Medication Safety:
What errors occur, what are the common causes and how do we begin to prevent them?

Marla Husch, RPh
Director, Infusion Specialties
Center for Safety and Clinical Excellence
Cardinal Health
San Diego, CA

Medication error: defined
- Any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems including: prescribing; order communication; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use. 

Medication Process:
The National Problem
- Medication errors are estimated to account for over 7,000 deaths annually.
- In one study, 2 medication errors leading to patient harm occurred in every 100 admissions.
- An average of 4.6 days were added for each preventable adverse drug event (ADE), at a cost of $5,857.
- Extrapolated cost of preventable ADEs over a year was 2.8 million dollars for a 700-bed teaching institution.

Why do medication errors occur?
- Complex systems
- Multiple hand-offs
- Extreme variability
- Culture
Where do medication errors occur?

- History
- Reconcile
- Order
- Transcribe
- Clarify
- Dispense
- Deliver
- Administer
- Monitor
- Educate
- Discharge

Patient Harm

3%+ of patients
62%+ of identified ADEs
8% of patients
34% of identified ADEs

*SELECT, PROCURE, STORE: No measurement of harm specific to this phase of the medication use process is available in the literature.


No smoking gun:
Most errors stem from multiple nodes in the medication use process

- Handwriting
- Profiling
- Clarification/communication
- Look-alike/sound-alike
- Clarification
- Misuse of protocol
- Dispensing
- Decimal point
- Extra "0"
- Administration
- Incomplete order
- Patient Information System
- Admit
- Discharge
- Between units
- Monitoring (labs)
- Programming
- Misuse of technology
- Telephone order/verbal order
- Medication
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**50% of errors had more than 1 cause and involved more than one discipline

Former pharmacist indicted in lethal chemotherapy case

Wednesday October 03, 2007
Associated Press

– CLEVELAND — A former pharmacist has been indicted on charges of involuntary manslaughter and reckless homicide in the case of a 2-year-old girl who died after receiving an improperly mixed dose of chemotherapy.
– Eric Cropp, 39, of Bay Village, failed to catch a mistake in a saline solution that was administered to Emily Jerry of Mentor along with her chemotherapy treatments. The solution, mixed by a pharmacy technician, contained concentrated sodium chloride, a 23.4 percent solution, instead of a saline solution with 1 percent sodium chloride.
– "He was charged because of the number of opportunities he had to catch the mistakes that he ignored," Cuyahoga County assistant prosecutor Paul Soucie said. "There were a number of blinking red lights that he did not pick up on."
– Cropp was indicted on the third-degree felony charges on Thursday. He faces up to five years in prison if convicted.

http://www.chronicle.com/
Results: Discrepancies

- Medications observed = 426
- Observations with no discrepancy = 145 (34%)
- Observations with 1 or more discrepancies = 281 (66%)

426 Observations → 390 Discrepancies

- 0.92 Discrepancies per observation
- 1.3 discrepancies per patient with an IV pump

Results: Types of Discrepancies

n = 390

- No rate on label 50%
- Incorrect rate on label 4%
- Unauthorized medication 17%
- No ID band 14%
- Incorrect IV medication 4%
- Delay of therapy 1%
- No rate on label 30%

Conclusions

- The actual number of discrepancies associated with IV infusion devices exceeds the number reported through incident reports – 7 more errors were observed in one day than were reported through incident reports in two years
- Discrepancies associated with IV infusion pumps are high-risk, and have the potential to cause harm – 16 (4%) of the discrepancies identified had the potential to cause harm
- Programming discrepancies occur and have the potential to cause harm – 39 (9%) of the 426 observed medications were programming discrepancies and 7 (18%) had the potential to cause harm

Conclusions

- Discrepancies in other phases of the medication use process (prescribing, transcribing, dispensing, and monitoring) may lead to IV administration discrepancies:
  - Medications and IV fluids for which there is no order (prescribing or transcribing) written in medical record
  - Labeling discrepancies (literature suggests that labeling errors may lead to IV administration errors)
  - Patient identification

The Epidemiology of Prescribing Errors: The Potential Impact of Computerized Prescriber Order Entry
Bobb A, Gleason K, Husch M. Archives of Internal Medicine 2004;164:785 -792.

Methods:
- At a 700-bed academic medical center in Chicago, Illinois, clinical staff pharmacists saved all orders containing a prescribing error for a week in early 2002.
- Pharmacist investigators subsequently classified

- drug class, error type, proximal cause, phase of hospitalization, and potential for patient harm, as well as rated the likelihood that CPOE would have prevented the prescribing error.

Results :

1,111 prescribing errors were identified (62.4 errors per 1000 medication orders)

- Missing or inaccurate allergy information
- Improper or omitted dose
- Drug/allergy interaction
- Nomenclature/wrong formulation
- Incorrect treatment duration
- Improper or omitted frequency
- Drug/drug interaction
- Improper medication infusion rate
- Medication duplication
- Unauthorized medication
- Incorrect or unspecified medication
- Unreadable order

1111 errors
Who will save the day?

- We will!
- With a thoughtful multidisciplinary approach….

Guiding principles

- Interventions are:
  - evidence-based,
  - multidisciplinary,
  - focus on avoiding harm to patients

- Principles for a safe process:
  - Making the safest thing to do the easiest thing to do
  - Standardize and simplify
  - “Error proof” through fail-safe systems and forcing functions
  - Reduce reliance on memory
  - Push appropriate information to the point-of-use
  - Apply system redundancies

How to Lower the Risks and Obtain Full Benefits: Lessons from another industry

- Automatic seatbelt
- Visible speed limits
- Always drive on the same side of the road
- Alarm if car put in drive without all doors shut

Human Factors Engineering

- Human factors engineering is the science of designing systems to fit human capabilities and limitations.

