Fifty-six errors were identified as “communication” issues within the EHR. The majority (69.6%, n = 39 of 56) were due to a prescriber free-texting instructions in the order comments field, which is a separate field from the sig or instructions field, and the contradictory instructions were overlooked by the pharmacist or nurse. More than a third of the free-text orders (35.9%, n = 14 of 39) specified when to hold or discontinue the medication, which is a workaround that prescribers may use instead of modifying the end date within the CPOE medication order. The second most common place in the EHR that prescribers provided additional order instructions was in the “communication order” or “nursing communication order” section of the medical record as demonstrated in this report:

The patient had chest pain and a recent stent. The physician ordered a heparin bolus. He told the nurse the patient needed a heparin drip. The
physician placed the heparin drip as a nursing miscellaneous [communication]. This entry does not drop the order, allow documentation, or open the automated dispensing cabinet. He told the nurse that he was unable to enter the order. There was a delay in the start of the heparin drip due to this issue. The heparin bolus was given at 1730. The drip was started at 1820.

In all, 26 alerts within 21 reports fired for providers, pharmacists, and nurses. Of the reports that indicated multiple alerts had been generated, some described situations in which the same alert fired for multiple disciplines (e.g., prescriber and pharmacist) who accessed the patient’s order. Only three of the alerts actually caused the healthcare provider to modify their original order as illustrated in this example:

Order for aspirin came through for pharmacist approval. Order was for aspirin 65,610 mg. Physician was made aware of error and corrected to be 81 mg. She explained that she just reordered the medication as entered in the home med rec [medication reconciliation] (was entered as 810 tablets daily). She did ignore/override the maximum dose warnings.

In four of the cases (from three different hospitals), the report explicitly mentioned that alerts for prescribers had been disabled by the health system.

There were 26 reports that specifically mentioned that no alert fired, which suggests that healthcare professionals depend on alerts for important information. One such report stated:

Patient was given 650 mg PO Tylenol® [acetaminophen] about an hour after having received IV Ofirmev® [acetaminophen]. There was no alert in computer system that PO Tylenol should not be given within a certain timeframe of Ofirmev having been given. No adverse outcome to patient reported.

About one-third (30.8%; n = 8 of 26) of the reports stated that no alert fired, resulting in the patient receiving an extra dose of medication.

DISCUSSION

Errors due to HIT spanned across all HIT components, including the CPOE system, pharmacy system, electronic medication administration record (eMAR), clinical documentation system, clinical decision support system, ADC, and BCMA system. There were many causes for HIT-related errors, and they were unique depending on the context in which the system was used. Errors occurred when the system was not used as intended, did not work as expected, and because the systems often did not communicate seamlessly, which was evident by the number of errors that occurred during transitions of care.

Surprisingly, the point in the medication use process where errors occur today (see Figure 1) is very similar to where they occurred in 1993, before the widespread implementation of HIT. Bates et al. reported that most errors occurred during the ordering (49%) and administration (26%) stages, which is what was found in this analysis.11

Similar to what the Office of the National Coordinator (ONC)7 reported in 2014, data entry and selection errors, which are dependent on human interface with technology, were the most commonly reported HIT-related errors (39%) in the PA-PSRS data. From a sociotechnical perspective, HIT-related errors can be exclusive to IT, such as errors due to substandard drop-down menus (e.g., too many drug options listed very closely together), or HIT can contribute to an error that existed with
paper charts but is more likely to occur with HIT, such as errors due to distractions or multitasking. In addition to data entry, human interface errors occurred when practitioners overlooked information (e.g., missed comments free-texted in the administration field of a medication order) or did not actively seek out information (e.g., did not give a medication if the eMAR did not prompt them it was due).

**LIMITATIONS**

As with all reporting systems, the type and number of reports collected depend on the degree to which facility reporting is accurate and complete. Although the narrative fields of the reports are helpful in discerning what happened during the event, they often do not contain all of the HIT-related contributing factors. Event descriptions did not always clarify how the event deviated from the standard operation or specify the make or model of the HIT system, and reporters often presumed the reader would be familiar with the technology and processes used in the facility.

Lack of a unified, standardized reporting system across all facilities may be another limitation. Unless hospitals used the PA-PSRS system or another system with a PA-PSRS interface (that included the HIT-related question), HIT-related events, or answers to all of the HIT-related questions, may not have been captured in PA-PSRS.

Another limitation is that only six months of data was selected for analysis. This could have introduced a seasonality bias because the data analyzed was from January to June 2016, which correlates with the second half of an academic year. By this time of the year, residents and other students are familiar with the HIT systems used in the hospital and may be aware of the technology’s limitations.

**STRATEGIES**

The event reports analyzed reveal that errors due to HIT are multifactorial and highly complex. It is important that healthcare organizations and technology vendors continue to work with frontline and informatics staff to address technology-related issues that would improve the usability of the system. Consider the strategies listed below, which are based on events reported to the Authority, current literature, and observations from the Institute for Safe Medication Practices.

**General**

- Encourage individuals to report unsafe conditions, near misses, and errors due to HIT so these concerns can be analyzed and ameliorated.
- Conduct a root-cause analysis using information from the individual(s) involved in the events along with IT staff members who are knowledgeable and can address IT system vulnerabilities.
- Provide training to new staff members unfamiliar with the technology and make sure they are competent before allowing them to use HIT for patient care.
- Monitor technology usage metrics such as system downtime, number of alert overrides, and the number of medication orders submitted through CPOE.
- Identify workarounds that staff are using to address system flaws. Correct these system flaws so the
workarounds can be eliminated, and be sure to inform staff when changes in the system have been made.

- Reduce the need for manual human interface with the computer by allowing systems to communicate seamlessly.13
- Use tall man letters on computer screens to help differentiate look-alike medication names.14-15 Avoid displaying look-alike names next to one another in computer drop-down lists, and consider differentiating look- and sound-alike drugs by including their purpose (e.g., hydroXYzine [antihistamine] and hydrALAZINE [vasodilator]).
- Use easy-to-read, larger size, sans serif fonts in electronic systems.14
- Allow only metric measurements of patient weight (i.e., kilograms or for low-birth-weight infants, grams), and include a field that displays the date the weight was collected.14
- Ensure that there are well-designed downtime procedures in case of software or hardware malfunctions and that all appropriate personnel receive training.16
- Determine the character limits of the medication name and other related fields in the electronic systems, infusion pumps, and other related technologies used in the organization. Assess and review how these systems may truncate information or lines to make sure any break in the line does not lead to the absence of important drug information or possible misinterpretation.

CPOE/Pharmacy System

- Triage phone calls and limit distractions to providers, pharmacists, and nurses when ordering medications or completing other crucial tasks.12,13
- Use standardized order sets within the EHR to guide prescribers to select appropriate drug therapy and doses, to prevent medication errors.4 The order sets can include ancillary orders that facilitate safe medication practices, such as a daily INR when warfarin is ordered.
- Eliminate alerts in the system that are clinically irrelevant, to prevent alert fatigue.5-7
- Work with prescribers to include the indication for the medication within their orders.14,18
- Limit the ability to order medications using a combination of both discrete and free-text fields, because these could contradict each other or lead to misinterpretation.14
- Provide a mechanism to facilitate safe order entry of complex medications (e.g., electrolyte solutions) or drugs that require a variable dose schedule (e.g., steroid tapering) so that orders include all required elements and appear clearly and in a logical sequence.14

eMAR

- When the dose of the medication differs from the available strength, list the amount needed for the dose on the eMAR (e.g., propranolol 5 mg [1/2 x 10 mg tablet]). This information should be displayed on the same line in the eMAR.14
- List the drug name, patient-specific dose, route, and frequency on the first line of the medication administration record and the available concentration and any directions on how to prepare the dose below it.19

ADC

- ADCs should be located in an area of limited foot traffic, where a minimum number of distractions is the norm.16
- Configure all ADCs to dispense in a pharmacy-profile mode. Use of a “profiled” ADC ensures that the pharmacist will validate the new medication order in the pharmacy system prior to the medication being accessed by the nurse. Do not allow users to select medications using the inventory mode, except in an emergency.16
- Display the time the last dose was removed from the ADC on the ADC screen display. Medications appear to the user as unavailable, until the correct time frame for administration. If the practitioner determines it is necessary to select a dose of a medication prior to its scheduled administration time, then additional strategies (e.g., an independent double-check for high-alert medications and documentation of rationale for the override) are needed.16
- Store each medication and strength in an individual lidded ADC compartment that opens only when the specific medication is selected.16

Smart Infusion Pumps

- When developing pump libraries, limit entries to a single concentration for each drug, if possible.20
- Standardize dosing nomenclature for each drug within each library (e.g., do not include multiple dosing methods for the same drug in the drug library, such as mcg/min and mcg/kg/min). The dosing method in the pump should match the display on the CPOE screen, pharmacy label, and eMAR.20
- Set hard dose limits to avoid catastrophic events.20
- Use data captured by smart pumps (e.g., number of infusions programmed using the drug library, number of soft stop overrides, number of times an alert resulted in the reprogramming of an infusion) to evaluate smart pump use, identify opportunities for improvement, and take action to correct problems.20
— Consider integrating smart pumps with the EHR system to improve usability and decrease reliance on manually transferring information from one system to the other.21,22

CONCLUSION

It is clear that ongoing HIT system surveillance and remedial interventions are needed. Oftentimes, failures in the HIT systems are attributed to human error, which hinders the investigation into secondary causes of the patient safety event such as limitations in software interoperability, usability, and workflow processes. The interaction between clinician and software is a key component that is to be taken into consideration when trying to improve the safety of HIT. Incident reports can provide valuable information about the types of HIT-related issues that can cause patient harm, and ongoing HIT system surveillance can help in developing medication safety interventions.23 Efforts to improve HIT safety should include attention to software interoperability, usability, and workflow.23,24 The relationship between clinician and software includes complex interactions that must be considered to optimize HIT’s contribution to medication safety.

NOTES


REVIEWS & ANALYSES


Dislodged Gastrostomy Tubes: Preventing a Potentially Fatal Complication

INTRODUCTION

A Pennsylvania healthcare facility experienced two recent events involving dislodged gastrostomy tubes that resulted in serious patient harm due to peritonitis. In both events, delays occurred in recognizing that the tubes were dislodged. These delays allowed time for gastric contents to leak into the surrounding tissue, requiring intravenous antibiotics and surgery to “wash out” the peritoneal cavity and remove damaged tissue. Despite providing staff education and implementing a protocol to confirm and document proper tube placement, the facility was concerned about recurrence. The facility contacted the Pennsylvania Patient Safety Authority to discuss this concern, to ask whether other facilities were experiencing the same problem, and to learn of additional strategies to prevent this complication.

In response to this inquiry, Authority analysts queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) database to identify similar events and other reported events associated with gastrostomy tubes. Further, analysts reviewed the medical literature to determine the frequency of gastrostomy tube dislodgement and to identify strategies to prevent, recognize, and manage this complication.

Background

A gastrostomy tube is a tube placed through the abdominal wall directly into the stomach for decompression or provision of long-term enteral nutrition. A gastrojejunostomy tube has one lumen that terminates in the stomach and one lumen that terminates in the jejunum. This tube is used when both gastric decompression (via the gastric port) and enteral nutrition (via the jejunal port) are needed. These tubes can be placed using surgical, endoscopic, or radiologic techniques. For this article, the term gastrostomy tube is used to refer to both gastrostomy and gastrojejunostomy tubes.

Percutaneous endoscopic gastrostomy (PEG) has become the more commonly used technique for gastrostomy tube placement because it requires less time to perform than surgical placement, is less invasive, and does not require general anesthesia—a particular advantage for older and high-risk patients. As for complications, both surgically and endoscopically placed tubes have been found to have the same, frequent, minor complications (i.e., leaking, dislodgement, and superficial cellulitis), and major complications (i.e., aspiration, peritonitis requiring surgical intervention, sepsis, and death).

Gastrostomy tubes are held in place by an inner bumper or balloon that rests against the inside wall of the stomach and an external bumper or other securement device that rests against the patient’s abdomen. With newly placed gastrostomy tubes, the inner bumper helps to hold the stomach against the inner anterior wall of the abdomen (see Figure 1), so that the stomach can adhere to the wall as the gastrocutaneous tract and stoma matures—usually within the first 14 days. It is during this time period that dislodgement can result in major harm to the patient, up to and including death, whereas dislodgement after this time period is more likely to result in minor harm or no harm.

