


Striving for Zero: Medication Error Prevention Strategies

Haesuk Heagney, PharmD
Medicine/Surgery & Medication Safety Pharmacist
Email: heagney.haesuk@mayo.edu

Mayo Clinic in Florida
4500 San Pablo Road
Jacksonville, FL 32224-1865
mayoclinic.org

Medication Error


- "To Err is Human – Building a Better Health System" (1999)
- "Preventing Medication Errors" (2006)
 - At least 1.5 million preventable adverse drug events (ADEs) each year
 - 380,000 **preventable** ADEs occur per year in hospitals
 - 530,000 **preventable** ADEs in outpatient Medicare patients
 - 800,000 **preventable** ADEs in long-term care facilities
 - About one medication error per patient per day
 - Each preventable ADE added about \$8,750 to hospital stay



1) Rohn LT, Corrigan JM, Donaldson ME, et al. National Academy Press. 1999.
2) Institute of Medicine. National Academies Press. 2006.


Disclosure

I do not have a vested interest in or affiliation with any corporate organization offering financial support or grant monies for this continuing education activity, or any affiliation with an organization whose philosophy could potentially bias my presentation.




Medication Error

- Department of Health and Human Services (2010)
 - Bad hospital care contributed to 180,000 deaths in Medicare alone
 - Third-leading cause of death
- Journal of Patient Safety (2013)
 - Between 210,000 and 400,000 **deaths** per year due to medical errors
- Department of Health and Human Services (2014)
 - Roughly a third of patients discharged from hospitals to skilled nursing facilities were harmed by their treatment
 - 60% of nursing home residents are harmed by their treatment
 - \$2.8 billion a year in hospitalization cost



1) Altes H. NPRS. 2013.
2) James JT. 2013; 31(12): 122-128.
3) Jaffe L. NPRS. 2014.



Striving for Zero: Medication Error Prevention Strategies


Part I

List common factors that contribute to medication errors.
Discuss strengths and limitations of voluntary reporting system.
Describe the processes of root cause analysis and failure mode and effects analysis.

Medication Error

"Any **preventable** event that may cause or lead to **inappropriate medication use or patient harm** while the medication is in 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."

- National Coordinating Council for Medication Error Reporting and Prevention - (NCCMERP)



Where do they Occur Most Frequently?

Errors	Prescribing	Transcribing	Dispensing	Administering
Errors	?	?	?	?

The Cheese

*Use of Abbreviations
Sound-alike Look-alike
High-Alert Medications
Drug Name Suffixes
Medication Devices*

Examples of Medication Errors

- Wrong Drug
- Wrong Drug for Allergy
- Wrong Drug for Clinical Condition
- Wrong Dosage Form
- Wrong Strength
- Wrong Time
- Wrong Rate
- Wrong Patient
- Wrong Route
- Duplicate
- Omission
- Comission

Contributing Factors

- **Use of Abbreviations**
 - Sound-alike Look-alike
 - High-Alert Medications
 - Drug Name Suffixes
 - Medication Devices
- "Neo" in surgical areas
 - Neo-Synephrine (phenylephrine)?
 - neostigmine?
- "Levo"
 - Levophed (norepinephrine)?
 - levofloxacin (Levaquin)?
 - Levodopa?
 - levothyroxine?
- "Nitro"
 - nitroglycerine?
 - nitroprusside??
- NoAC = New Oral Anticoagulant??

2) Medication Safety: Strategies for #Prescription Medication Errors | Pharmacist Letter 2013.130310

Medication Use Process

1) Picture obtained on 8/29/14 from: <http://www.cdrregisternews.com/newsapp/May%202010%20Low%20Columns.cfm>

2) Pictures obtained on 8/29/14 from: <http://www.assnbar.com/article/cardiac-rehabilitation-week-an-important-observance-and> and <http://www.gpiif.com/gpiif-dms-information/articles/gpiif-in-medication/> and <http://www.seefeldinstitute.com/patient-safety-what/>

Contributing Factors

- Use of Abbreviations
- **Sound-alike Look-alike**
- High-Alert Medications
- Drug Name Suffixes
- Medication Devices

2) Look-alike, sound-alike medications. Pharmacist's Letter/Prescriber's Letter 2008;2(2):240202.
3) ISMMP. ISMMP's List of Confused Drug Names, 2014.


Contributing Factors

- Use of Abbreviations
- Sound-alike Look-alike
- **High-Alert Medications**
- Drug Name Suffixes
- Medication Devices

Medications with a heightened risk of causing significant harm to the patient when used in error

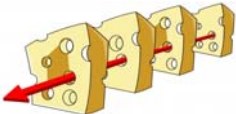

*Limited access
Transcription procedures
Standardized strengths
Auxiliary labeling
Electronic prescribing
Availability of reversal agents
Independent double checks
Product segregation
Standardized storage and preparation
Monitoring services
Dosage limitations*

1) [ISMP List of High-Alert Medications in Acute Care Settings](#), ISMP, 2014.



Why do Medication Errors Occur?

- Weak points or flaws in the Medication Use System
 - Lack of or Inadequate Policy and Procedure
 - Poor Drug Distribution Practice
 - Hardware and Software Issues
 - Inadequate Training Process
 - Insufficient Staff/Scheduling Issue
 - Improper Work Environment
 - Failed Communication
 - Alert Fatigue
 - Knowledge deficit

1) [Academy of Managed Care Pharmacy, Medication Errors](#), 2010.
2) [Pezemski C, et al. *Abstracts Int J Pharm Pract*. 2012; 21 \(6\): 413-6.](#)


Contributing Factors

- Use of Abbreviations
- Sound-alike Look-alike
- High-Alert Medications
- **Drug Name Suffixes**
- Medication Devices


CD? SR? XL? XR? IR? ER?

