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USP Patient Safety
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USP Patient Safety CAPSLink™

This message has been sent to you as a service of the U.S. Pharmacopeia, Center for the Advancement of Patient Safety (CAPS). USP is a not-for-profit, non-governmental organization that promotes the public health by establishing state-of-the-art standards to ensure the quality of medicines and other health care technologies. CAPS is a component of USP's Patient Safety public health program. The USP Center for the Advancement of Patient Safety was created to encourage medication error reporting, conduct data analysis and research, develop educational programs, and propose standards, recommendations, and guidelines that ultimately improve the safety and quality of patient care.

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Medication Errors in Radiological Service Areas

The below information represents a small portion of data and information contained in USP's most recent MEDMARX Data Report: **A**

Chartbook of 2000–2004 Findings from Intensive Care Units and Radiological Services.

For complete data findings related to medication errors in these clinical areas see:

<http://www.usp.org/products/medMarx/>

Radiological services encompass a broad array of diagnostic and treatment modalities that are used in patient care and performed by various healthcare practitioners. The number of radiological imaging procedures performed in the United States per year has been estimated at 300 million, of which 20% involve the use of a radiological pharmaceutical.

Radiologic procedures are unique compared to care provided in other patient care areas within hospitals and health systems for several reasons, including the following:

(1) Many patients undergo a radiologic procedure during their inpatient stay and the amount of time a patient spends in a radiological service area is very short compared to the time a patient spends in their primary inpatient care area. Therefore, opportunities for errors can arise from the breakdowns in communication and lack of access to complete patient information during transitions or “handoffs” in patient care.

(2) Care provided during a radiologic exam is very focused on the particular diagnostic or invasive procedure. Drugs not directly associated with the exam (which the patient was receiving pre-exam or which may be continued post-exam) may not garner ample attention as part of the continuum of care.

(3) Requirements for training and certification of radiologic technicians and technologists in different radiological service areas vary depending on state regulations and institutional policies. These supportive staff are often involved in the dispensing and administering of medications.

Despite the significant attention given to medication safety in recent years, little published information exists on the scope and type of medication errors occurring across the array of radiological services.

Medication errors associated with radiological services are captured within the MEDMARX database under three locations: (1) Cardiac Catheterization Laboratory (2) Nuclear Medicine and (3) Radiology Department. During the 5-year period of 2000–2004, there were 2,032 records submitted by 315 facilities involving error events that occurred in

radiological service areas (Table 1).

Table 1. Medication Errors by Radiological Service Area

Radiological Service Area	n	%
Cardiac Catheterization Laboratory ^a	825	40.6
Nuclear Medicine ^b	52	2.6
Radiology Department ^a	1,155	56.8
Total	2,032	100

a. For the 5-year period 2000–2004.

b. Nuclear medicine was added to the location pick list in April 2004 and findings represent only 9 months of data collection.

Severity of Errors

Of the 2,032 medication errors reported for all radiological service areas, 13.2% (n=268) were intercepted (Category B) before reaching the patient. However, 81.1% (n=1,648) of these errors did ultimately reach the patient (Categories C–I) and 12% (n=245) resulted in some level of patient harm (Categories E–I). When error data were stratified by the clinical service area, Cardiac Catheterization Laboratory had the highest percentage (19.8%) of intercepted errors while the Radiology Department had the lowest percentage (8.3%). Consequently, the Radiology Department had the highest percentage (88.3%) of reported errors that reached the patient and the highest percentage of harmful errors (15.1%).

Medication Use Process Node

Review of the error descriptions uncovered a variety of problems for each medication use process node including the following:

◆ Prescribing

- ▶ Drug ordered to which patient is allergic
- ▶ Failure to adjust dose for decreased renal function
- ▶ Incorrect/inappropriate use of standard order sets
- ▶ Over sedation requiring reversal agents

◆ Transcribing/Documenting

- ▶ Failure to record drug allergies, discontinued drugs, drugs retrieved from automated drug dispensing devices, and drugs given during the procedure
- ▶ Incorrect documentation of patient's weight

◆ **Dispensing**

- ▶ Incorrect restocking of automated drug dispensing devices
- ▶ Incorrect preparation of IV infusion
- ▶ Incorrect computer entry of patient weight or drug order
- ▶ Wrong product "dispensed"/given to patient/family member