Researchers have estimated dislodgement to occur in up to 5.3% of patients within the first 14 days after placement, and in 12.8% of patients over the lifetime of the tube. Dislodgement can result in major harm to the patient, up to and including death, whereas dislodgement after this time period is more likely to result in minor harm or no harm.

METHODS

Analysts identified events involving gastrostomy tubes by querying the PA-PSRS database for reports containing the terms “gastrostomy,” “gastrojejunostomy,” “PEG,” “GT,” “GJT,” and “g tube,” (including misspellings) that were submitted over five years, from January 2011 through December 2015.

ABSTRACT

A Pennsylvania healthcare facility contacted the Pennsylvania Patient Safety Authority after experiencing two events involving dislodged gastrostomy tubes that resulted in serious patient harm. Querying the Pennsylvania Patient Safety Reporting System, analysts found that healthcare facilities submitted 1,858 event reports involving gastrostomy tubes between January 2011 and December 2015. Dislodgement was the most frequently reported problem, described in 996 event reports. Of these, 73 were reported as Serious Events resulting in patient harm, with the highest level of harm (including peritonitis, sepsis, and death) reported in cases in which these tubes continued to be used for enteral feeding before providers realized that the tubes were in an improper position. Potential causes for dislodgement were described in about two-thirds of reports, with the top two causes identified as (1) patient pulling on the tube, and (2) movement of the tube during patient transfer, repositioning, or other care. Hospitals can decrease the risk for this complication by implementing best practices and risk reduction strategies to confirm proper positioning of gastrostomy tubes and to prevent, recognize, and manage dislodgement. (Pa Patient Saf Advis 2017 Mar;14[1]:9-16.)
Analysts manually reviewed all reports and eliminated those that described events not directly involving these tubes (e.g., skin integrity event reports that mention gastrostomy tube feeding as an intervention to promote wound healing, aspiration event reports that mention plans for gastrostomy tube placement).

Events identified as directly involving gastrostomy tubes were analyzed according to PA-PSRS event type and harm score and categorized according to the specific problems described in the event narratives (e.g., clogged or leaking tubes, pain, medication administration problems). Analysts further examined event reports describing dislodged gastrostomy tubes to identify potential causes of dislodgement.

RESULTS

The query identified 1,858 event reports; 548 were excluded for lack of relevance, leaving 1,310 reports that directly involved gastrostomy tubes. Gastrostomy tube events were reported for patients across all age groups, with the majority reported for patients older than the age of 50 (n = 862, 65.8%; see Figure 2).

Event Type and Harm Score

Complication of procedure, treatment, or test was the most frequently reported event type (n = 835 of 1,310; 63.7%), followed by other or miscellaneous (n = 177; 13.5%).

The majority of events were reported as Incidents without harm to patients (n = 1,187; 90.6%).

Table 1 shows the number of events reported as either Incidents or Serious Events, for each event type. Of 123 events reported as Serious Events resulting in patient harm, most were reported as resulting in temporary harm. (n = 107; 87.0%), followed by death (n = 12; 9.8%), near-death requiring life-sustaining treatment (n = 3; 2.4%), and permanent harm (n = 1; 0.8%).

---

**Figure 1. Properly Placed and Dislodged Gastrostomy Tubes**

**PROPER GASTROSTOMY TUBE PLACEMENT**

**DISLODGED GASTROSTOMY TUBE**
Gastrostomy Tube Problems

Dislodged and possibly dislodged tubes were the most frequently reported problem (n = 1,026 of 1,310; 78.3%), which held true across all age groups (see Figure 2). The second most frequently reported problem was mechanical (n = 122; 9.3%). Table 2 lists all problems identified in reports to the Authority for events involving gastrostomy tubes.

Potential Causes of Dislodged Gastrostomy Tubes

The most frequently identified potential cause for dislodged and possibly dislodged gastrostomy tubes was the patient pulling on the tube (n = 326 of 1,026; 31.8%), followed by movement of the tube during patient transfer, repositioning, or other care (n = 204; 19.9%), and deflated or ruptured retention balloons (n = 72; 7.0%). Other potential causes are listed in Table 3. More than one-third of reports for dislodged or possibly dislodged gastrostomy tubes did not identify a potential cause (n = 364; 35.5%).

Serious Events Associated with Dislodged Gastrostomy Tubes

Of 996 reports for events involving dislodged gastrostomy tubes, 73 (7.3%) were...
reported as Serious Events resulting in patient harm. Most of these were reported as resulting in temporary harm (n = 62 of 73; 84.9%), followed by death (n = 9; 12.3%), and near-death requiring life-sustaining treatment (n = 2; 2.7%).

Event narratives for events resulting in death described cardiac arrest due to complications from peritonitis including sepsis, necrotizing fasciitis, and multi-organ failure. Five of the nine event narratives described enteral feeding formula leaking into the peritoneal cavity before dislodgement was recognized.

### PA-PSRS Events Narratives

The following are examples of patient safety events in which delayed recognition of dislodged gastrostomy tubes resulted in patient harm.*

A 66-year-old male was admitted with a PEG [percutaneous endoscopic gastrostomy] tube that had been inserted at another facility. The next day, the patient vomited twice and the PEG site began leaking bile and tube feeding. The tube feeding was held and the PEG was placed to straight drainage. On the fourth day surgery was consulted for a suspected acute abdomen. During surgery, a large amount of intraperitoneal fluid was found, consistent with gastric perforation. The PEG site was leaking gastric contents. The stomach showed no attachment to the abdominal wall.

A 74-year-old male had a Foley catheter being used as a gastrostomy tube. The nurse auscultated over the stomach to confirm correct placement before administering medication. Thirty minutes later, the JP [Jackson Pratt] drainage was noted to be increasing and had the appearance of tube feeding. The physician ordered a STAT chest x-ray and for the gastrostomy tube to be placed to gravity to drain. Upon assessment, the balloon was found to be deflated with the tube not fully in the stomach. The patient was scheduled to go to the operating room for an abdominal exploration.

An 18-month-old girl was seen in the emergency room for a gastrostomy tube that fell out 11 days after placement. The parents had placed a Foley catheter in its place, and a new gastrostomy tube was placed without issue. The parents called the surgeon the following day to report that the tube was leaking formula, but was not loose, and the child seemed

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

---

**Table 2. Gastrostomy Tube Problems** Identified in Event Reports (N = 1,310)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>NO. OF REPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislodged or possibly dislodged tube</td>
<td></td>
</tr>
<tr>
<td>Dislodged tube</td>
<td>996</td>
</tr>
<tr>
<td>Possibly dislodged tube</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>1,026</td>
</tr>
<tr>
<td>Mechanical problems</td>
<td></td>
</tr>
<tr>
<td>Leaking tube</td>
<td>60</td>
</tr>
<tr>
<td>Clogged tube</td>
<td>47</td>
</tr>
<tr>
<td>Other mechanical problem</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
</tr>
<tr>
<td>Impaired skin integrity</td>
<td>84</td>
</tr>
<tr>
<td>Insertion and removal problems</td>
<td></td>
</tr>
<tr>
<td>Insertion problem</td>
<td>65</td>
</tr>
<tr>
<td>Removal problem</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
</tr>
<tr>
<td>Other Tube Care Problems</td>
<td></td>
</tr>
<tr>
<td>Medication administration issues</td>
<td>19</td>
</tr>
<tr>
<td>Enteral nutrition administration issues</td>
<td>16</td>
</tr>
<tr>
<td>Not clamped or draining as ordered</td>
<td>16</td>
</tr>
<tr>
<td>Wrong port accessed (i.e., gastric, jejunal, or balloon ports)</td>
<td>15</td>
</tr>
<tr>
<td>Not flushed or irrigated correctly</td>
<td>4</td>
</tr>
<tr>
<td>Site care or dressing not appropriate</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
</tr>
<tr>
<td>Pain</td>
<td>38</td>
</tr>
</tbody>
</table>

Note: As submitted to the Pennsylvania Patient Safety Authority, 2011 through 2015.

* Gastrostomy tube problems were identified as a result of qualitative analysis of event report narratives.

† Some event report narratives described more than one gastrostomy tube problem; therefore, the number of reports totals more than 1,310.

‡ Some event report narratives described more than one mechanical problem; therefore, the number of reports totals more than 122.

§ Some event report narratives described more than one other tube care problem; therefore, the number of reports totals more than 55.
comfortable. The next morning the child was found dead at home. An autopsy identified the cause of death as acute peritonitis, following dislodged gastrostomy tube. The findings note that the tip of the feeding tube was not in the stomach.

DISCUSSION

Pennsylvania healthcare facilities have reported a variety of patient safety event types and problems involving gastrostomy tubes, with dislodgement identified as the most frequently reported problem across all age groups. The majority of gastrostomy tube events, including events involving dislodgement, have been reported as Incidents, without harm to patients. However, consistent with the literature,^2,10,12,13^ Serious Events resulting in patient harm, up to and including death, have been reported for events involving dislodged gastrostomy tubes. The highest levels of harm involved cases in which these tubes continued to be used for enteral feeding before providers realized that the tubes were in an improper position.

Aside from peritonitis, sepsis, and death, other serious harm can result from even minor changes in gastrostomy tube position, particularly in the first few weeks before the gastrocutaneous tract matures. In fact, even a change in tube position of just six millimeters may indicate dislodgement or other problems, such as “buried bumper syndrome” (i.e., when excessive tension causes the internal bumper to erode the gastric lining or abdominal wall or both) or pyloric obstruction (i.e., when the internal bumper or balloon migrates into the stomach, blocking the gastric outlet).^4,13,14^

The American Society for Parenteral and Enteral Nutrition (ASPEN) has long recognized the potential for serious patient harm associated with enteral nutrition therapy. In response, ASPEN in 2009 convened an interdisciplinary task force to issue comprehensive enteral nutrition practice recommendations. The task force stated, “While the process of administering [enteral nutrition] may appear less complex compared with parenteral nutrition, serious harm and death can result due to potential adverse events occurring throughout the process of ordering, administering, and monitoring.”^14^ ASPEN issued new recommendations in November 2016, concurrent with Authority analysis of gastrostomy tube events reported to PA-PSRS. The updated recommendations reflect a heightened emphasis on patient safety, including a detailed description of practices to prevent dislodgement. See “2016 ASPEN Safe Practices for Enteral Nutrition Therapy” for more information.

Facility Efforts to Reduce Dislodged Gastrostomy Tube Events

The Authority spoke with a representative of the healthcare facility that had expressed concern over recent adverse events involving dislodged gastrostomy tubes to learn what strategies had been implemented as part of its performance improvement plan to reduce the risk for similar events happening in the future.

“We looked at the entire process, from the point of gastrostomy tube insertion, performed by our surgeons, through to the daily care and maintenance of gastrostomy tubes, performed by our bedside nurses,” said the facility representative.

The first change implemented was to require surgeons to document the centimeter marking at the skin level in the electronic health record for newly placed tubes. The brand of gastrostomy tube used at the facility is manufactured with centimeter markings on the tube.

The second change was to require nurses to assess and document the centimeter marking at the skin level with every clinician handoff immediately after placement: from the operating room to the post-anesthesia care unit, from the post-anesthesia care unit to the intensive care or medical-surgical unit, and at every shift change. For patients with existing gastrostomy tubes with mature gastrocutaneous tracts, this assessment and documentation is required daily.

Table 3. Potential Causes for Gastrostomy Tube Dislodgement* Identified in Event Reports (N = 1,026)

<table>
<thead>
<tr>
<th>POTENTIAL CAUSES FOR DISLODGEMENT</th>
<th>REPORTS (%)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient pulling on the tube</td>
<td>326 (31.8)</td>
</tr>
<tr>
<td>Movement of the tube during patient transfer, repositioning, or other care</td>
<td>204 (19.9)</td>
</tr>
<tr>
<td>Balloon deflated or ruptured</td>
<td>72 (7)</td>
</tr>
<tr>
<td>Patient fall</td>
<td>46 (4.5)</td>
</tr>
<tr>
<td>Increased intra-abdominal pressure (i.e., coughing, sneezing, crying, vomiting)</td>
<td>16 (1.6)</td>
</tr>
<tr>
<td>Inadequate securement</td>
<td>6 (0.6)</td>
</tr>
<tr>
<td>Tubing broken or ruptured</td>
<td>2 (0.2)</td>
</tr>
<tr>
<td>No reason reported</td>
<td>364 (35.5)</td>
</tr>
</tbody>
</table>

Note: Data submitted to the Pennsylvania Patient Safety Authority, 2011 through 2015.
* Potential causes for gastrostomy tube dislodgement were identified as a result of qualitative analysis of event report narratives.
† Some event report narratives described more than one potential cause for gastrostomy tube dislodgement; therefore, the number of events totals more than 1,026, and the total percentage exceeds 100.
REVIEWS & ANALYSES

In rolling out these changes, a problem was identified with the electronic health record, “We found that the place to document the centimeter marking at the skin level was ‘hidden.’ So we worked with our informatics team to change those fields to remain ‘face up’—in other words, always visible to nurses when completing their documentation,” said the representative.