Introduction of a new dosage formulation

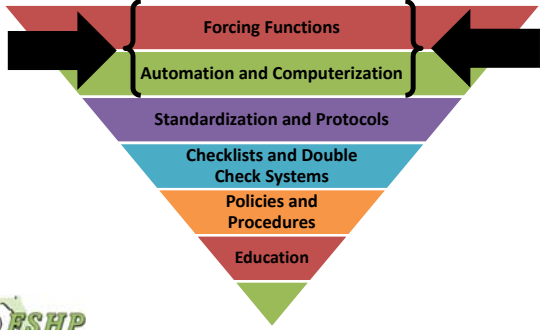

Incorrect dosing interval
Incorrect dosing frequency
Omission of a suffix
Incorrect spelling of the suffix



1) [Promoting the Safe Use of Suffixes in Prescription Drug Names](#), NSC/MEEP, 2014.



Rank Order of Error Reduction Strategies

Contributing Factors

- Use of Abbreviations
- Sound-alike Look-alike
- High-Alert Medications
- Drug Name Suffixes
- **Medication Devices**





1) [Medication errors due to medication delivery devices](#), Pharmacist's Letter/Prescriber's Letter, 2007-2013/2013



Examples of Technology

- Bar Code Medication Administration Technology (BCMA)
- Computerized Physician Order Entry (CPOE)
- Clinical Decision Support
- Automated Dispensing Cabinets
- Smart Pump Technology
- Drug Carousel Dispensing System/Robots
- Electronic Medical Record/E-Prescribing



1) [ASHP Statement: An Health-Syst Pharm](#), 2009; 46: 388-90.
2) [Fedorova CA, et al. *An J Health-Syst Pharm*](#), 2014; 71:924-42.
3) [Somaratne NR, et al. *International Journal of Medical Informatics*](#), 2012; 81: 829-832.
4) Pictures obtained from: <http://www.williams.org/news/story/9553> and http://www.mprx.com/pharmacy_services/administrator.aspx. And <http://webm.duke.edu/perspectives.aspx?perspectiveID=66>.

Use of Technology

	Prescribing	Transcribing	Dispensing	Administering
Errors	39%	12%	11%	38%
Errors Intercepted	48%	33%	33%	2%
Sources of Harm	28%	11%	10%	51%

Strategies for Improvement	CPOE	Electronic pharmacy order entry systems eMAR	ADCs Barcoding Robots	BCMA Integrated infusion management
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1) Prevost RR. Hosp Pharm. 2013; 48 (suppl 3): S5-58

Benefits of Technology

- Reduce pharmacy dispensing errors
- Reduce administration errors
- Integrate patient's medication administration record with the medication administration process
- Confirm the five rights of medication administration
- Facilitate communication among healthcare providers
- Eliminate or significantly reducing the need for handwritten orders
- Eliminate illegible and poorly handwritten prescriptions
- Ensuring proper terminology and abbreviations
- Prevent ambiguous orders and omitted information

1) Koppell K, et al. J Am Med Inform Assoc. 2008; 15: 408-423.
2) Academy of Managed Care Pharmacy. 2010.
3) Burdison T. NPPE. 2012.

Use of Technology

- State Initiatives to Avoid Prescription Drug Errors
 - Mandated electronic prescribing for Medicare patients
 - States responses:
 - Addressed improved legibility, clearer or "common sense" labeling of bottles, regulating telepharmacy and electronic records
 - Drug prescriptions "must be legibly printed or typed" to assure they can be understood by pharmacists (effective 7/1/2003)
- E-Prescribing initiatives
 - New Medicare rule that offers payment bonus to physicians who use e-prescribing (started in 2003)

1) National Conference of State Legislatures. 2009

Use of Technology

- Implementation of CPOE
 - Error rate reduction by 60%
- Implementation of E-Prescribing
 - Transcription error rate reduction by 50%
- Implementation of BCMA
 - Reduction in error potential from 3.1% to 1.6%
 - Error reduction ranging from 27.3% to 87%

1) Cochran GJ, et al. BMJ Qual Saf. 2014; 23: 223-230.
2) Academy of Managed Care Pharmacy. Medication Errors. 2010.
3) Burdison T. NPPE. 2012.
4) ASHP Statement. Am J Health-Syst Pharm. 2009; 66: 588-90.
5) Pedersen CA, et al. Am J Health-Syst Pharm. 2014; 71: 1054-62.
6) Patient information on BCMA from www.ama-assn.org

Technology Implementation

Table 11. Hospitals' Use of Technologies for Medication Safety*

No. Staffed Beds	No. and % Using EHR System							
	Any EHR (Complete or Part/Full)	Complete EHR (No Paper Charts)	Partial EHR (Some Components on Paper)	No EHR (All Paper)	No. PHI Using Inpatient CPOE System With CDSS	No. (%) Using BCMA	No. (%) Using Smart/Infusion Pumps	
All	815	282	468	85	71,027/75	71,062/51	21,126/20	
US-30	815	282	468	85	71,027/75	71,062/51	21,126/20	
US-100	358	127	213	22	32,525/32	33,176/23	10,000/20	
200-300	346	115	188	43	34,848/31	34,778/30	10,402/20	
300-399	33	10	19	4	3,249/31	3,173/31	1,170/20	
400-1000	48	15	27	6	48,754/40	48,779/39	14,527/11	
1000+	88	31	53	4	88,242/40	88,277/39	24,187/11	
All hospitals—2013	413	142	245	26	41,126/39	41,189/39	12,146/10	
All hospitals—2012	403	138	233	32	40,124/37	40,161/36	11,977/10	
All hospitals—2011	358	127	213	18	34,754/31	34,754/31	10,167/10	
All hospitals—2010	333	116	193	24	34,143/31	34,143/31	10,053/10	
All hospitals—2009	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2008	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2007	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2006	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2005	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2004	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2003	333	116	193	24	33,711/30	33,711/30	10,054/10	
All hospitals—2002	333	116	193	24	33,711/30	33,711/30	10,054/10	


*Data are presented as number of hospitals, number of hospitals using technology, and percentage of hospitals using technology. Percentages are based on the total number of hospitals in the study. Percentages are based on the total number of hospitals in the study. Percentages are based on the total number of hospitals in the study. Percentages are based on the total number of hospitals in the study.