Stroop Test

- Call out the color of each object as fast as you can

Analogous to many medical technologies

Typical improvement using human factor engineering

Managing Risk: A Systems Approach

- Reduce the likelihood of error
- Make errors apparent
- Minimize the consequences of error

Focus on Harm

- Sixty-one percent of reported errors/near misses were associated with 8 medications (n=422)

65% of reports were completed by Nursing
High-alert medications

- United States Pharmacopeia (USP):¹
  - Summary of Information 2002 MedMARx report:
    - SIX medications alone were responsible for 30% of the most serious harm ¹
- Review of 317 preventable adverse drug events (ADEs)...
suggested that three high-priority preventable ADEs accounted for 50% of all reports: ²,³
  - Overdoses of anticoagulants or insufficient monitoring were associated with hemorrhagic events,
  - Overdosing of opiates were associated with somnolence and respiratory depression,
  - Inappropriate dosing or insufficient monitoring of insulin was associated with hypoglycemia

Insulin

- Insulin is consistently implicated in patient harm through national reporting systems²

Insulin utilization and hypoglycemia in non-ICU inpatients

**Define/Measure**

Problem: 516 hypoglycemic events occurred on four inpatient units from September 1, 2005 – November 30, 2005.

**Project Goals**

- 10%-20% decrease in hypoglycemic events in the non-ICU adult inpatient units
- 20% increase in the # of patients on the SQ insulin protocol receiving appropriate PO intake documentation
- 20% increase in compliance with hypoglycemic protocol documentation

**Causes of insulin induced hypoglycemic events**

- Lack of structured communication (documentation) between clinicians
- Only 7% of episodes had glucose rechecked within 20 minutes per the hypoglycemic protocol

**Causes of insulin induced hypoglycemic events**

- Low compliance with the hypoglycemic protocol
- Lack of a consistent place to document meal/snack/supplement intake
- Low compliance with the hypoglycemic protocol
- Only 7% of episodes had glucose rechecked within 20 minutes per the hypoglycemic protocol

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Bringing it all together for nurses
“Diabetic Coordination of Care Learning Module”

Diabetic Coordination of Care
A Self-Study Guide for Nurses

The purpose of this education program was to give our nurses the knowledge and tools to protect our patients from errors and harm associated with insulin administration.

Insulin utilization and hypoglycemia in non-ICU inpatients

Outcome Results:
34% decrease in the average of hypoglycemic events post-improvements (p < .0001)

Percent of Point-of-Care glucose levels < or = 60mg/dL by month
(p < 0.0001)

Insulin utilization and hypoglycemia in non-ICU inpatients

Process metrics

All areas show continued improvement

Technology helps but is not a panacea

Seconds to overriding an alert
n=21,394

Standardizing Nomenclature

• Incidents of confusion as well as serious medication errors have been reported where undiluted epinephrine 1:1,000 (1 mg/mL) was given intravenously to patients instead of the 1:10,000 (0.1 mg/mL) concentration. Some incidents resulted in fatalities.

• Studies show that these expressions are error-prone. Knowledge about concentrations expressed as a ratio or percentage is inadequate, even among physicians and emergency medicine residents.


PO intake
assessment
Hypoglycemic
assessment
20 Min glucose re-check
Alert fatigue and CPOE

- Alert fatigue as it pertains to Computerized Physician Order Entry (CPOE)
  - Heish et al found 80% of allergy alerts were overridden in 1150 patients\(^1\)
  - At VA Puget Sound, Payne et al reports 69% of critical drug interactions were overridden and 88% of “allergy-drug” interaction alerts are overridden\(^2\)
  - At Beth Israel Deaconess Medical Center, Weingart et al, reports that physicians override “allergy-drug” alerts at a rate of 91.2% and “high-severity” drug-drug interactions at a rate of 51.2% and “high-severity” drug-drug interactions at a rate of 51.2%\(^3\)


Medication Process: Interventions

**Systems Perspective: Summary**

<table>
<thead>
<tr>
<th>Select, Prescriber</th>
<th>History, Reconcile</th>
<th>Order, Transcribe</th>
<th>Clarify, Deliver</th>
<th>Monitor, Administer</th>
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- Culture, data analysis, infrastructure
- Single medication list & robust process, patient role
- CPOE Lists and Alerts
  - Look & sound alike
  - Limit risk by limiting options, locations
- Positive patient & medication reconciliation, i.e., smart pumps, look alike, sound alike, patient role, patient feedback

**Recommendations for a safer medication use system**

- Take steps in a process away; try not to add them
- Consider human factors and general patient safety principles
- Attack them in a multidisciplinary fashion

“Laughter is the best medicine. Take your prescription to a funny looking pharmacist.”
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Objectives:

- Define a medication error and reasons why they occur
- Describe the components that make up the medication use process and where in the process medication errors occur
- Describe patient safety principles and human factors engineering in relation to medication errors
- Describe how patient safety principles and human factors engineering can be utilized to prevent medication errors

Questions: (Answers highlighted)

1. All of the following are always steps in the medication use process EXCEPT:
   - Dispense
   - Prescribe
   - **Read back and verify**
   - Monitor

2. Which of the following is a patient safety guiding principle?
   - Standardize and simplify
   - Clinical decision support
   - Training
   - Monitoring

3. A medication error is only considered an error if it reaches the patient and causes harm
   - True
   - **False**

4. Medication errors only occur at the administration phase of the medication use process
   - True
   - **False**