Education was provided to all staff, “but we know that we must remain vigilant—especially when patients with gastrostomy tubes are cared for on units that don’t usually see a lot of these tubes,” said the representative.

The facility is also looking into purchasing a new external securement device. “We have had trouble finding a good anchor for gastrostomy tubes that do not have an external bumper,” said the representative. “We are currently using a device that is similar to a [urinary catheter] securement device—it is like tape, with a Velcro strap that goes around the tube. But we are looking for something more effective that will stay in place and limit tube movement.”

Lastly, the facility representative told the Authority that the facility believes the lessons learned and strategies implemented to prevent dislodged gastrostomy tubes can be applied broadly to all tubes, including vascular access devices, endotracheal tubes, and surgical drains.

Best Practices and Risk Reduction Strategies

The following best practices and risk reduction strategies are suggested to confirm proper positioning of gastrostomy tubes and to prevent, recognize, and manage dislodgement.

– Review current recommendations from ASPEN for safe enteral nutrition therapy practices, including gastrostomy tube care and steps to prevent dislodgement.15

– Document the tube type, tip location, and external centimeter markings in the medical record at the time of gastrostomy tube insertion and with follow-up physical assessments.4,14,15

– Assess the gastrostomy insertion site daily and observe the position of the tube and external bumper. Ensure that the external bumper is not taut against the skin and that the tube can be freely rotated.4,13,15

– Apply an external securement device to gastrostomy tubes that do not have external bumpers.14,15

– Provide daily skin care to keep the insertion site clean and dry, and ensure that the external bumper or securement device is properly positioned. This may help prevent patients from intentional or inadvertent pulling on the tube due to irritation at the insertion site.4,15

2016 ASPEN SAFE PRACTICES FOR ENTERAL NUTRITION THERAPY

The American Society for Parenteral and Enteral Nutrition (ASPEN) published “ASPEN Safe Practices for Enteral Nutrition Therapy” in November 2016. These consensus recommendations update ASPEN’s “Enteral Nutrition Practice Recommendations,” last published in 2009. The new title further emphasizes ASPEN’s commitment to patient safety. ASPEN recognizes that enteral nutrition is a complex therapy with potential for adverse events that can result in serious patient harm, including death. Notable updates include stronger recommendations against the use of auscultation and aspiration of gastric contents to confirm proper tube placement (radiographic confirmation is the gold standard), and the addition of new recommendations dedicated to securing enteral tubes and preventing their dislodgement.

The MARK acronym, included in the recommendations, is suggested for use as a guide for maintaining proper tube placement.

Mark the tube at the exit site using an indelible marker and record the external length at the time of tube placement.

Anchor the tube using the proper securement device and technique, which varies by tube and anatomical location.

Reassess tube placement, especially in patients at risk for dislodgement or during activity that increases risk of dislodgement, such as patient transfer and repositioning.

Keep pressure off the skin (or nasal septum) at the insertion site, and ensure staff have the Knowledge needed to ensure safe practice in policy, procedure, and clinical practice.


2016 ASPEN SAFE PRACTICES FOR ENTERAL NUTRITION THERAPY

The American Society for Parenteral and Enteral Nutrition (ASPEN) published “ASPEN Safe Practices for Enteral Nutrition Therapy” in November 2016. These consensus recommendations update ASPEN’s “Enteral Nutrition Practice Recommendations,” last published in 2009. The new title further emphasizes ASPEN’s commitment to patient safety. ASPEN recognizes that enteral nutrition is a complex therapy with potential for adverse events that can result in serious patient harm, including death. Notable updates include stronger recommendations against the use of auscultation and aspiration of gastric contents to confirm proper tube placement (radiographic confirmation is the gold standard), and the addition of new recommendations dedicated to securing enteral tubes and preventing their dislodgement.

The MARK acronym, included in the recommendations, is suggested for use as a guide for maintaining proper tube placement.

Mark the tube at the exit site using an indelible marker and record the external length at the time of tube placement.

Anchor the tube using the proper securement device and technique, which varies by tube and anatomical location.

Reassess tube placement, especially in patients at risk for dislodgement or during activity that increases risk of dislodgement, such as patient transfer and repositioning.

Keep pressure off the skin (or nasal septum) at the insertion site, and ensure staff have the Knowledge needed to ensure safe practice in policy, procedure, and clinical practice.

Consider the use of soft wrist restraints, hand mitts, or abdominal binders to limit access to the tube in patients with cognitive impairment, both permanent (e.g., dementia) and transient (e.g., postoperative delirium), or who are otherwise assessed to be at high risk of dislodging their gastrostomy tube.\(^4\)^\(^1\)\(^5\)

Surgeons may consider the use of T-fasteners in children and other patients at high risk for dislodgement. These devices are placed prior to placement of gastrostomy tubes to anchor the stomach to the abdominal wall. These devices do not prevent dislodgement but may prevent disruption of the gastrocutaneous tract and facilitate safe reinsertion of a gastrostomy tube if dislodgement does occur.\(^1\)\(^2\)\(^3\)\(^4\)\(^5\)

Notify the physician immediately for gastrostomy tubes that are suspected or confirmed to be dislodged. Tubes that dislodge within the first 14 days of insertion may need to be replaced surgically. If the gastrocutaneous tract is mature, a new balloon-tipped gastrostomy tube may be inserted at the bedside by qualified personnel.\(^6\)\(^7\)

Perform a radiologic contrast study to confirm proper placement of gastrostomy tubes reinserted at the bedside.\(^8\)\(^9\) Air insufflation with radiographic imaging or gastroscopy can also be used to confirm placement.\(^4\)

Avoid replacing gastrostomy tubes with catheters or tubes not designed to be used for enteral feeding, such as urinary or gastrointestinal drainage tubes, which lack an external anchoring device. Using these tubes may result in enteral misconnection and tube migration.\(^4\)\(^1\)\(^4\)

Provide education to nurses and other clinicians about the design, care, and maintenance of commonly used gastrostomy tubes, including proper use of gastric, jejunal, and balloon ports.\(^1\)\(^5\)\(^6\)

For gastrostomy tubes with retention balloons, check the volume of water in the balloon weekly. Deflate the balloon with a syringe and reinfuse the designated amount of water—usually 7 to 10 milliliters.\(^1\)\(^8\)

Teach patients and family members proper gastrostomy tube care, including steps to prevent, recognize, and manage dislodgement.\(^1\)\(^5\)

### CONCLUSION

Dislodgement of gastrostomy tubes is an adverse event that can result in serious harm to patients, up to and including death. Analysis of patient safety events reported to the Authority confirms that dislodgement of gastrostomy tubes is a problem affecting patients of all ages in hospitals across Pennsylvania. Hospitals seeking to reduce this complication are encouraged to implement best practices and strategies to confirm proper positioning of gastrostomy tubes and to prevent, recognize, and manage dislodgement.

### NOTES


7. Lin HS, Ibrahim HZ, Kheng JW, Fee WE, Terris DJ. Percutaneous endoscopic gastrostomy patients at high risk for dislodging their gastrostomy tube. 4,15


INTRODUCTION
Personnel at a Pennsylvania healthcare facility contacted the Pennsylvania Patient Safety Authority to learn about the types of handoff-related events reported by other facilities in the state so they could adapt and improve their handoff processes. Handoffs involve sharing patient information and often include performing a visual inspection of the patient to confirm the accuracy of information conveyed. Handoff communications coordinate patient care by passing essential information about a patient’s health status and responsibility for the patient’s care from one healthcare worker to another. They occur at change of shift (e.g., attending physicians, nursing staff), transfer of patients from one area within a healthcare facility to another, transfers between facilities, and during shifts when staff leave the unit or area to tend to other patients or take a break. Each handoff provides opportunities to catch and correct errors.

When a handoff is successfully completed, the next person responsible for the patient has the necessary information to inform care for that specific patient. In cases in which information is incomplete or a handoff fails to occur, an incomplete understanding of a patient’s condition may contribute to inappropriate or inadequate treatment. In a study by Tucker and Edmondson, missing or incorrect information was one of five broad types of healthcare problems or process failures encountered by nurses. Lapses in handoffs impact all groups of healthcare clinicians (e.g., physicians, nurses, allied health professionals) and nonclinicians (e.g., transportation staff).

Handoffs between healthcare workers occur hundreds to thousands of times each day, creating opportunities to identify effective handoff communications. The Joint Commission identified inadequate communication as the third most frequently identified root cause for a sentinel event in 2014 and 2015. Good communication is a part of patient care and leadership standards. The challenge in completing a successful handoff is knowing what information is most important and how to convey the information in a clear and concise manner appropriate for the patient’s circumstances. For example, hospital intensive care units may adhere to handoff criteria that differ from obstetric unit criteria. Effective handoffs require teamwork, shared practices, and shared expectations (e.g., use of handoff tools).

The literature is replete with articles focusing on the use of handoff tools. Healthcare professionals have developed and validated a variety of handoff tools that provide a shared mental model to help complete a patient handoff. Examples of well-known handoff tools for clinicians include SBAR (Situation, Background, Assessment, and Response) and I-PASS (Illness severity, Patient summary, Action list, Situation awareness and contingency planning, and Synthesis by receiver), and for clinical and nonclinical staff, the “ticket to ride” tool, used when transporting patients.

Handoff tools help clinicians gather needed information and pass it on to other healthcare workers, but this integral part of coordinating patient care can fail. (See Table 1.)

METHODS
Analysts queried the PA-PSRS database to identify handoff-related events reported by Pennsylvania healthcare facilities that occurred in 2014 and 2015. The query searched free-text data fields of the event type “Other,” event description, and recommendations using the following keywords: handover, sign off, nursing report, shift report, off (continued on page 19)
Table 1. Handoff Barriers

<table>
<thead>
<tr>
<th>COMMUNICATION DEFICITS</th>
<th>INCONSISTENT PROCESSES</th>
<th>ENVIRONMENTAL DISTRACTIONS</th>
<th>INSUFFICIENT TRAINING AND EDUCATION</th>
<th>LEADERSHIP/STAFFING CHALLENGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing or incomplete information&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>No formal process in place&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Lack of time, inability to follow up or share additional information&lt;sup&gt;2-5&lt;/sup&gt;</td>
<td>Lack of resources to implement handoff program&lt;sup&gt;1,3&lt;/sup&gt;</td>
<td>Lack of leadership support; organization administrative structure that impedes open communication&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Use of unclear language, such as abbreviations and acronyms similar-sounding medication names&lt;sup&gt;2,8,6&lt;/sup&gt;</td>
<td>Lack of standardized forms, tools, or process&lt;sup&gt;1,4-7&lt;/sup&gt;</td>
<td>Excessive noise or activity, including background noise, leading to sensory and information overload&lt;sup&gt;1-3,7&lt;/sup&gt;</td>
<td>Inadequate or no handoff training program&lt;sup&gt;1,3,7&lt;/sup&gt;</td>
<td>Different levels of staff experience and expertise or staff with different expertise and training (e.g., MD and RN)&lt;sup&gt;3,4,5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Differences in communication patterns or language; cultural differences&lt;sup&gt;1-3,5&lt;/sup&gt;</td>
<td>Multiple handoff tools used&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Frequent transfers (e.g., new admissions arising during handoffs) or high census&lt;sup&gt;1-4&lt;/sup&gt;</td>
<td>Staffing challenges (e.g., too few nurses, high staff turnover)&lt;sup&gt;1,3,7&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Unclear roles and responsibilities of team members&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Process too time consuming or reports too long&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td>Complex patients with high-acuity or new acute-care situation requiring immediate care&lt;sup&gt;1,4,7&lt;/sup&gt;</td>
<td>Missing or unclear handoff policies and procedure&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Lack of attention or responsiveness of receiver&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Illegible written notes from outgoing staff&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Interruptions, distractions, or multitasking during a handoff report&lt;sup&gt;1,2,4,7&lt;/sup&gt;</td>
<td>Lack of teamwork and mutual respect; culture of blame&lt;sup&gt;3&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Lack of mutual respect or support&lt;sup&gt;1,3&lt;/sup&gt;</td>
<td></td>
<td>Difficulty accessing records&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Cognitive bias&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Unorganized or lengthy reports&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td>Cognitive bias&lt;sup&gt;1,2,4,5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Outgoing nurse not available&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td>Lack of privacy&lt;sup&gt;1,2,4,5&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect, extraneous, or irrelevant information&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td>Staff fatigue or stress&lt;sup&gt;1,2,4&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor lighting&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electronic device failure&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes

(continued from page 17)

In the handoff; and statements of no hand-

reports or unit transfers); discrepancies such as omitted or inconsistent information; lack of physical checks of equipment, orders, or medications; healthcare clinicians involved in the handoff; and statements of no hand-off performed.