Medication Errors and Technology

1) Samarasekera NR, et al. International Journal of Medical Informatics. 2012; 81: 620-613

Technology: Not All Positive...

- System Issue
 - Dropdown menu does not provide appropriate option
 - Prescriber is forced to select
 - Additional information does not match what is selected
- User Issue
 - Poor interface between user and computer (69.4%)
 - Improper procedures or rule violations (22.5%)
 - Creation of "workarounds"






1) ASHP Statement. *Am J Health-Syst Pharm.* 2009; 66: 588-96.
 2) Polsteren CA, et al. *Am J Health-Syst Pharm.* 2014; 71: 924-42.
 3) Samaranyake NR, et al. *International Journal of Medical Informatics.* 2012; 83: 829-833.
 4) Picture obtained from: <http://photos.state.gov/libraries/missouri/2112/05271/forcing-change-to-the-medical-industry/>

Alert Fatigue

- Clinical Decision Support System
 - Notification of potentially dangerous information
 - Benefits: better decisions, improved outcomes
 - Alert fatigue
 - Inapplicable, excessive, unnecessary alerts/information
 - Clinicians override or ignore notifications (49 - 96 %)
 - Drug-Drug Interaction with Discontinued medications
 - Drug Class Alerts
 - Serotonin Syndrome
 - QTc Prolongation
 - Duplicate Orders




1) Avoiding Alert Fatigue. *Gold Standard.* 2014.
 2) Avoid this Warning! Don't Miss Important Computer Alerts. *ISMP.* 2007.

What are Workarounds?

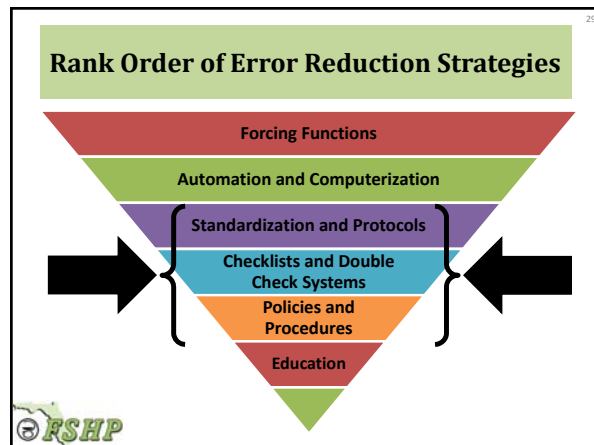
"Intentionally using computing in ways for which it was not designed or avoiding its use and relying on an alternative means of accomplishing work. Workarounds are typically ad hoc strategies to solve immediate and pressing problems."

In Pharmacy,

Any workflow action that is not included as part of the official pharmacy prescription preparation process workflow.




1) Wilkinson TW. Ashburn University. 2014.



Workarounds

- Nursing Workarounds
 - Over a 6-hour period, average of 3.8 workarounds per administration
 - Scanning the medication outside of the patients' room
 - Scanning the patient barcode not attached to the patient (90.1%)
 - Confirming the administration before administration occurred (82.6%)
 - Scanning medications for more than 1 patient at a time (46.3%)
- Pharmacy Workarounds
 - Duplicate orders
 - Lack of medication order verification
 - Medications within the incorrect section of the eMAR
 - Incorrectly timed medications causing administration too late/early
 - User disables audio alarms on device




1) Miller DJ, et al. *Ann Pharmacother.* 2011; 45: 142-8.
 2) Koppel R, et al. *J Am Med Inform Assoc.* 2008; 15: 408-423.
 3) Just Culture and its critical link to patient safety. *Part 01.* *ISMP.* 2014.

Why do Medication Errors Occur?

- Failure to Comply with Policies and Procedures
 - Lack of understanding OR misunderstanding
 - Staff actions that do not follow explicit or implicit rules, assumptions, workflow regulations, or intentions of system designers

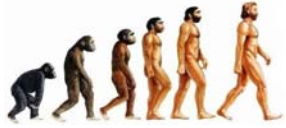





1) Academy of Managed Care Pharmacy. *Medication Errors.* 2010.
 2) Penzance G, et al. *Abstracts Int J Pharm Pract.* 2012; 22 (6): 412-6.
 3) Koppel R, et al. *J Am Med Inform Assoc.* 2008; 15: 408-423.
 4) Picture obtained on 4/29/14 from: <http://www.cartoonists.com/cartoon-while-driving-car-over/>

Why do Medication Errors Occur?

- **Individual Factors**
 - Forgetfulness
 - Stress
 - Tiredness
 - Distractions
 - Routinized Practice (Mindlessness)





1) Academy of Managed Care Pharmacy. Medication Errors 2010.

2) Pozanski G, et al. Abstract Int J Pharm Pract. 2012; 21 (6): 413-6.


3) Koppel R, et al. Ann Nl Med Inform Assoc 2009; 15: 408-425.


Independent Double-Check

"It must be correct since it was already checked by a pharmacist."

"Gee! I am so busy; I'm going to just sign this since it will be double-checked by somebody else anyways."

"She is a really good technician; I can always rely on her. I don't have to double-check her math."