◆ **Administering**

- ▶ Omission of pre-procedural doses
- ▶ Giving drug(s) to the wrong patient:
 - correct chart but wrong patient transported to radiology
 - similarly named patients
 - failure to identify patient
- ▶ Incorrect programming of IV pump:
 - mcg/kg/hour versus mcg/kg/min or mg/hour versus mL/hour
 - "switching" IV infusion rates for two drugs
- ▶ IV infusion taken off IV pump leading to "free flow"
- ▶ Incompatible drugs infused together
- ▶ Infiltration/extravasation of contrast
- ▶ Failure to label IV bags before patient transfer back to nursing unit

◆ **Monitoring**

- ▶ Lab results (e.g., renal function) not checked prior to initiating therapy
- ▶ Patients left in exam room unattended after receiving sedatives
- ▶ IV infiltrations go undetected during procedure
- ▶ Patients not placed on cardiac monitor post exam

Types of Error

Across all three radiological service areas, the four most frequently reported types of error were *Improper dose/quantity* (28%), *Unauthorized/wrong drug* (17%), *Omission error* (17%), and *Prescribing error* (12%) (Table 2). Collectively, these four represent nearly three-quarters of all type of error selections. Based on frequency alone, these error types should be targeted for risk-reduction strategies. From a high-risk perspective, *Improper dose/quantity*, *Unauthorized/wrong drug*, and *Wrong administration technique* warrant careful attention since these types of error were most often involved with harmful events. *Improper dose/quantity* errors were both high volume and high risk and were often associated with mistakes made in operating or programming the patient's IV pump, failing to properly sedate the patient resulting in oversedation, or failing to adjust the dosage of a drug based on the patient's kidney function.

Table 2. Leading Types of Error

Type of Error	All Radiological Events ^a		Harmful Radiological Events ^b		Harmful Overall MEDMARX ^c
	n	%	n	%	%
Improper dose/quantity	491	28	57	35	2
Unauthorized/wrong drug	301	17	33	20	2
Omission error	291	17	11	7	2
Prescribing error	213	12	15	9	<1
Wrong administration technique	187	11	34	21	6

a. Based on 1,747 records

b. Based on 161 records

c. Based on 823,268 records

Case Example: Improper dose/quantity due to operating an IV pump — A patient was transported to Radiology for a procedure with fluoroscopy. To properly position the patient during the procedure, the radiology nurse removed the IV tubing from the IV infusion pumps. After the procedure was completed, the IV tubing was inadvertently reconnected to the wrong pumps. When the patient was returned to the Patient Care Area, the unit nurse discovered that fentanyl (originally

infusing at 2 mL/hour) was infusing at 125 mL/hour, while the large-volume IV (originally infusing at 125 mL/hour) was now infusing at a rate of 2.5 mL/hour. Approximately 75 mL of fentanyl had infused by the time the error was discovered.

Causes of Error

USP's MEDMARX database contains over 60 different possible causes of error. The three most frequently reported causes of error across all radiological service areas were *Performance deficit* (41.7%), *Procedure/protocol not followed* (25%), and *Communication* (19.4%). These three causes comprised 86% of all reported causes and were also among the causes most associated with harm (Table 3). Although *Performance deficit* was the most frequently reported cause, the majority of time it was selected in combination with other causes such as *Procedure/protocol not followed* and *Communication*.

This is in agreement with patient safety experts and other published research that believe most errors are the result of multiple causes—many of which involve organizational and technical failings and not simply due to the carelessness of the caregivers. Many of the systems used by healthcare staff to provide patient care have not been carefully examined and redesigned to make them safer for the patient. Contributing factors such as distractions, short staffing, and an increase in workload are common and constant problems in the dynamic hospital environment. Healthcare facilities should strive to improve the design of their systems, processes, and technology to minimize the more prevalent causes and contributing factors that lead to errors.

Table 3. Leading Causes of Error

Leading Causes of Error	All Radiological Events ^a		Harmful Radiological Events ^b	
	n	%	n	%
Performance deficit	762	41.7	93	50.3
Procedure/protocol not followed	456	25.0	36	19.5
Communication	354	19.4	30	16.2
Knowledge deficit	242	13.2	21	11.4
Documentation	171	9.4	9	4.9
Monitoring inadequate/lacking	122	6.7	22	11.9

Contraindicated, drug allergy	96	5.3	18	9.7
Calculation error	94	5.1	14	7.6
Dispensing device	92	5.0	7	3.8
Pump, improper use	83	4.5	12	6.5

- a. Based on 1,827 records
b. Based on 185 records

Case Example: Performance deficit, procedure protocol not followed, and communication failures — A diabetic patient on metformin was admitted for dyspnea. A cardiac catheterization and angiogram was scheduled; and, per protocol, the patient’s antidiabetic drug (metformin) was held prior to the procedure. The protocol also requires that this drug be held postprocedure because of the risk of renal complications. However, orders to discontinue the metformin postprocedure were not faxed to the pharmacy, and therefore metformin was not deleted from the medication administration record. Concurrent postprocedural orders that were written stated “renew preprocedure meds.” The patient continued to receive metformin for six doses and developed acute renal failure, requiring hemodialysis. Hospitalization was prolonged for more than 10 days.