RESULTS

Of the 1,565 handoff-related event reports, 99.1% (n = 1,551) were reported as Incidents (e.g., near-miss events or events that reached the patient but did not cause harm). The remaining 0.9% (n = 14) were reported as Serious Events (i.e., an event that reached the patient that contributed to or resulted in harm).

Handoff Settings and Staff Involvement

Three handoff settings were identified in the event descriptions:

- Shift-to-shift transitions (39%, n = 610 of 1,565)
- Unit-to-unit transfers (30.3%, n = 474)
- Temporary coverage (e.g., during a lunch break; 1.8%, n = 28)

In the final 28.9% (n = 453), the handoff setting was unidentified.

Specific healthcare professionals were identified in the majority of the event reports (68.6%, n = 1,074 of 1,565). In many cases, more than one class of healthcare professional was identified in the event description, but their role as the giver or receiver in the handoff was not consistently stated. They are grouped as follows:

- Registered nurse (86.4%, n = 928 of 1,074)
- Medical doctor (18.2%, n = 195)
- Allied health professional (6.2%, n = 67)
- Nonclinical staff (2%, n = 22)
- Student nurse or resident (2%, n = 21)

Completed Handoffs

The majority of the event reports identified the occurrence of a handoff, 81% (n = 1,268 of 1,565), versus events reporting lack of a handoff (see Figure). Discrepancies between the information shared and the patient’s condition was the most common problem. Event reports that identified a discrepancy without stating whether the staff addressed the discrepancy accounted for 59.2% (n = 751 of 1,268) of these reports; in the remaining 40.8% (n = 517) of the handoff reports, staff identified and followed up on hand-off discrepancies. Discrepancies without an identified follow-up were found most often after a handoff occurred, 56.3% (n = 423 of 751), and included omitted information in 61.5% (n = 260 of 423) and a lack of a physical check or failure to clarify intravenous (IV) lines, orders, or skin conditions during a handoff in 10.2% (n = 43 of 423) of events.

Good Follow Through

The following narratives illustrate efforts to see patient issues through to completion.*

Charge registered nurse (RN) received call from the lab with a critical lab value. Patient was not on the unit and no hand-off report was yet given on the patient. The patient was [still showing to be on another unit]. The RN [who received the critical lab value] called the other unit to make

[ sure that the] patient’s RN was aware [of the lab value]. Staff stated that the patient had left the unit and was possibly having a procedure. The charge RN called the [procedure room], reached the RN caring for the patient, and passed on these critical lab results.

During change of shift report, the outgoing RN reported that new skin breakdown on the patient’s buttock was present. The outgoing RN stated the wound was not there when he cared for the patient previously. The oncoming RN’s assessment of the wound noted several areas of open skin. The patient was incontinent and requires frequent care. Barrier creams were applied to the skin. The certified registered nurse practitioner was informed of [the patient’s] skin integrity and the certified wound ostomy and continence nurse saw patient the next day.

Discrepancies Noted During Handoff without Indication of Staff Follow Through (n = 136 of 751)

Medication errors comprised more than half of the 136 events in which discrepancies were noted during the handoff (55.1%, n = 75) and included dose omission, extra or wrong dose, prescription delays, monitoring errors, and incorrect medication lists. The PA-PSRS miscellaneous or “Other” category comprised 17.6% (n = 24) of event reports; catheter-line problems (e.g., infusion rates, infiltrates) and patient identification issues accounted for the majority of these event reports. Errors in procedures, tests, or treatments included problems such as delays in providing treatments or receiving test results, missed treatments, or dietary issues and accounted for 14.0% (n = 19) of these event reports. The remaining event reports involved transfusions, skin integrity, equipment problems, and complications of procedures, tests, or treatments.

While giving handoff report in the OR, the [outgoing] nurse noted an
Discrepancies Noted After Handoff without Indication of Staff Follow Through (n = 120 of 423)

Medication errors and errors in procedures, tests, and treatments comprised the majority of the 120 event reports in which discrepancies were noted after the handoff (41.7%, n = 50 and 33.3%, n = 40, respectively). Reasons for medication errors were similar to the discrepancies noted during handoff, such as dose omission, wrong dose, and extra dose. Errors in procedures, tests, and treatments included problems related to test orders, scheduling, lost specimens, and missing results. The remaining events included equipment problems, skin integrity problems, transfusions, and problems with IV lines, monitoring, transfers, and documentation issues.

Patient taken to the OR for a procedure. Later, the OR called and told the nurse that surgery was cancelled due to a critical lab value. The OR told the nurse to come and get the patient, because the patient was sedated. When the nurse arrived to the OR, the patient was on the stretcher, struggling to breathe. The RN brought the patient back to the floor and applied oxygen. Better communication is needed between units. The RN was leaving the building at night. The technician reports a patient has been in the waiting area for several hours to have a test performed. The patient states he arrived in the early afternoon and did not
get a [gown or ID band] when he checked in. A different RN who gave a handoff [to the outgoing RN] at [the end of day] stated the schedule was done. The [outgoing RN] was not notified of the patient waiting [until she was leaving].

**No Physical Check of Equipment, Orders, or Medications without Indication of Staff Follow Through (n = 43 of 423)**

Medication errors accounted for 79.1% (n = 34 of 43) of events in which physical checks were not performed. The nine remaining events without physical checks involved pressure ulcers, blisters, IV infiltrations, laboratory delays, falls, and equipment and discharge issues.

The patient was ordered to be transferred to the unit. The RN received report [prior to patient arrival]. The patient was apparently brought to the unit from the OR. No one from the OR [informed any staff on unit] that they brought the patient [to the unit]. Apparently, the patient was hooked up to the monitor. The charge nurse noted [a while later] that a patient was on the monitor. The [charge] RN went to the room to check to see why the monitor would [have a reading] and found the patient in bed.

The nurse found the [medication] infusion ordered at 17 units/hour was turned off. [The nurse was] unable to determine how long the IV was off. Line tracing was not completed at handoff.

When the RN went to give the dose of [medication], he found a syringe from the previous dose full and never infused. Nursing failed to check line during handoff at shift change.

**Detail Not Mentioned during Handoff without Indication of Staff Follow Through (n = 260 of 423)**

Two-hundred and sixty reports cited information omitted during handoff. The most frequent event type in this group was medication errors (33.5%, n = 87). Errors in procedures, tests, or treatments (e.g., delays or omissions in treatments) accounted for 27.7% (n = 72) of event reports with missing information; miscellaneous type reports (e.g., documentation issues) accounted for 17.3%, (n = 45) of these reports. The remaining reports about missing information were categorized as complications of procedures, tests, or treatments; equipment problems; skin-related problems; transusions; and falls.

The RN transported the patient via bed and left prior to bedside handoff. The patient’s do not resuscitate (DNR) status was not communicated during the phone report. The patient arrived complaining of shortness of breath. [The patient’s condition deteriorated]; the patient became unresponsive and stopped breathing. A code blue was called. On hearing the code paged overhead, the RN from the [unit that the patient transferred from] arrived and informed [the staff of the patient’s] DNR status. The doctor found a 10-second pause on the telemetry monitor [strip] in the patient’s chart. The RN from the prior shift never informed anyone, including the doctor [on call or RN during handoff].

The patient was brought to the [procedural area] from the unit. Upon arrival, a ticket to ride [slip] in the chart was checked for the patient assessment and isolation needs. Isolation was listed as none. The patient was in the procedural area for [more than four hours] in multiple rooms. During transportation [back to her room] the patient [questioned] why [the staff] did not wear isolation gowns for her exam due to her being on contact precautions.

**DISCUSSION**

Although a lack of accurate and complete information received during a handoff can have disastrous consequences for patients, in 40.8% of the event reports that stated a handoff occurred, staff followed up on important patient information. Much can be learned about ways to enhance patient safety, even when care is delivered as expected without harm.

**Safety-II**

Safety-I is usually associated with things that go wrong.24 The concept of Safety-II...
A Systems Perspective

A systems perspective focuses on understanding and examining connections and interactions between individual components (e.g., handoff processes) that make up a system. Rather than focusing on single components as causal factors in accidents, systems theory considers the interactions of multiple components. In healthcare, internal and external organizational factors make up a diverse group of components that influence system functioning. Using a systems approach to evaluate and address the problem of incomplete or missing handoffs can provide insight into the organizational factors that influence the process of sharing information between people. Managing the many diverse organizational factors involves individual decision making when determining what information to include and present at a handoff. Leveson posits that each individual decision may appear safe and rational within the context of the individual’s work environment and local pressures but may be unsafe when considering larger system influences. She states that “it is difficult if not impossible for any individual to judge the safety of their decisions when it is dependent on the decisions made by other people in other departments and organizations.” For example, individuals can vary greatly in deciding what information to share during a handoff. It may be possible to structure handoff processes to help healthcare staff see the complete picture or implications of their actions. Ongoing conversations between front-line staff and management using critical thinking and reasoning can help balance patient care delivery and determine how to modify strategies and activities to provide safe patient care (e.g., providing important information) while reducing the chance of errors.

Another enticing solution to reduce variations in handoff information is to standardize the handoff tool as part of the handoff process (see “Challenges to Effective Standardization”). Periodic evaluation of the solution (i.e., standardized handoff tool) is needed to confirm the resolution of problems. If the intervention does not achieve the intended results or achieves results for only a limited time, more fundamental interventions may be required. In systems theory, a quick or immediate solution to a problem that does not address the underlying cause is referred to as “shifting the burden.” Braun describes how an initial solution that provides symptomatic resolution “in the short run” may not address the underlying systemic problem(s) and can disrupt a worker’s ability to execute a prescribed task. For example, if something the worker needs is unavailable (e.g., patient information) or something is present that should not be, the task cannot be executed as planned.

Risk Reduction Strategies

Table 2 lists strategies addressing many of the circumstances that can adversely affect handoffs; these strategies address individual and system barriers to effective communication. These risk reduction strategies align with the barriers to effective handoffs presented in Table 1. This list of strategies for effective handoffs is by no means exhaustive. See also the available interactive format at http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2017/Mar;14(1)/Pages/17.aspx.

LIMITATIONS

PA-PSRS does not have a structured data field for handoffs; therefore, a keyword search of the event detail and other free text data fields was applied; facilities may have submitted reports using different terminology. Often event reports included limited information about the staff involved during the handoff, when the handoff occurred, and at what point in the handoff process a discrepancy was identified. Information about the circumstances present during a handoff is rarely mentioned, which restricts insights into why handoffs did not happen or why information was omitted. The event reports also do not contain information about how an outgoing staff member decided what information was important to communicate to the oncoming staff member.