1) Picture obtained on 10/5/14 from: <http://www.keepcalm-o-matic.co.uk/?y=keep-calm-and-double-check-6/>

Why do Medication Errors Occur?

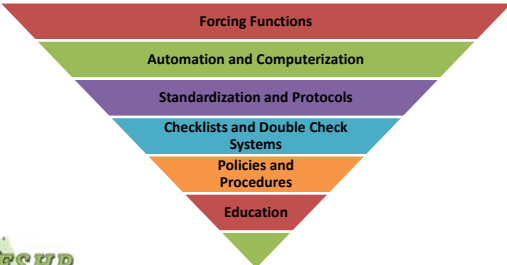
- **"Inattentional Blindness"**
 - An action carried out differs from what was intended
 - Portion of the pharmacists' attention is diverted and the mind unconsciously, and sometimes incorrectly, "fills in the gaps"
 - Conspicuity (Sensory and Cognitive)
 - Mental Workload and Task Interference
 - Attention is diverted to secondary tasks
 - Low workload reduces mental attention
 - Expectation
 - Capacity




1) Inattentional Blindness: What Captures Your Attention? ISMP 2014

"To Err is Human"

- Understanding that medication errors occur because...
 - Weak points or flaws in the Medication Use System






Independent Double-Check

- Detect potentially harmful errors before reaching patients


Study	Description	Error Rate (E/P) Error Occasions Per 1,000 Prescriptions	Consequence
Reicin H, et al. ¹ 1992	Compared use of 1 versus 2 nurses to administer intravenous medication. 100% error rate observed with 1 nurse and 0% with 2 nurses.	E/P 1.000 1 error/1,000	Use of 2 nurses led to a statistically significant 20% reduction in errors resulting in patients.
Chappell SM, et al. ² 1998	Use of pharmacist reviewed charts to correct medication orders and prevent double checks.	E/P 0.50% 500 errors/100,000	An independent double check decreased 80% of errors, leading to a reduction in error rate from 0.5% to 0.15%.
Horn L, et al. ³ 2005	Compared independent nurse rate with and without double check.	E/P per year: With double 0.8 Without double 0	Double check led to a 30% reduction of dispensing errors.
Goodrich T, et al. ⁴ 2001	Individual versus pharmacist found when they independently identified contraindications. Error rate 4.2%.	E/P 4.2% 4200 errors/100,000	Use of double check identified 4.2% of errors otherwise not identified. 97% of contraindications were correctly identified.
Goodrich T, et al. ⁵ 2001	Individual versus pharmacist. Individual error rate 10.0% and pharmacist error rate 0.5%.	E/P 10.0% 1000 errors/100,000	The ability to detect and correct 90% of errors was not affected by workload or time on shift.
Jensen LR, et al. ⁶ 2004	Dispensed drug errors. Individual charting error rate 10.0% and pharmacist error rate 0.5%.	E/P 10.0% 1000 errors/100,000	Double check was the single most effective measure in the study.
Goodman LL ⁷ 2000	Usability testing to compare use of three charting and double check methods. Individual error rate 10.0% and pharmacist error rate 0.5%.	E/P 10.0% 1000 errors/100,000	Use of either How about or read-back led to detection of 80% of medication errors, and pharmacist error rate was 0.5%.
Wolfe RE, et al. ⁸ 2010	Investigation to test ability of pharmacist to identify potential errors using error simulation. Error rate 10.0% and pharmacist error rate 0.5%.	E/P 10.0% 1000 errors/100,000	Use of checklist with pharmacist error rate 0.5% and pharmacist error rate 0.5%.




1) Independent Double Checks: Underused and Misused. ISMP Medication Safety Alert 2012

Monitor, Analyze, Improve

- Periodically review policies and procedures
- Conduct ongoing systematic quality evaluation
- Formulary Control
- Medication Use Evaluations
- Establish educational programs
- Select adequate personnel
- Offer suitable work environment





1) ASHP Guidelines. Am J Hosp Pharm. 1993; 50: 305-14.

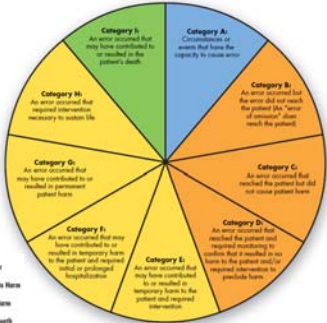
2) ASHP Statement. Am J Health-Syst Pharm. 2009; 66: 508-9.

3) Pedersen CA, et al. Am J Health-Syst Pharm. 2014; 71: 924-42.

4) Ross AJ, Zillich JL, et al. 2012; 61: 232-242.

Categorization of Medication Errors

- Harm:** Impairment of the physical, emotional, or psychological function or structure of the body and/or pain resulting therefrom
- Monitoring:** To observe or record relevant physiological or psychological signs
- Intervention:** May include change in therapy or active medical/surgical treatment
- Intervention Necessary to Sustain Life:** Cardiovascular and respiratory support



Legend:
 No Error
 Error, No Harm
 Error, Harm
 Error, Death


Mandatory Reporting in Florida

- Facilities have three business days to report adverse incidents to their own internal risk management programs. Certain adverse events must then be reported to the Department of Health within fifteen days.
- Each licensed facility must submit an annual report summarizing its adverse incident reports for the prior year. This annual report is confidential and is not available to the public. However, on at least a quarterly basis, the Agency for Health Care Administration must publish "a summary and trend analysis of adverse incident reports . . ."