Commonly Reported Drug Products

- ◆ Anti-blood clotting agents
- ◆ Sedatives
- ◆ Narcotics
- ◆ Radiographic contrast agents (oral and IV)

Generally, radiological pharmaceuticals (oral and IV) have not been purchased or managed under the purview of the pharmacy department and traditionally have not received the same type of review and oversight as other drugs used within the hospital or health system. FDA classifies radiographic agents as medications and the Joint Commission’s Medication Management Standards have prompted more pharmacies to begin examining how these agents are ordered and administered.

Suggestions for Improving Medication Safety in Radiological Service Areas

1. Include radiology/other clinical diagnostic departments within the facility's medication safety initiatives.
2. Convene a risk-analysis team including radiology to conduct a FMEA on radiological procedures.
3. Assess if boxed warnings (e.g., “Not for Intrathecal Use” or “Not for Myelography”) are adequate or if there are ways to make these warnings more prominent.
4. Examine where radiographic products are stored throughout the facility:
 - a. ease with which they can be accessed
 - b. ordering procedures
 - c. how distributed
5. Review override procedures for automated dispensing devices located in ancillary departments.
6. Create standardized order forms for radiographic procedures:
 - a. review procedures for metformin-containing medications
7. Examine how drug allergy information is obtained and documented...is it readily accessible?
8. Examine policies/procedures for interrupting and resuming IV infusions
9. Work with lab/others to ensure that all appropriate lab test results (e.g., serum creatinine) are available to radiology staff prior to initiating any radiological test
10. Provide routine and on-going staff education for pharmacy, radiology, and nursing
11. Review established guidelines (e.g., American College of Radiology guidelines and standards <http://www.acr.org> manual addresses issues related to contrast media).

The data findings in the most recent MEDMARX Data Report—*A Chartbook of 2000-2004 Findings From Intensive Care Units and Radiological Services* (<http://www.usp.org/products/medMarx/>) indicate that more needs to be done to improve medication use in these life-saving clinical areas. This Report should serve as a stimulus for hospitals and their related health systems, and health care practitioners to conduct their own self-analysis on medication use processes in

radiological service areas and to make improvements to reduce the risk of error.



In the News...

1. JCAHO Issues Sentinel Event Alert on Medication Reconciliation

Last week the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) released the most recent *Sentinel Event Alert* focusing on the quality and safety issues associated with medication reconciliation failures. The Alert urges healthcare organizations to focus efforts toward improving the reconciliation of medications whenever a patient moves from one location to another location within a health care facility (e.g., from a critical care unit to a general medical unit); or from one health care facility to another or to home; and/or when there is a change in the caregivers responsible for the patient. The failure to reconcile medications during these transitions can cause serious patient injuries and even death. Medication reconciliation is one of the Joint Commission's 2006 National Patient Safety Goals. [Click here to read more.](#)

2. Communication 'Omissions' Most Common Cause of Adverse Events

A recent study that analyzed communication failures during a patient's hospitalization identified "omitted content" as the primary communication failure that occurs when patients are transferred from one physician to another. Failing to communicate an active medical problem was the leading problem, but other failures (e.g., not communicating the rationale of a treatment decision made by the primary team) was also seen. The study, published in the *Quality and Safety in Health Care Journal*, interviewed medical interns to determine which communication failures resulted in adverse events or near misses. [Abstract communication failures](#); [Abstract Academic Medicine](#).