CONCLUSION

In Pennsylvania, 40.8% of the completed handoff event reports exemplify how healthcare providers accomplish the intended purpose of a handoff, namely maintaining continuity of care, while
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>RISK REDUCTION STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardize inconsistent processes</td>
<td>Develop and update handoff policies and procedures&lt;sup&gt;1,3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Map the handoff process&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>For handoffs, provide opportunities for face-to-face communications to seek clarification and discuss questions&lt;sup&gt;1,4,5&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Create a handoff tool or considering using a standardized handoff tool:</td>
</tr>
<tr>
<td></td>
<td>SBAR</td>
</tr>
<tr>
<td></td>
<td>I-PASS</td>
</tr>
<tr>
<td></td>
<td>IPASS the BATON</td>
</tr>
<tr>
<td></td>
<td>Ticket to ride&lt;sup&gt;1,3,6-12&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Perform physical checks of the patient and equipment (e.g., IV lines) during a handoff&lt;sup&gt;1,7&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Include patient and family in discussions of plans and goals&lt;sup&gt;1,7&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Tailor the handoff to the unit&lt;sup&gt;2,3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Standardize the discharge process&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Minimize environmental distractions</td>
<td>Create a specific place for the report that is well lit and quiet&lt;sup&gt;1,5&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Maintain patient and family privacy&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Allow sufficient time to give report&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Clear communication</td>
<td>Limit interruptions and distractions&lt;sup&gt;1,2,5,6&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Keep remarks objective&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Speak using a moderate pace&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Verify that the oncoming person understands and accepts transfer of responsibility&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Be concise yet thorough&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Avoid using jargon, acronyms, or abbreviations&lt;sup&gt;1,13&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Prepare the report ahead of time&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Use briefs or huddles&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Identify patient and family needs and concerns&lt;sup&gt;5,7&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Document handoffs&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Improve training and education</td>
<td>Use simulation to role-play and teach effective handoff skills&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Use real-life examples (e.g., stories) during training&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Teach assertiveness and listening skills&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Provide training to new staff and refresher to existing staff&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Discuss how stress, fatigue, or information overload affects understanding&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Address how social and cultural norms affect communication&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Create paper and web resources to reinforce handoff skills&lt;sup&gt;1,3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
### Table 2. Handoff Strategies (continued)

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>RISK REDUCTION STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage leadership and staff</td>
<td>Facilitate nurse-physician dialogue(^1)</td>
</tr>
<tr>
<td></td>
<td>Provide consistent expectations for compliance(^1)</td>
</tr>
<tr>
<td></td>
<td>Allow time to plan a new handoff strategy(^1)</td>
</tr>
<tr>
<td></td>
<td>Find role models to demonstrate effective handoffs(^1)</td>
</tr>
<tr>
<td></td>
<td>Evaluate and measure the impact of handoffs on adverse events(^3)</td>
</tr>
<tr>
<td></td>
<td>Facilitate critical thinking and reasoning skills(^{14})</td>
</tr>
</tbody>
</table>

Notes:

CHALLENGES TO EFFECTIVE STANDARDIZATION

Applying a standard process to human behavior is intended to provide a consistent approach and a shared expectation of tasks between workers.1 The challenge in standardizing a process, such as a handoff, is to be sure that the process does not turn into a one-size-fits-all approach. Training workers to think critically, using evidence-based information to make informed choices, and understanding what actions can be altered in a standardized process helps workers accomplish their job safely and effectively.2,3 This is important because implementing a standard handoff process with a set of predictable steps has the potential to lead to repetitive behaviors that can turn into habits.2 Over time, workers may disregard or take for granted information regularly shared in the handoff process to the point that attention is reduced and subtle but important information is missed or overlooked, potentially creating unsafe conditions.4 Although standardizing processes and approaches to patient care can be beneficial, critical thinking and reasoning skills have an important place in patient care.

Notes
7. Joint Commission Comprehensive Accreditation Manuals: Hospital. Washington (DC): The Joint Commission; 2016: Effective: 2016 Jul 1. Leadership. LD.03.04.01: The hospital communicates information related to safety and quality to those who need it, including staff, licensed independent practitioners, patients, families, and external interested parties.

(continued from page 22)

addressing discrepancies that will inevitably arise when communicating patient information. These Safety-II events demonstrate the benefits of a good handoff, in which discrepancies are caught before harm reaches the patient. Using a systems approach that includes critical thinking skills coupled with the risk reduction strategies outlined in this article can help healthcare leadership and staff find ways to improve their facilities’ handoff processes.

NOTES

7. Joint Commission Comprehensive Accreditation Manuals: Hospital. Washington (DC): The Joint Commission; 2016: Effective: 2016 Jul 1. Leadership. LD.03.04.01: The hospital communicates information related to safety and quality to those who need it, including staff, licensed independent practitioners, patients, families, and external interested parties.


Retained Surgical Items: Events and Guidelines Revisited

INTRODUCTION

Retained surgical items (RSIs)—also known as unintended retained foreign objects or retained foreign bodies—can cause emotional and severe physical harm such as infection, loss of function, and even death.¹ Nationally, items left behind include sponges, sharps and needles, instruments, small miscellaneous items, devices, and device fragments.²

Patients may suffer for years with pain or other disabilities as a result of an undiagnosed RSI. For example, a sponge was found in a California woman four years after abdominal surgery. She complained of nausea, dehydration, and bleeding before the sponge was discovered during surgery for a suspected ovarian cyst.³

RSIs are considered a serious reportable event by the National Quality Forum⁴ (NQF) and a sentinel event by the Joint Commission.⁵ The organizations differ on criteria for the conclusion of surgery (see “Retained Surgical Item Definitions”). The Pennsylvania Patient Safety Authority does not endorse a particular RSI definition.

NQF endorses RSIs as one of 29 events suitable for public reporting so that organizations can take actions to prevent recurrence and deliver safer healthcare. The Joint Commission reports that organizations continue to struggle with RSIs, which were the most frequently reported sentinel event in 2014 and 2015, with 112 and 115 reported, respectively.⁶ The Centers for Medicare and Medicaid Services (CMS) includes RSIs as hospital-acquired conditions that should never happen.⁷

Articles published about RSIs in the Pennsylvania Patient Safety Advisory in 2009⁸ and 2012⁹ offer recommended best practices and guidance for preventing RSIs. Ongoing analysis of reports to the Authority suggests RSIs remain a challenge.

METHODS

Analysts queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for reports of events that were discovered (date item was recognized) between January 2014 through December 2015 (inclusive) using search terms including “foreign,” “fb,” “retained,” “detected,” “retrieve,” “discover,” “missing,” “search,” “fragment,” “tip,” and “wrong count” regardless of care area (e.g., delivery suite, catheterization laboratory, operating room [OR]). The search term “RSI” yielded 19 cases: 8 were duplicates found through other search methods, 9 had the string “RSI” within other irrelevant reports (e.g., rapid sequence intubation), and 2 reported unsuccessful searches for possible foreign bodies. Events were excluded if the event narrative contained phrases such as “absence of foreign,” “x-ray found no,” “no evidence of foreign,” “no evidence of retained,” or “did not identify foreign.” Event reports identified via relevant monitor codes assigned by analysts to classify events were also included in the dataset.

Analysts manually reviewed the resulting set of event report narratives to identify reports describing RSI events and grouped them into related categories by harm score, anatomic site, event type categories, event reporting taxonomy, and by NQF and Joint Commission definitions.

Retained and unretrieved objects that were unrecognized† at the time they were left behind were classified into the following related categories using a taxonomy

³ For the purposes of this article, “unrecognized” implies the device fragment was unknowingly left behind.
REVIEW & ANALYSIS

RETAINED SURGICAL ITEM DEFINITIONS

National Quality Forum

The National Quality Forum defines retained surgical item as unintended retention of a foreign object in a patient after surgery or other invasive procedure. This includes medical or surgical items intentionally placed by providers that are unintentionally left in place. It excludes (1) objects present prior to surgery or other invasive procedure that are intentionally left in place, (2) objects intentionally implanted as part of a planned intervention, and (3) objects not present prior to surgery or a procedure that are intentionally left in when the risk of removal exceeds the risk of retention such as microneedles and broken screws.1

This event is intended to capture:

— Occurrences of unintended retention of objects at any point after the surgery or procedure ends, regardless of setting (post-anesthesia recovery unit, surgical suite, emergency department, patient bedside) and regardless of whether the object is to be removed after discovery.

— Unintentionally retained objects (including such things as wound packing material, sponges, catheter tips, trocars, guide wires) in all applicable settings.1

Surgery ends after devices such as all probes and instruments have been removed; if relevant, final surgical counts confirming accuracy of counts and resolving any discrepancies have concluded; all incisions or procedural access routes have been closed in their entirety; and the patient has been taken from the operating or procedure room.2

The Joint Commission

The Joint Commission considers unintended retention of a foreign object in a patient after an invasive procedure a sentinel event.3

If a foreign object (e.g., a needle tip or screw) is left in the patient because of a clinical determination that the relative risk to the patient of searching for and removing the object exceeds the benefit of removal, this would not be considered a sentinel event to be reviewed. However, in such cases, the organization shall (1) disclose to the patient the unintended retention, and (2) keep a record of the retentions to identify trends and patterns (e.g., by type of procedure, by type of retained item, by manufacturer, by practitioner) that may identify opportunities for improvement.3

When, exactly, is “after surgery”?4

“After surgery” is any time after completion of the skin closure, even if the patient is still in the operating room under anesthesia.

adapted from NoThing Left Behind®, AORN®, and the U.S. Food and Drug Administration (FDA):10

— Items traditionally counted in the OR:
  □ Soft goods (e.g., surgical sponges, surgical towels, dressing sponges, drape towels, packs, prep swabs, gauzes)
  □ Sharps (e.g., scalpel blades, suture needles)
  □ Instruments (e.g., the whole instrument such as forceps, scissors, retractors)
  □ Small miscellaneous items (e.g., small intact items such as a wing nut, vessel loops, screws, nails)

— Other items:
  □ Other soft goods (e.g., cotton ball, dressings placed outside of OR)
  □ Unknown item (i.e., items not identified in the event narrative)
  □ Devices (e.g., guidewires or catheters left in intravascular or interstitial spaces)
  □ Unretrieved unrecognized device fragments (device fragments that are not retrieved because they are unrecognized (i.e., broken parts or pieces of devices and surgical items)

Unretrieved device fragments that were recognized but were left behind when the risk of removal exceeded the risk of retention (e.g., broken screws, piece of a drill bit) were categorized separately. Items (e.g., sponges) that were intentionally placed and left in place either temporarily or permanently were excluded.

An approximate RSI statewide rate was calculated by dividing the total number of RSIs identified during procedures performed in OR suites in hospitals and ambulatory surgical facilities (excluding vaginal RSIs) divided by the total number of OR revenue codes (excluding labor room/delivery revenue codes) identified from statewide inpatient and outpatient hospitals and ambulatory surgery facilities.
RETIRED SURGICAL ITEM DEFINITIONS (continued)

Why was this particular point in the process selected as the definition of “after surgery”?

The decision to define “after surgery” as the completion of skin closure was based on the premise that a failure to identify and correct an unintentional retention of a foreign object prior to that point in the procedure represents a significant system failure, which requires analysis and redesign. It also places the patient at additional risk by virtue of extending the surgical procedure and time under anesthesia.

Sometimes a needle or screw will break, leaving a fragment behind. Is this a reviewable sentinel event?

In some cases, a broken needle or screw fragment is recognized at the time of surgery and a clinical judgment is made to leave the fragment in the patient. That decision is based on an assessment of the relative risks of leaving it in versus removing it. Therefore, it would not be considered an unintentionally retained foreign object.

What about a retained sponge following vaginal delivery?

A retained sponge after a vaginal delivery is a reviewable sentinel event. The new language in the definition of reviewable sentinel events is, “Unintended retention of a foreign object in a patient after surgery or other procedure.” Note that it says “other procedure” not “other invasive procedure.” Vaginal delivery in the hospital is not an “invasive” procedure, but it is a procedure. More to the point, a retained sponge in this circumstance is indicative of the same underlying systemic problems that could cause other “retained foreign body” situations.

† ©The Joint Commission, 2016. Reprinted with permission.

Notes

 REVIEWS & ANALYSES

Figure 1. Retained Surgical Item Flow Chart

Query of PA-PSRS database using search terms related to retained surgical items; items discovered January 1, 2014, through December 31, 2015: N = 1,145

Narratives reviewed: N = 1,145

Retained surgical items: n = 112 by NQF criteria
Known but unretrieved device fragments: n = 57
Reports excluded because irrelevant (e.g., “no evidence of FB”) or FB was intentional (e.g., sponges placed as temporary packing): n = 960

Best practices and resources developed for reduction of RSI events.

RESULTS

Analysts identified 112 RSIs that met both NQF and Joint Commission definitions (see “Retained Surgical Item Definitions”), and an additional 16 that met Joint Commission definition alone, for a total of 128 RSIs.

The identified events were submitted in three PA-PSRS event type categories:

1. “Error related to procedure/treatment/test”
   a. NQF: 90 (of 112, 80.4%)
   b. Joint Commission: 103 (of 128, 80.5%)

2. “Complication of procedure/treatment test”
   a. NQF: 18 (of 112, 16.1%)
   b. Joint Commission: 21 (of 128, 16.4%)

3. “Other/miscellaneous”
   a. NQF: 4 (of 112, 3.6%)
   b. Joint Commission: 4 (of 128, 3.1%)

All events were associated with hospitals and ambulatory surgical facilities (i.e., no events were identified from birthing or abortion centers).