Mandatory vs. Voluntary

- 1999 landmark IOM To Err is Human**
- Mandatory Reporting**
 - Accountability**
 - State departments of health and the licensing boards
 - May generate useful data
 - May lead to underreporting to avoid penalties, punitive actions, and legal and public scrutiny
- Voluntary Reporting**
 - Learning**
 - From frontline practitioners
 - Information can be used promptly to create improvements
 - Confidentiality and trust
 - Perceived to be credible
 - Limited participation
 - Dependent on recognition

Root Cause Analysis (RCA)



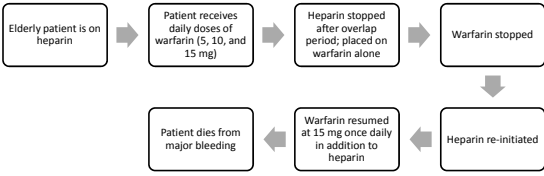
- Used to identify the critical underlying reasons for the occurrence of an adverse event or near-miss
 - Undertaken after a medication error has already occurred
 - Focus on systems and processes to determine why an event occurred
 - Consider both common causes and special causes for the error

Mandatory Reporting in Florida

- "Licensed health care facilities are required to establish internal risk management programs that include an investigation of the frequency and causes of specific types of adverse incidents."
- "Certain adverse incidents must then be reported to the Agency for Health Care Administration and the Department of Health."
- "Adverse incident is an event over which health care personnel could exercise control and which is associated in whole or in part with medical intervention, rather than the condition for which such intervention occurred."



Root Cause Analysis (RCA)

- A patient was about to receive a wrong dose of heparin.




Root Cause Analysis (RCA)

- Questions for Assessing System-Level Vulnerabilities
 - Communication
 - Training
 - Fatigue/Scheduling
 - Environment/Equipment
 - Rules/Policies/Procedures
 - Barriers





1) Cohen MR. Medication Errors. 2nd ed. Washington, D.C.: American Pharmacists Association, 2007.

RCA and FMEA

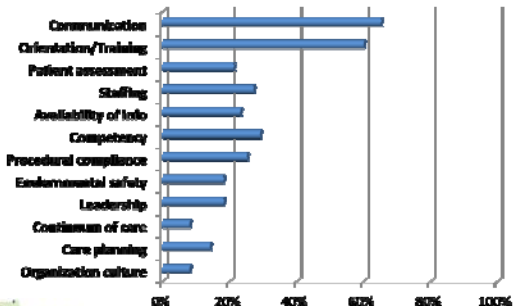


Earlier this month we learned of a fatal heparin overdose for this very reason. A nurse and medical resident planned to administer an IV bolus dose of 3,000 units of heparin to a patient. Both mistakenly thought each 10 mL vial of heparin held a total of 1,000 units when, in fact, each vial contained 10,000 units (1,000 units/mL). Instead of 3,000 units, they gave the patient 30,000 units (3 vials). The patient died after developing an intracranial hemorrhage and brain stem herniation.




1) Important Change With Heparin Labels, National Alert Network, 2013.

Root Cause Analysis (RCA)




Category	Percentage
Communication	~65%
Orientation/Training	~60%
Patient assessment	~25%
Staffing	~25%
Availability of info	~25%
Competency	~25%
Procedural compliance	~25%
Environmental safety	~25%
Leadership	~25%
Continuum of care	~25%
Care planning	~25%
Organization culture	~25%




1) Cohen MR. Medication Errors. 2nd ed. Washington, D.C.: American Pharmacists Association, 2007.

RCA and FMEA




- Heparin Label Change
 - FDA announcement made on 12/6/2012
 - Effective 5/1/2013
- Assemble an interdisciplinary team.
- Describe and document the current process
- Determine potential areas where errors may occur
- Decide how likely they are to occur and to cause patient harm
- Prioritize and take action to eliminate or reduce unacceptable errors
- Make sure the actions have been successful



1) Cohen MR. Medication Errors. 2nd ed. Washington, D.C.: American Pharmacists Association, 2007.
2) FDA Drug Safety Communication, 2013.


Failure Mode and Effects Analysis (FMEA)

- Used to *prevent* process or product problems before they occur
 - Ways in which products or processes can fail
 - Why they might fail
 - How they can be made safer
- Steps
 - Assemble a multidisciplinary team
 - Define the specific focus of the FMEA topic
 - Process Flow Diagram (Describe the process, identify all sub-processes, etc.)
 - Hazard Analysis (Determine severity, possibility, and probability of detection of failure modes)
 - Actions (Determine which causes can be eliminated, controlled, or accepted)
 - Follow-Up




1) Cohen MR. Medication Errors. 2nd ed. Washington, D.C.: American Pharmacists Association, 2007.
2) Larson CM and Saine D. Medication Safety Officer's Handbook. Maryland: American Society of Health-System Pharmacists, 2013.

RCA and FMEA



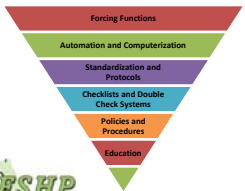

- What are the risks?
 - Over-dose
 - Under-dose
- What can be done to *minimize risk*?
 - Full transition to the newly labeled heparin
 - Complete segregation of old and new heparin vials
 - Computer databases express drug amounts the same way as the vial label
 - (i.e. 10,000 units/10 mL [1000 units/mL])
 - Warning display on automated dispensing cabinet screen upon removal of heparin vial
 - Use of auxiliary labels
 - Restrict availability
 - Review of High-Alert Medication policy/procedure



1) FDA Drug Safety Communication, 2013.

Part I in Summary

- There can be **many causes** leading to a medication error.
 - Use of Abbreviations
 - Sound-alike Look-alike
 - High-Alert Medications
 - Drug Name Suffixes
 - Medication Devices
- Recognize and understand potential contributing factors.
 - System Failures
 - Human Errors
- Increase Reporting.
 - Patient Harm
 - Near-Misses
- Act on What is Reported.
 - RCA
 - FMEA

Striving for Zero: Medication Error Prevention Strategies

Part II

Identify strategies to prevent medication errors and enhance patient safety.
Analyze examples of medication errors.