3. Infection Control Guidelines for Cardiovascular Catheterization Lab

The Society for Cardiovascular Angiography and Interventions (SCAI) recently published an updated set of guidelines for infection control in cardiovascular catheterization laboratories. SCAI stated there was a need to update the existing guidelines, which were 10-years old, given

the increasing complexity and number of interventional cardiology procedures. The guidelines are published in the January 2006 issue of *Catheterization and Cardiovascular Interventions: Journal of the Society for Cardiovascular Angiography and Interventions*. The new guidelines include information on the circumstances under which patients should receive an antibiotic, protective masks and other garb to be worn by catheterization lab staff, and the acceptable level of air circulation in the catheterization lab. http://www.scai.org/pr.aspx?PAGE_ID=4319

4. FDA Updates

FDA Announces New Drug Label Format to Reduce Medical Errors:

Earlier this month, the FDA announced a major revision to the regulations governing the content and format of labeling for prescription drug information. The intent of the new regulations is to make it easier for practitioners to access, read, and use information in prescription drug labeling, enhance the safe and effective use of prescription drug products, and reduce the number of adverse reactions resulting from medication errors due to misunderstood or incorrectly applied drug information. The newly designed package insert will provide the most up-to-date information in an easy-to-read format that draws physician and patient attention to the most important pieces of drug information before a product is prescribed. The new rule is effective June 30, 2006. <http://www.fda.gov/bbs/topics/news/2005/NEW01272.html>

Brand Names May Not Mean the Same Medication: The FDA recently announced that the brand names of 105 U.S. products represent other products in foreign countries. This is a major problem for consumers who buy medications outside this country. <http://www.fda.gov/oc/opacom/reports/confusingnames.html>

5. Managing Disruptive Practitioners

This month's issue of *Annals of Internal Medicine* contains a review written by Lucian Leape and John Fromson regarding the issues associated with disruptive physician behavior. The authors point out that physician performance failures are not rare and pose substantial threats to patient safety. The article goes on to outline a four stage program for fairly and objectively evaluating physician performance. Stage one: institutions should adopt explicit performance standards of behavior and competence; Stage two: all physicians should be required to read, understand, and follow the standards and know that adherence

will be monitored with consistent failure resulting in the loss of privileges or dismissal; Stage three: annual monitoring would occur by formal evaluations of all members of the staff using validated measures of competence and behavior; and Stage four: results of the evaluations should be provided confidentially to each individual. <http://www.annals.org/cgi/content/full/144/2/107>

6. Patient Safety Viewpoints Expressed

Various perspectives on patient safety are outlined in an editorial in the December 14, 2005, issue of the *Journal of the American Medical Association*. The article discusses both doing the right thing at the right time, but also discusses the importance of preventing doing something wrong at any time. Preventing an error before its effect reaches a patient is what safety is about.

<http://jama.ama-assn.org/cgi/content/extract/294/22/2906?etoc>

7. Quality Gaps in Patient-Safety Decrease

A report released earlier this month noted that the U.S. made more progress toward ending disparities in the safety of health care received by various populations than in closing gaps in other areas of quality.

The Report also noted, however, that the overall decrease in the prescribing of potentially inappropriate drugs to the elderly saw nearly a 5% increase from 2000 to 2002. <http://www.ahrq.gov/qual/nhqr05/nhqr05.pdf>

USP Medication Error Reporting Programs:



MEDMARX[®]—USP's comprehensive, Internet-accessible, anonymous medication errors reporting program, and quality improvement tool. The program facilitates productive and efficient documentation, tracking, trending, and prevention of medication errors.



Medication Errors Reporting (MER) Program—presented in cooperation with the Institute for Safe Medication Practices, this nationwide program makes it possible for health professionals to report medication errors confidentially and anonymously to USP.

Other USP patient safety resources:

- [MEDMARX Annual Data Summary reports](#)—provides readers with a wealth of information on reported error events including patterns in the types, causes, and level of harm associated with medication errors.
- [Understanding and Preventing Medication Errors: A Resource for Healthcare Practitioners](#)—a CD toolkit with practical guidelines, forms, and templates to help healthcare facilities improve error-reduction initiatives.
- [Advancing Patient Safety in U.S. Hospitals: Basic Strategies for Success](#)—a book in which hospitals share stories about how they reduced medication errors and promoted safer patient care.
- Medication Safety Pocket Reference—a pocket-sized reference booklet containing listings of similar drug names and dangerous abbreviations that could cause medication errors. Contact custsvc@usp.org and ask for item #3227702.
- Similar Drug Names Poster—a wall poster for easy reference listing look-alike and sound-alike drug names known to cause confusion and potential medication errors when handwritten or communicated verbally. Posters are packaged in quantities of 1 (item # 3728251) 10 (item # 3728252) and 50 (item # 3728253). Contact custsvc@usp.org and ask for the appropriate item number.

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