Events were categorized by harm scores with 53.6% (60 of 112) reported as Serious Events according to NQF, and 53.9% (69 of 128) according to the Joint Commission. See Table for harm scores.

Taxonomy. Analysts categorized counted soft goods as the predominant RSI item reported by Pennsylvania healthcare facilities, using NQF (47/112, 42.0%) and Joint Commission (58/128, 45.3%) criteria.

Body site. Most RSIs were left in the abdomen or pelvis, followed by the vagina, chest, head, extremities, and soft tissue space (see Figure 3).

Unretrieved recognized device fragments. Analysts found an additional 57 event reports describing device fragments (e.g., broken screw, catheter tip, metallic fragment) that were recognized but were intentionally not retrieved by the surgeon.

Occurrence. Excluding vaginal RSIs, analysts identified 82 (NQF criteria) and 97 (Joint Commission criteria) RSI reports that were discovered during the same time period that 5,493,283 OR revenue codes were submitted. Analysts estimate that 1.5 (NQF criteria) and 1.8 (Joint Commission criteria) RSIs occur per 100,000 patient procedures.

RSI Events

Analysts grouped RSI events into the following case scenarios with examples of events reported to the Authority:*  

1. Surgical count correct; RSI found after surgery:
   Patient underwent a right radical nephrectomy, with a robotic-assisted and hand-assisted port. All counts were correct. A few days later, the patient developed a fever and vomiting. An X-ray revealed a retained surgical sponge. The patient was taken back to the operating room for sponge removal.

2. Incision re-opened after incorrect sponge or instrument count:
   Patient went to surgery for several procedures. After the patient’s incision was closed, the sponge count was found to be incorrect. First count of sponges was relayed as correct, second count was wrong. Patient was still under anesthesia and draped. Patient was reopened, the sponge removed and [incision] re-closed.

3. Surgical count correct; missing sponge identified by surgical counting device:
   Initial and subsequent visual counts verified by circulator and surgical technician. Physician informed counts were correct. After close of skin, surgical counting device identified a missing sponge at final count. X-ray confirmed a sponge on right

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.
side of abdomen. Incision was reopened and sponge was retrieved.

4. RSI discovered during surgery for another procedure:
During patient’s surgical procedure, the surgeon found part of a plastic drain in the patient’s abdomen.
Retained sponge found in patient’s abdomen when patient’s chest was opened for transplant surgery.

5. Vaginal RSI discovered by another healthcare provider:
Patient had a spontaneous vaginal delivery and had a small tear requiring a single stitch. At the patient’s first post-partum visit, the nurse practitioner discovered a retained sponge.
The patient underwent removal of an ovarian cyst. A two-part uterine manipulator was inserted vaginally for the procedure. Three weeks later, one part of the manipulator was found in the patient during a post-op visit and removed.

Patient delivered vaginally with repair of episiotomy. She was discharged to home. Four weeks later, she went to the emergency department with complaints of vaginal pain. An examination revealed a retained vaginal sponge. The sponge was removed and the patient was discharged to home in stable condition.

6. RSI discovered at another facility:
An x-ray from another facility revealed a retained foreign object.

Patient taken to OR for exploratory laparotomy, which revealed a foreign body that was removed.
The following case scenarios are examples of an unretrieved recognized device fragment:

During an operative procedure to fix a bone fracture, a drill bit broke and was intentionally left in place.
When the physician’s assistant was closing the patient’s wound, the tip of a needle broke off. The surgeon was notified and returned to the room. A flat plate was ordered and showed a very small foreign object within the leg. After attempting to retrieve the piece of metal unsuccessfully, the surgeon decided to continue with wound closure. The tip was approximately 2 millimeters. Surgeon felt retrieval of the needle tip would cause more harm than to leave the needle tip in place in soft tissue. Surgeon notified patient and spouse.

Any time an item is retained, a critical investigation should be conducted to see where the process failed, according to Wood. “It’s important that we rectify the mistake and also use it as a learning opportunity to prevent it from happening in the future,” she said.

Ronald M. Wyatt, MD, MHA, patient safety officer and medical director in the Division of Healthcare Improvement at the Joint Commission said the Joint Commission receives sentinel events in which the patient never leaves the OR. “We don’t get into the location of the patient,” he said. “If that patient is in the operating room or out of the operating room, and the team knows there was something left behind and it wasn’t addressed, it is a URFO [unintended retained foreign object].” The commission uses the term “URFOs” since there is a “spectrum” of items that can be left behind that are not all surgical items, he said. Pennsylvania facilities can report these events through PA-PSRS using the event type “Events related to procedure/treatment/test,” and selecting the subtypes “Surgery/invasive procedure problem,” and “Foreign body in patient.”

Safety culture. “By definition, these events may have led to death, permanent harm, or severe temporary harm,” Wyatt said. When reviewing the causes that directly related to the event, the Joint Commission found limitations in leadership, communication, and teamwork as the top three root causes, he said.

DISCUSSION

RSI Reporting

There is controversy about the determination of when an item is “retained,” according to Amber Wood, MSN, RN, CNOR, CIC, CPN, senior perioperative nursing specialist at AORN, but both NQF and Joint Commission agree that RSIs pose serious complications for patients.

Table. Retained Surgical Item Events Reported to the Pennsylvania Patient Safety Authority, by Event Harm*

<table>
<thead>
<tr>
<th>HARM (SCORE)</th>
<th>NO. (%) OF EVENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National Quality Forum Criteria (N = 112)</strong></td>
<td><strong>Joint Commission Criteria (N = 128)</strong></td>
</tr>
<tr>
<td>Incident: Unsafe conditions (A)</td>
<td>3 (2.7%)</td>
</tr>
<tr>
<td>Incident: No harm (B1 through D)</td>
<td>48 (42.9%)</td>
</tr>
<tr>
<td>Serious Event: Temporary harm (E through F)</td>
<td>60 (53.6%)</td>
</tr>
<tr>
<td>Serious Event: Significant harm (G through I)</td>
<td>1 (0.9%)</td>
</tr>
</tbody>
</table>

Note: Data from January 2014 through December 2015. Events are as defined by the National Quality Forum and The Joint Commission.

* Event harm scores are defined by Pennsylvania Patient Safety Reporting System taxonomy and are assigned to events by healthcare facilities at the time of report submission. http://www.patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/mar;12{1}/PublishingImages/taxonomy.pdf
“Typically, what underscores all of those root causes is a failed safety culture,” Wyatt said. Teams that don’t work well together because of some team dynamic or dysfunction, will work around a process or a person until it results in a sentinel event, Wyatt said. “What we typically find is weak or absent leadership,” he said. “We can put in all kinds of processes, but if leadership is not working on building a strong culture of safety, we are going to keep seeing events.”

There are three victims: the patient, the care teams, and the organization, Wyatt said. “Folks in the community will not go there for surgery,” he said. “This is a reputational issue for the organization. Culture should not tolerate this type of behavior.”

**NoThing Left Behind**

Verna C. Gibbs, MD, clinical professor of surgery, University of California, San Francisco, and director of NoThing Left Behind®, a national surgical patient safety project to prevent retained surgical items, works with healthcare systems in Minnesota and California to help standardize event reporting of RSIs and understand root causes. Using a structured taxonomy to classify RSIs, Gibbs found the most frequently retained item is the cotton gauze surgical sponge with most reports referring to a 4- by 4-inch sponge or the 18- by 18-inch laparotomy pad. Gibbs found the most common body sites where RSIs are found are the abdomen/pelvis, the vagina, and then the chest, in that order. In Pennsylvania, Authority analysts also found the same three most common sites. Increased appreciation has occurred around the problem of retained vaginal sponges and miscellaneous items left behind after spontaneous vaginal births as well as elective gynecological operative cases, according to Gibbs. This has led to efforts to move better safety and prevention strategies to labor and delivery areas in addition to the OR and other procedural areas, she said.

**Rate of occurrence.** The rate of occurrence varies in the literature and is difficult to compare because different RSI definitions, information sources, and taxonomy are used. The overall frequency is estimated at 1 in 1,500 abdominal operations and 1 in every 8,000 to 18,000 inpatient surgical procedures. Gibbs states on her website that estimates range from 2,000 to 4,000 events each year in the United States.

**Device Fragment Adverse Events**

Device fragments are a concern because they can cause local tissue reaction, infection, perforation and obstruction of blood vessels, and death. Contributing or mitigating factors may include biocompatibility of the device materials, location of the fragment, potential migration of the fragment, and patient anatomy. During magnetic resonance imaging (MRI) procedures, magnetic fields may cause metallic fragments to migrate, and radiofrequency fields may cause them to heat, causing internal tissue damage and/or burns. In 2008, FDA published a Public Health Notification describing serious adverse events arising from fragments of medical devices left behind after surgical procedures. In contrast with FDA’s description, this Advisory article analysis differentiates whether the device fragment was knowingly left behind (versus discovered subsequently). Authority analysts found 57 unretrieved recognized device fragments known to the surgeon but left

---

**Figure 2. Retained Surgical Items as Reported to the Pennsylvania Patient Safety Authority**

<table>
<thead>
<tr>
<th>REPORTS</th>
<th>Counted</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft goods</td>
<td>47</td>
<td>6</td>
</tr>
<tr>
<td>Small miscellaneous items</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Instruments</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Sharps</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Unretrieved unrecognized device fragments</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Unknown item</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Devices</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Other soft goods</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Soft goods</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>National Quality Forum criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Joint Commission criteria</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** As Reported through the Pennsylvania Patient Safety Reporting system, January 2014 through December 2015. Analysis of data revealed 112 RSIS that met the definitions of both the National Quality Forum (NQF) and the Joint Commission, and an additional 16 that met the Joint Commission definition alone, for a total of 128 RSIs.
behind because the risks of infection and trauma related to removal were believed to exceed the risks of retention.

PREVENTION GUIDELINES

Updated AORN and Joint Commission guidelines provide prevention methods to help perioperative team members decrease the risk of RSIs during all facets of an invasive procedure.6,10 A consistent counting method, separating items (e.g., sponges), minimizing distractions, and team training are best practices, according to Wood.11

“We found that when you’re standardizing your counting, that you’re less likely to make mistakes, and that is what the literature has showed us,” Wood said. “That is part of human factors and how human beings think.” AORN also recommends not subtracting or removing items from the count. “The more you are manipulating the count, the more risk you have for making a calculation error,” Wood said.

Team members may be helped by tools such as a Patient Safety First California Partnership for Health video featuring a sponge counting system presented by Gibbs (available at http://www.hospitalcouncil.org/post/surgical-safety-preventing-retained-surgical-items), AORN performance evaluations, and audit tools. In addition, a June 2014 Pennsylvania Patient Safety Advisory article, “Distractions in the Operating Room,” includes strategies to reduce distractions in the OR setting.19

The following highlights of the guidelines may be useful to healthcare facilities seeking to prevent and reduce RSIs:

Counting Process Suggestions

- Standardize count policies for all procedures.6
- Establish uniform documentation of the count process across all procedural areas, including areas where emergent procedures may be performed (e.g., emergency department, intensive care unit, or at the bedside on a nursing unit).
- Reconcile the count so the entire team is involved and supports the request.6
- Require full counts for breaks or shift changes such as lunch breaks.18
- Assess individuals’ competency in the count process prior to the completion of orientation and then annually.18
- View counts concurrently by two individuals including the nurse circulator.18
- Consider using a sponge pocketing system and pointing at the item while audibly counting.18

Minimize Distractions, Noise, and Interruptions18

- Minimize distractions, noise, and unnecessary interruptions during the surgical count. This can include limiting the number of individuals in the procedure room.
- Create a “no-interruption” zone and prohibit nonessential conversation and activities, including rushing the count.
- Consider restarting the count for a group of items (e.g., laparotomy sponge) if the count is interrupted.
- Conduct the initial count before the patient arrives in the surgical area.

Physical Environment6

- Standardize the layout of procedural areas to help teams working in new or unfamiliar locations.
- Adjust lighting levels to enhance visibility for adequate inspection of equipment and viewing of the white board.

Team Communication and Interaction

Develop policies that address physician-staff interaction, which may include:

- Requiring physician acknowledgment that the count is correct prior to completion of skin closure, performing a systematic sweep of the wound before closing, and examining the vagina after delivery.26


— Calling out when an instrument is placed into a body cavity and not immediately removed.²,⁶
— Alerting the team when packing is placed into a body cavity and not immediately removed.
— Requiring team affirmation that the patient meets criteria for an intraoperative x-ray to screen for RSIs.⁶

**Notes**


**Limitations**

Limitations of this study include scant detail in some PA-PSRS reports, the potential to misinterpret information in the narrative descriptions in PA-PSRS reports, and the possibility that reporters used terms not included in the search strategy. The information provided by PHC4 may not have included all surgical procedures performed during the analysis period, and some RSIs may not have been identified or reported through PA-PSRS.