References

- A National Survey of Medical Error Reporting Laws. *Yale Journal of Health Policy, Law, and Ethics*. 2008. Accessed on 10/4/14 from: <http://www.yale.edu/ijph/issue/v14/i4/i4090/doi/ijph14090.pdf>
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Analysis of Pharmacist Closed Claims



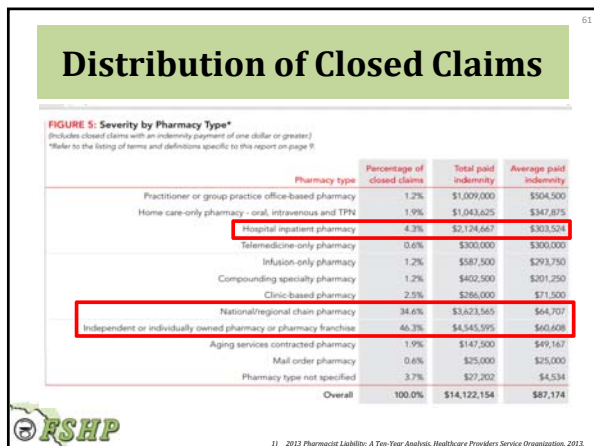
- A 10-year report
- Pharmacists and technicians
- Liability patterns and trends
- 1409 reports
- Medication-related incidents
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Distribution of Closed Claims

Paid indemnity	Percentage of closed claims
\$1 to \$9,999	43.9%
\$10,000 to \$49,999	32.7%
\$50,000 to \$99,999	8.0%
\$100,000 to \$249,999	6.2%
\$250,000 to \$499,999	3.7%
\$500,000 to \$749,999	1.2%
\$750,000 to \$999,999	1.2%
\$1,000,000	3.1%



Severity of Wrong Dose Closed Claims

Drug	Dose Prescribed	Dose Dispensed	Total Paid Indemnity	Resulting Injury or Adverse Effect
Phenergan	12.5 mg	25 mg	\$500,000	Simultaneous overdoses of both drugs, causing permanent brain damage
fentanyl	12.5 mcg	75 mcg	\$500,000	
fentanyl	50 mcg	100 mcg	\$975,000	
Coumadin	2 mg	10 mg	\$500,000	Exacerbation of unstable INR, increased bleeding risk and endocarditis, requiring prolonged hospitalization
Tacrolimus	N/A	N/A	\$362,500	Rejection of prior transplanted liver, requiring a second liver transplant
Amitriptyline	10 mg	100 mg	\$187,500	Sedation, confusion and fall, resulting in facial fracture, subdural bleeding, and death

RSHP 1 | 2013 Pharmacist Liability: A Ten-Year Analysis, Healthcare Providers Service Organization, 2013

Severity by Allegation Category

Primary allegation	Percentage of closed claims	Total paid indemnity	Average paid indemnity
Infection control error - contamination of drug/container/equipment	0.6%	\$1,000,000	\$1,000,000
Compounding calculation and/or preparation error	3.7%	\$2,240,500	\$373,417
Failure to counsel patient	1.2%	\$524,500	\$262,250
Wrong form/route	2.5%	\$617,621	\$154,405
Failure to identify drug allergy	1.9%	\$372,500	\$124,167
Failure to identify overdosing	3.1%	\$567,399	\$113,480
Wrong strength	0.6%	\$79,167	\$79,167
Wrong dose	31.5%	\$3,791,807	\$74,349
Inappropriate/improper substitution	1.9%	\$216,250	\$72,083
Failure to consult with prescribing practitioner for any question/concern	4.9%	\$519,241	\$64,905
Wrong drug	43.8%	\$4,129,636	\$58,167
Failure to identify drug interactions	0.6%	\$30,833	\$30,833
Failure to provide child-resistant cap	0.6%	\$15,000	\$15,000
Prescription given to wrong patient	3.1%	\$17,500	\$3,500

RSHP 1 | 2013 Pharmacist Liability: A Ten-Year Analysis, Healthcare Providers Service Organization, 2013

Case Study 1

Patient AB is a 23-year-old woman who is 23 weeks pregnant and has been experiencing slight vaginal bleeding. She is admitted for observation and bed rest.

Her physician prescribes a progesterone suppository in an effort to prevent premature labor and delivery.

Upon receiving the medication, patient goes into active labor and prematurely delivers a 23-week gestation male infant.

The baby is born severely impaired, requiring intubation and ventilator support.

RSHP 1 | 2013 Pharmacist Liability: A Ten-Year Analysis, Healthcare Providers Service Organization, 2013


Severity of Wrong Drug Closed Claims

Drug Prescribed	Drug Dispensed	Total Paid Indemnity	Resulting Injury or Adverse Effect
Progesterone	Prostaglandin	\$1,000,000	Premature labor and delivery of a 23-week infant who was both premature and severely neurologically impaired
6-mercaptopurine	Propylthiouracil	\$900,000	(Child) Leukemia relapse and death
Diamox	Diabinese	\$275,000	A rare series of adverse effects that were difficult to diagnose, resulting in permanent, significant vision loss
Primidone	Prednisone	\$450,000	Permanent brain damage
Tegretol	Theophylline	\$200,000	Grand mal seizures, requiring hospital treatment followed by extensive home care
Isosorbide	Glipizide	\$185,000	Hypoglycemic crisis, resulting in brain damage and ultimately in death


RSHP 1 | 2013 Pharmacist Liability: A Ten-Year Analysis, Healthcare Providers Service Organization, 2013