**Conclusion**

RSIs are uncommon, but they do occur, and may cause direct patient harm. In events reported through PA-PSRS, the most common locations for RSIs are the abdomen and pelvis, followed by the vagina and chest. The most common type of item that is retained is the surgical sponge. Detecting and reporting RSIs may help to determine patterns and root causes using a definition decided upon by the healthcare facility. Attention to components of the surgical item counting process may help prevent RSIs. AORN and the Joint Commission suggest standardizing counting protocols; providing visual cues when sets are incomplete; minimizing distractions; and promoting a systems approach to performance improvement.

**Acknowledgments**

Kimberly A. Farley, BSN, RN, Gwynedd Mercy master’s degree student in science of nursing, provided consultation and contributed to data acquisition for this article. Edward Finley, BS, Pennsylvania Patient Safety Authority provided data analysis and interpretation.


Influenza is a contagious respiratory illness that can cause mild to severe illness and can lead to death. Elderly people (65 years or older) are at greater risk of serious complications from influenza than younger individuals because human immune defenses become weaker with age. In the 2012–2013 influenza season, about half of the 12,336 reported influenza-associated hospitalizations occurred in elderly people. An estimated 5,500 influenza-associated deaths occur annually in elderly people, accounting for about 90% of deaths from influenza infections in the United States. In 2014, the Centers for Disease Control and Prevention (CDC) listed influenza and pneumonia combined as the eighth leading cause of death in elderly people. Respiratory tract infection was the second most frequent healthcare-associated infection reported to the Pennsylvania Patient Safety Authority by Pennsylvania’s long-term care (LTC) facilities from 2013 through 2015.

CDC recommends annual influenza vaccination for all healthcare personnel, especially those who work in LTC, as the best way to prevent influenza infection among healthcare personnel and their patients. Influenza vaccine effectiveness is generally lowest in the elderly, making vaccination of healthcare personnel working with elderly residents in LTC settings critical.

**NATIONAL DATA**

As reported in the September 18, 2015, Morbidity and Mortality Weekly Report, influenza vaccination coverage for the 2014–2015 influenza season was highest among healthcare personnel working in hospitals (90.4%) and lowest among healthcare personnel working in LTC settings (63.9%). Healthcare personnel working in LTC settings have had the lowest reported influenza vaccination coverage for the past five influenza seasons. In comparison, Healthy People 2020 recommends increasing the percentage of healthcare personnel who are vaccinated annually against seasonal influenza to a target goal of 90%. Healthcare personnel who were required by their employers to be vaccinated had the highest influenza vaccination coverage (96.0%). Healthcare personnel who were not required by their employers to be vaccinated had a 73.6% coverage rate when vaccination was offered on-site at no cost for one day and an 83.9% coverage rate when vaccination was offered on-site at no cost for multiple days. Healthcare personnel working in settings in which vaccination was not required, promoted, or offered on-site had a 44.0% coverage rate.

**PENNSYLVANIA DATA**

The Pennsylvania Department of Health reports LTC healthcare personnel vaccination rates of 57.6% in 2013 and 66.8% in 2014, well below the Healthy People 2020 target goal of 90% for healthcare personnel (Figure 1). The Authority found in its 2015 Annual Long-Term Care Survey that mandatory staff influenza vaccination programs are in place in 47.8% (120 of 251) of the Pennsylvania LTC facilities that responded. In addition, 91.2% (229 of 251) of the Pennsylvania LTC facilities that responded provide annual staff influenza prevention education programs.

**BARRIERS TO INFLUENZA VACCINATION COMPLIANCE**

Efforts are needed to improve vaccination coverage among healthcare personnel in LTC settings. LTC facilities can promote influenza vaccination each season by reducing barriers to healthcare personnel vaccination. Barriers may include lack of access to influenza vaccine, personal beliefs, misconceptions, fear, lack of enthusiasm about influenza vaccination, and high staff turnover.
STRATEGIES TO IMPROVE VACCINATION COVERAGE RATES

The ease of access to influenza vaccine can influence vaccination rates (Figure 2). Steps that can increase access to influenza vaccination are as follows:

- Provide free vaccine in the workplace
- Offer vaccine at multiple times and locations convenient to all workers on all shifts during the flu season
- Use a mobile vaccination cart to take influenza vaccinations to staff
- Offer vaccination at meetings
- Provide education for staff
  - Focus on protecting healthcare personnel, their families, and residents
  - Review the seriousness of influenza, including the risk to young or healthy people
  - Review the influenza vaccine’s effectiveness and possible side effects
- Encourage enthusiasm about influenza vaccination with the following steps:
  - Promote vaccination via communication tools, such as posters, facility intranet, e-mails, newsletters
- Address personal beliefs, misconceptions, and fear:
  - Have contests or provide incentives for vaccination, such as raffles, gift cards, a pizza party, cake
  - Vaccinate leaders in front of the staff
  - Address high staff turnover:
    - Educate and vaccinate staff as part of new employee orientations
    - Offer influenza vaccination education multiple times during the flu season

Although influenza vaccination coverage for Pennsylvania LTC healthcare personnel is slowly increasing, it is well below the Healthy People 2020 target. Comprehensive vaccination strategies demonstrated to improve coverage among LTC healthcare personnel include providing and promoting information about the benefits of influenza vaccination, ensuring convenient access to vaccine in the work setting, and providing the vaccine free of charge to healthcare personnel.

**Figure 1. Pennsylvania Long-Term Care Healthcare Personnel Influenza Vaccination Rates**

**Figure 2. National Healthcare Personnel Influenza Vaccination Rates, 2014–2015**

**PERCENTAGE**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Vaccination Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>57.6</td>
</tr>
<tr>
<td>2014</td>
<td>66.8</td>
</tr>
</tbody>
</table>

**PERCENTAGE**

| Vaccine not required, promoted, or offered on-site | 44.0 |
| Vaccine not required; offered on-site for one day | 73.6 |
| Vaccine not required; offered on-site for multiple days | 83.9 |
| Vaccine required by employers | 96.0 |

**Sources:**
- Note: Data as reported by Pennsylvania Department of Health; Healthy People 2020 target goal is 90% of healthcare personnel vaccinated annually against seasonal influenza.
- **Figure 1. Pennsylvania Long-Term Care Healthcare Personnel Influenza Vaccination Rates**
- **Figure 2. National Healthcare Personnel Influenza Vaccination Rates, 2014–2015**
- **VACCINATION RATES**

NOTES


The Authority Celebrates Pennsylvania Healthcare Providers for Outstanding Patient Safety Efforts

INTRODUCTION
The Pennsylvania Patient Safety Authority held its annual I Am Patient Safety contest to recognize individuals and groups taking action to positively impact patient safety. The contest provides an opportunity to showcase the great work being done in Pennsylvania healthcare facilities and reward the people involved. We received more nominations this year than ever before. As one of the judges, I personally read all 184 submissions and was impressed by the evident level of dedication and resulting impact on patient safety.

The judging panel, composed of an Authority board member, executive and management staff, and a patient community member, evaluated submissions using the following criteria: the person or group demonstrated (1) a discernible impact on patient safety for one or many patients, (2) a commitment to patient safety, (3) a strong patient safety culture present in the facility, and (4) initiative. Winners were awarded with a plaque, certificate, and recognition pin from the Authority. Their photos and patient safety efforts were highlighted on posters that could be displayed within their facilities. Winners and healthcare facility representatives were also invited to attend the March 2017 Authority Board of Directors meeting and a luncheon to meet Authority board members and staff. I want to thank everyone who participated in the contest. It is always a challenge to narrow such an impressive group of nominations down to just a handful of winners.

The next round of nominations begins May 1, 2017. Please take the time to acknowledge the patient safety stars in your facilities by nominating them for this contest. The Authority board members and staff appreciate the time you have taken to tell us about your colleagues’ efforts to improve patient safety in Pennsylvania.

Thank you, again, to all who participated in the I Am Patient Safety contest. Please join me in congratulating the winners for their commitment to patient safety.

The individuals and groups recognized for the I Am Patient Safety contest and their achievements are grouped by name of facility.*

**Trisha Patel,** PharmD, BCPS, BCCCP
**Critical Care and Infectious Disease Pharmacist**
**Cancer Treatment Centers of America® at Eastern Regional Medical Center**

A patient with cancer was ill with signs and symptoms that suggested a urinary tract infection. Trisha Patel, a critical care and infectious disease pharmacist, went beyond her standard inpatient duties to review the outpatient’s urine test results. Trisha, who works to ensure that patients are on the right antibiotics for their particular disease, noticed the patient was infected with a harmful, multidrug-resistant bacterium. She called the infectious disease consultant and the patient was admitted to the hospital to receive necessary intravenous (IV) antibiotics.

Trisha’s attention to detail and quick identification of the bacteria prevented the patient from developing a worsening infection.

*Any included numbers and/or results were provided for publication by the recognized healthcare facilities. The Pennsylvania Patient Safety Authority has not independently verified, and bears no responsibility or liability for, these numbers and/or results.
Melissa Hewitt, Clinical Nurse Manager, Registered Nurse, Certified Neonatal Intensive Care Nursing, MSN
Arlene Stonelake, Registered Nurse, Certified
Meghan Mahoney, Registered Nurse, Certified
Labor & Delivery Department
Einstein Medical Center Montgomery
A large team of nurses in a pain-management procedure center needed to consult about cases while still maintaining patients’ privacy. To achieve this, the center implemented among the staff use of two-way wireless communications, with devices that have a microphone and a single earpiece.

Recently, a patient in the procedure room fainted while being helped from the procedure table to a wheelchair. The procedure room nurse used her wireless device to call for assistance. Multiple staff members responded. Thanks to the wireless system, the post-op nurses were also aware of the situation and notified the family and gathered the supplies needed to properly care for the patient.

Wannetta Love, Registered Nurse, CCRN
Intensive Care Unit
Phoenixville Hospital
As a registered nurse in the intensive care unit (ICU), Wannetta (Neadie) Love observed two patients who each had an endotracheal tube. One patient had a facial pressure injury associated with the endotracheal tube, while the other patient did not. She investigated and found that the unaffected patient had been transferred from another facility that used a special holder to reduce pressure-injury development. Love championed the use of these holders.

Because of her efforts, the hospital decided to purchase the pressure-reduction devices, which are now used in the ICU. No facial pressure injuries have occurred since.

Erin Madden, Patient Care Assistant - Nursing 4S PCT
Phoenixville Hospital
As a patient care assistant, Erin Madden was helping a patient into bed. She had made sure the bed’s wheels were locked, but during the patient’s transfer, the bed shifted away. Fortunately, the patient did not fall. The bed was repaired. But Erin remained concerned and raised the issue during one of the unit’s daily safety huddles. The concern was relayed to hospital leadership. It was discovered that even

Andrew Klee, Infection Control Practitioner
The Healthcare Acquired Infections Team
Guthrie Robert Packer Hospital
Good hand hygiene is important in protecting patients from healthcare-acquired infections (HAIs) that healthcare workers can unintentionally spread. The HAI Team, under infection preventionist Andrew Klee, convinced the hospital to install an electronic hand-hygiene monitoring system. Any employee who routinely enters patient rooms wears a monitoring badge, and handwashing compliance is posted for all to see. The team also collaborated with the Environmental Services Department to use an ultraviolet-light robot to disinfect operating and intensive care unit rooms.

The results were favorable—the oncology unit saw a threefold decrease in patients infected in the hospital with the harmful bacterium Clostridium difficile.

Paul Karlin, DO, Medical Director of Critical Care Unit (CCU) and Division Chief for Pulmonary Medicine
Jeanes Hospital
Jeanes Hospital performs case reviews for each patient death, to improve patient safety and quality of care. Dr. Karlin performs the lion’s share of these case reviews. He looks to improve clinical care, foster respect and communication among providers, provide patient dignity, and enhance family-member relations. He is frank about opportunities for improvement but does not place blame.

His efforts, as architect of a new departmental structure and captain of the ship, have prompted physician and staff education, policy and process revisions, and practice changes that support better patient outcomes.