- ### Case Study 1
- What happened in the pharmacy...
 - Pharmacist was feeling ill
 - It was a busy day
 - Pharmacist was unfamiliar with progesterone
 - Pharmacy had not carried progesterone suppository for many years
 - When pharmacist entered what was thought to be the correct mnemonic for progesterone, Prostin appeared
 - Pharmacist believed the two drugs were the same
- Distraction
 - Stress
 - Tiredness
 - Staffing issue
 - Inadequate support from management
 - Knowledge deficit
 - Unavailability of electronic medical record
 - Inadequate inventory management
 - Failure to comply with policy/procedure
 - Workaround
 - Lack of technology
- RSHP** 1 | 2013 Pharmacist Liability: A Ten-Year Analysis, Healthcare Providers Service Organization, 2013

Case Study 1




- Full Implementation of Technology
 - Use of Computerized Physician Order Entry (CPOE)
 - Complete integration of Electronic Medical Record (EMR)
 - Ensure that pharmacy staff is equipped with comprehensive drug information resources
- Comply with Institutional Policy and Procedures
 - Do not dispense any unfamiliar drug without performing adequate research regarding its uses, contraindications, and hazards
 - Contact the prescriber regarding any question related to the prescribed drug, including contraindications and potential interactions



Case Study 2

- Failure to supervise
- Distraction
- Stress
- Staffing issue
- Inadequate support from management
- Knowledge deficit
- Training issue
- Failure to comply with policy/procedure
- Insufficient or lack of policy or procedure
 - Downtime
 - IV Room workflow
 - High-Alert Medications




Case Study 2

One-and-a-half-old Emily is diagnosed with a yolk sac tumor. After enduring months of surgeries, testings, and rigorous chemotherapy sessions, her parents are told that Emily's treatment is a success!

However, her physicians still feel that one final treatment is necessary to prevent the tumor from reappearing.


During her final round of treatment, Emily collapses in her mother's arms, crying in pain and vomiting.

Her IV chemotherapy was started at 4:30 pm.
By 5:30 pm, she is on life support.
Emily dies.



Case Study 2 Continues...


- Pharmacist
 - 13 additional dispensing errors as retail pharmacist
 - "Unprofessional conduct" in violation of state law
 - Permanent revocation of pharmacist license
 - No contest to a charge of involuntary manslaughter for improperly supervising the technician
 - 6 months in jail
 - Additional 6 months in home confinement with electronic monitoring
 - 3 years probation
 - 400 hours of community service
 - Fine of \$5,000 and payment of court costs (+ undisclosed attorney fees)
- Pharmacy Technician



1) *Vivian J.C. U.S. Pharm.* 2009; 34(11): 66-68.
2) *AcadCare (CSP) Medication Safety Alert (CSP)* 2009.
3) *An Injustice has been Done (CSP)* 2009.

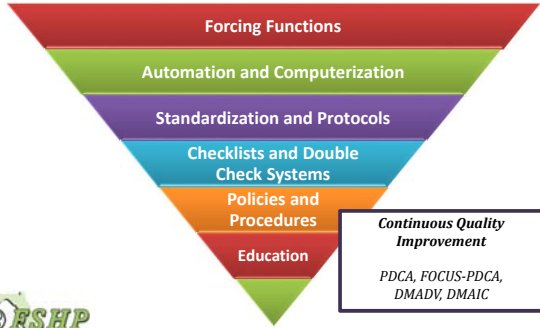
Case Study 2

- What happened in the pharmacy...
 - It is a typical Sunday morning with typical weekend staffing
 - Pharmacy system is down until mid-morning
 - Pharmacist is so busy he cannot even take a scheduled break
 - Pharmacist receives an order for etoposide in 0.9% sodium chloride
 - Pharmacy technician is talking on her cellphone, making plans for her wedding
 - Upon hanging up the phone, pharmacy technician uses 23.4% sodium chloride to compound chemotherapy
 - Pharmacist receives a phone call from Emily's nurse requesting Emily's chemotherapy to be delivered right away
 - Checking area is crowded with many other solutions, vials, and syringes
 - Pharmacist sees an empty 250 mL bag of 0.9% sodium chloride near the bag of compounded chemotherapy; asks pharmacy technician and confirms use
 - Pharmacist also sees an empty vial of 23.4% sodium chloride; assumes it was for the automated compounder
 - Pharmacist does not inquire more since he knows the technician is experienced




1) *Vivian J.C. U.S. Pharm.* 2009; 34(11): 66-68.
2) *AcadCare (CSP) Medication Safety Alert (CSP)* 2009.
3) *An Injustice has been Done (CSP)* 2009.

Medication Error Prevention Strategies



Continuous Quality Improvement

PDCA, FOCUS-PDCA, DMADV, DMAIC



Medication Error Prevention Strategies

- Simplify and Standardize
- Reduce Reliance on Memory
- Error-Proof
- Improve Information Access
- Make Errors Visible
- Reduce Hand-offs
- Automate Wisely
- Improve Communication
- Provide Adequate Training

FSHP

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

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Probability of forgetting something drops by 70% when the necessary steps are already embedded in the process

- Examples:
 - ✓ Use of checklists
 - ✓ Use of protocols
 - ✓ Automated reminders

FSHP

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

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- Reduce Reliance on Memory
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- Improve Information Access
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- Reduce Hand-offs
- Automate Wisely
- Improve Communication
- Provide Adequate Training

Limit products and/or performance of tasks or procedures

Reduce opportunity for error occurrence

Facilitate error detection and recovery

- Examples:
 - ✓ Standardized documentation
 - ✓ Physician Order Sets
 - ✓ Standard concentrations

FSHP

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013
2) Nolin TW. B-Med J 2000; 320: 771-773

Use of Checklists

- Study of the use of checklist for pharmacist order verification
 - Increased awareness for medication safety
 - Encourage development of a systematic and comprehensive approach to medication order review
 - Good training tool for new practitioners and students
 - Provide standardization for medication order review process
- Question of practicality
 - Use of checklist for EVERY order?
- Question of usefulness
 - Use in high-alert medications, complex situations?