The Pain Center of OSS Health
OSS Health
A large team of nurses in a pain-management procedure center needed to consult about cases while still maintaining

OTHER FEATURES

A large team of nurses in a pain-management procedure center needed to consult about cases while still maintaining
with wheels locked, nearly 60% of the beds on the unit were unstable.

This finding led to a hospital-wide assessment and repair of the wheel locks on all beds in the facility, lessening patients’ risk of falling.

Ashley Hartzell, Registered Nurse
Babette Rudick, Registered Nurse
Lisa Swenson, BSN, RN, ONC
Jacqueline Brown, Medical Assistant
Tina Frank, MHS, BSN, RN
Teresa Diez, Certified Registered Nurse Practitioner
Surgery Optimization Clinic
PinnacleHealth System

A surgery optimization clinic was established by Tina Frank, MHS, BSN, RN, with the help of her team Teresa Diez, CRNP; Lisa Swenson, BSN, RN, ONC; Ashley Hartzell, RN; Babette Rudick, RN; and Jacqueline Brown, MA. They collaborate with healthcare providers inside and outside the hospital to coordinate care, looking at “the whole person” through one-on-one education and support before surgery. These programs include screenings related to pain, smoking, sleep apnea and alcohol use, weight management and dietary practices, and “prehabilitation” to improve mobility.

Endoscopy Department and Infection Prevention and Control Staff
PinnacleHealth System

Recently, gastrointestinal professionals were shocked to learn that nationally, an antibiotic-resistant organism was being spread to patients through endoscopes that were contaminated, even after proper cleaning (the scopes have crevices that shelter bacteria). The PinnacleHealth endoscopy leadership, the endoscopy team, and the infection control department devised a plan to mitigate the risk to patients. The endoscopy team embraced the new disinfecting process, even though it takes more time.

After reorientation and education, the Endoscopy Department staff process endoscopes beyond professional standards.

Renu Joshi, MD, Medical Director, Endocrinology
Endocrinology Team
NP Inpatient Endocrinology Service
PinnacleHealth System

When patients with diabetes are hospitalized, controlling their blood glucose levels is difficult. Hospital workers may not have expertise in managing glucose levels. Additionally, the patient is seen by multiple practitioners—each treatment can affect a patient’s blood glucose levels. As medical director for endocrinology, Dr. Joshi heads a Diabetes Clinical Initiative and championed the creation of a Nurse Practitioner Inpatient Endocrinology Service. This multidisciplinary service improves knowledge among non-specialist staff and provides education, advice, and support to clinical staff, patients, and families.

Because of this program, diabetic patients’ hospital stays are shorter and they have fewer surgical-site infections than before.

Donna Miller, Nurse Manager
Jessica Radicke, Administrative Charge Registered Nurse
Marissa McMeen, Infection Control Practitioner
Bone Marrow Transplant Unit
Thomas Jefferson University Hospital

Concerned about the number of central line-associated bloodstream infections (CLABSIs) in the Bone Marrow Transplant Unit, Donna Miller, nurse manager; Jessica Radicke, administrative charge registered nurse; and Marissa McMeen, infection control practitioner made positive changes. Protocols were altered to limit who could change central-line dressings, and staffing was adjusted to cover this task. They introduced a medical manikin so nurses could practice and demonstrate accessing the central line. Senior leadership recognized and celebrated the team’s success.

Since the action plan was implemented, the unit has experienced just one CLABSI in 15 months.

Quality Based Improvement Resident Teams
Department of Surgery
Thomas Jefferson University Hospital

Recognizing the importance of quality and safety education, surgical residents at Thomas Jefferson University Hospital established the Quality Based Improvement Resident Teams (QBIRT) initiative. Under QBIRT, residents have researched, developed, and launched programs to reduce harm and improve the quality of care for surgical patients. They have led projects that have resulted in reducing surgical site infections and catheter-associated urinary tract infections and safer insertion of feeding tubes. With one hospital-wide QBIRT initiative, residents analyzed data and created a “risk score” to help predict postoperative respiratory failure in an effort to intervene earlier and prevent these complications.

Through advanced analytics, best practice implementation, team integration, and innovation, the residents of QBIRT have made a significant difference in patient care and surgical outcomes.

ICU Service Partners
Infectious Disease Practitioners
UPMC Susquehanna’s Williamsport Regional Medical Center

A team of intensive care service partners, infectious disease practitioners, and a professional development specialist analyzed every CLABSI in the ICU. They aimed to reduce CLABSIs. The expectation was set that staff would wear a mask and use a sterile drape whenever accessing a central line (to give medications or draw blood). The professional development specialist conducts competency checks and infectious disease practitioners monitor compliance with infection-control practices.

After achieving 572 days without a CLABSI, these partners continue with the goal of zero CLABSI for patients in the ICU.
Clinicians can obtain data with incredible ease—unlike the days when, as a medical student, my job was to go down to the laboratory in the afternoon to search the handwritten log, listed in order of specimen receipt rather than patient name, and hand copy the test results for each of the patients my team was treating. Over time, our access to data has improved and it is now available—literally—at our fingertips. However, the volume of data to be retrieved, interpreted, and synthesized has grown monumentally and can create data overload that shifts our challenges. Clinicians are confronted by unrelenting streams of data about individual patients, including written or verbal observations and reports, ordinal data, images, point-in-time numeric laboratory values, and continuous waveform data, as well as data about the logistical management of groups of patients (i.e., whiteboards and operating room schedules). During rounds on critically ill patients, clinicians may be confronted with more than 200 variables. In addition to thresholds, clinicians need to understand trends and complex combinations of factors. Electronic health records have increased access to data, but have also increased its volume, such as by adding metadata to many displays. Our ability to acquire data often exceeds our ability to fully understand and integrate it; this information overload can lead to preventable medical errors.

One strategy to manage the abundance of data is to use established best practices for effective data display, because the way information is represented significantly affects problem solving. Short-term memory quickly becomes overloaded and degrades when searching multiple data display screens; improved search time and efficiency may free cognitive resources that can be used for other interpretive or planning tasks. Understanding and applying principles of data visualization can improve our ability to access and interpret data to provide safe patient care.

Whether visual data is presented in electronic or paper format, its abundance can contribute to cluttered data display, and clutter contributes to attentional and performance costs. As clutter increases in visual displays, search time tends to increase while accuracy tends to decrease. Clutter contributes to distraction, uncertainty, and confusion. Clutter degrades object recognition and detection, information interpretation, and detection of unexpected events. Most of the displays Kamaleswaran and McGregor analyzed in their review of visual representations of physiologic data contained more than 20 variables per screen. However, information that is cluttered to one user may be meaningful to another. Clutter is not solely related to the number of items in a display; clutter is also impacted by factors including item density, arrangement, color, display organization, structure, order, conceptual grouping, background noise, and task relevance.

Kamaleswaran and McGregor describe four types of visual display for physiologic data; familiarity with their concepts may help efforts to improve the effectiveness of data display. First, tabular or text displays include tables and may mimic traditional flowsheets that provide data about a series of variables (i.e., temperature, laboratory test results) over time, using text and numbers. Second, graphic displays may use waveforms to display data, such as real-time presentation of cardiac rhythms on vital signs monitors; some present complex data derivations. Third, object-oriented displays manipulate two-dimensional graphical characteristics such as color, size, and shape to produce dynamic representations of changing properties or characteristics that emerge from integrating information from combinations of sources. Distinctive patterns or visible changes—such as a flashing visual signal—may activate pre-attentive processing, so that
the observer is alerted. Recognizing that a change has occurred precedes interpreting the specific information being presented. Finally, metaphoric displays include images related to the organ system associated with the data, such as a series of pipes and baffles representing blood flow into, through, and out of the heart or a dynamic image of lungs with varying volumes of inspiratory and expiratory fullness during different phases of respiration. Graphic and integrated displays have been shown to decrease response time, improve recall, and improve user satisfaction compared with traditional text displays.2

Optimal data display depends in part on the eye of the beholder. Information that is “signal” to one person may be “noise” to another. Data display issues include the following:

- Data display needs and preferences can vary based on the task, the user, and the situation.4
- Information displays that enhance agreement among individuals about current physiologic states may better support continuity of care across personnel and across work shifts.3
- Ideally, data displays integrate goals directly with information needs and also represent these relationships over time.5 Different users may have different goals, related to patient care, process improvement, or other purposes.
- Eventually predictive modeling may be able to represent the patient’s anticipated future state, based on current physiologic and treatment parameters, and compare this to the patient’s goal or desired state.

Following an iterative, human-centered design method1,2 during the development of data visualization can help manage the potential for competing requirements and unintended consequences. Moacdleh and Sarter’s review article, addressing research on clutter primarily from fields outside of healthcare, provides synopses of a variety of measurement approaches and techniques that could be applied to help improve healthcare data display, including performance evaluations (i.e., search time and accuracy), subjective assessments, and eye tracking metrics.6

Nonvisual data presentation formats, such as audible alarms, can also be valuable. In the operating room, pulse oximeters use the rate and tone of audible emittances to provide dynamic information about a patient’s heart rate and oxygen saturation that can be understood without requiring clinicians to divert their visual attention from procedural tasks. However, similar to visual information clutter, excessive or inconsequential audible alarms can be problematic.

The challenge in managing the potential for data overload is to determine the ideal middle ground between excessive data and insufficient information and to arrange the relevant information in a manner that supports clinicians’ cognitive processes.1,2,4

Understanding the relevant established best practices will help us design and implement data display in a manner that contributes to efficient, effective application to patient safety.

NOTES

SAVES, SYSTEM IMPROVEMENTS, AND SAFETY-II

“Saves, System Improvements, and Safety-II” is an occasional feature in the Pennsylvania Patient Safety Advisory, highlighting successes of healthcare workers in keeping patients safe. The Safety-II approach assumes that everyday performance variability provides adaptations needed to respond to varying conditions and that humans are a resource for system flexibility and resilience.

Catching a 10-Fold Overdose

A patient safety officer contacted the Pennsylvania Patient Safety Authority to share a potentially harmful event in which a nurse accidently gave 80 units of regular insulin instead of 8 units for treating hyperkalemia. Fortunately, the seasoned nurse caught the error when she noted that the actual mechanism of pushing the medication felt longer in duration than usual.

The healthcare facility investigated this event and realized that there were many contributing factors, including the following:

- The insulin syringes used by the organization included affixed needles that cannot be used with needleless connectors on intravenous (IV) tubing.
- For treating hyperkalemia, when insulin is given intravenously and not via the more usual subcutaneous route, the organization’s pharmacy department sent a kit to the intensive care unit (ICU) that contained a tuberculin (TB) syringe and vial of regular insulin.
- The use of the TB syringe and the scaling guide on this syringe (e.g., 0.1, 0.2, 0.3 mL) can resemble the markings on the side of the insulin syringe (e.g., 10, 20, 30 units). In fact, the nurse stated that the visual representation contributed to the error.

The organization reviewed the reasons why the patient received the wrong dose of insulin and acknowledged that the nurse was set up to fail and that other staff members could easily be involved in similar events in the future. The results of this investigation resulted in a change in the type of syringe (e.g., insulin syringe with a Luer-tip connector) used to administer IV-insulin.

Although the nurse caught this error while administering the insulin, learning from this event and developing a well-thought-out solution will probably prevent future harm by making the processes associated with the treatment of hyperkalemia safer. Although not related to treating hyperkalemia, the Authority has written about similar issues in which TB syringes were accidentally used in place of insulin syringes.1,2

Notes

NEED HELP GETTING THE WORD OUT?

Join your fellow healthcare providers in funneling patient safety research and resources directly into hands of facility leaders, patient safety committee members, healthcare providers, and other patient safety-minded individuals. Visit the Pennsylvania Patient Safety Authority’s website to:

Access the Pennsylvania Patient Safety Advisory
Quickly search or browse to the topic of choice among the hundreds of articles available for free. If there is a patient safety topic of interest to your peers, use the “e-mail to a friend” option to let them know about it.

Subscribe to the Advisory
Provide your name and e-mail address to receive notification and article summaries about the next Advisory issue. Forward topics of interest to your peers, or suggest they subscribe, too.

Obtain patient safety tools and tips
Sample policies, educational videos, assessment tools, checklists, and patient handouts are available about a growing collection of patient safety topics addressed in the Advisory.

Backed by analysis of real patient safety events and scientific evidence, the Pennsylvania Patient Safety Advisory can help improve healthcare delivery systems and educate providers about safe healthcare practices.

www.patientsafetyauthority.org
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, 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 nearly 50 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.

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.