FSHP

1) Meyer ED, et al. Clin J Hosp Pharm. 2011; 64(3): 199-206

Simplify and Standardize

- Formulary Management
 - Use of therapeutic Interchange
 - Minimize duplication of multisource products
 - Minimize duplication of therapeutically equivalent products
 - Use of pharmacist interventions
 - Monitor prescriber compliance with established medication-use policies
 - Review of new therapeutic agents
 - Education of prescribers about medication costs
 - Therapeutic category reviews
 - Non-formulary medication-use reviews

FSHP

1) Pedersen CA, et al. Am J Health-Soc Pharm. 2016; 71: 1214-21

Medication Error Prevention Strategies

- Simplify and Standardize
- Reduce Reliance on Memory
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- Automate Wisely
- Improve Communication
- Provide Adequate Training

Use of processes or design features that prevent errors or automate the inspection of process outcomes to determine if error is present

- Examples:
 - ✓ Constraints/Forcing Functions
 - Restriction of certain actions
 - Guardsrails on IV pumps
 - Hard Stops
 - Limit administration route

FSHP

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

Simplify and Standardize

Reduce Reliance on Memory

Error-Proof

Improve Information Access

Make Errors Visible

Reduce Hand-offs

Automate Wisely

Improve Communication

Provide Adequate Training

Provide up-to-date and easily accessible information resources

Organization-wide access to electronic or web-based resources

Locate printed reference materials on all patient care areas

Integrate information into point-of-care technologies (i.e. CPOE, ADGs, etc.)

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

Simplify and Standardize

Reduce Reliance on Memory

Error-Proof

Improve Information Access

Make Errors Visible

Reduce Hand-offs

Automate Wisely

Improve Communication

Provide Adequate Training

Interactive transfer of information

Allows questioning between giver and receiver

Reduce the need to communicate the information multiple times

- Examples:
 - ✓ Cross-Training
 - ✓ Work Schedule
 - Avoid hand-offs at critical times
 - Avoid patient-transfer during shift change

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Pharmacist-Led Interventions

Pharmacist Intervention	National Percentage
Dosage adjustment consultation	98.3
Pharmacokinetic consultation	91.5
Drug information consultation	93.2
Anticoagulation consultation	74.6
Antibiotic consultation	91.7
Nutrition Support consultation	55.9
Patient Teaching consultation	69.1
Pain Management consultation	45.7
Compliance/Medical History consultation	47.2
MTM Service	43.4

1) Pedersen CL, et al. Am J Health-Syst Pharm. 2016; 73: 924-42

Medication Error Prevention Strategies

Simplify and Standardize

Reduce Reliance on Memory

Error-Proof

Improve Information Access

Make Errors Visible

Reduce Hand-offs

Automate Wisely

Improve Communication

Provide Adequate Training

System improvement rather than automating what is technologically feasible

To support human worker; not to replace human worker

- Examples:
 - ✓ Alerts
 - Adjust sensitivity
 - Identify priority alerts
 - Evaluate bypassed alerts

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013
2) Read This Warning! Don't Miss Important Computer Alerts. ISMP, 2007

Medication Error Prevention Strategies

Simplify and Standardize

Reduce Reliance on Memory

Error-Proof

Improve Information Access

Make Errors Visible

Reduce Hand-offs

Automate Wisely

Improve Communication

Provide Adequate Training

Barcoding (BCMA)

Automated Reminders

Independent verification

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

Simplify and Standardize

Reduce Reliance on Memory

Error-Proof

Improve Information Access

Make Errors Visible

Reduce Hand-offs

Automate Wisely

Improve Communication

Provide Adequate Training

- Examples:
 - ✓ SBAR
 - Situation
 - Background
 - Assessment
 - Recommendation
 - ✓ Three-Way Communication
 - Sender communicates information
 - Receiver writes down information
 - Receiver repeats back
 - ✓ 5 Ps
 - Patient
 - Plan
 - Purpose
 - Problems
 - Precautions

1) Larson CM and Saine D. Medication Safety Officer's Handbook, 2013

Medication Error Prevention Strategies

- Simplify and Standardize
- Reduce Reliance on Memory
- Error-Proof
- Improve Information Access
- Make Errors Visible
- Reduce Hand-offs
- Automate Wisely
- Improve Communication
- Provide Adequate Training**

Ensure all staff members have the requisite knowledge to perform their duties in a safe and efficient manner

- Examples:
 - ✓ Orientation
 - ✓ New Hire Training
 - ✓ Annual Competency
 - ✓ Process Changes
 - ✓ Quality Improvement

11 Larson CM and Salze D. Medication Safety Officer's Handbook, 2013

Defining Culture of Safety

“The safety culture of an organization is the product of individual and group values, attitudes, competencies, and pattern of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety efforts. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy or preventative measures.”

11 Cohen MB. Medication Errors, 2nd ed. Washington, D.C. American Pharmacists Association, 2007.

Awareness

- After individualized feedback, group education sessions
 - Identify issues
 - Suggest improvement of systems and processes

Type of MOEE	Baseline (n=321)	Post-Intervention (n=148)	P
Missed Order	105 (32.7%)	71 (48%)	0.011
Duplicate Order	66 (20.6%)	18 (12.2%)	<0.001
Wrong Dose	46 (14.3%)	15 (10.1%)	0.001
Wrong Frequency	42 (13.1%)	21 (14.2%)	0.011
No Order	23 (7.2%)	11 (3.4%)	0.057
Wrong Drug	12 (3.7%)	9 (6.1%)	0.663

*MOEE = Medication Order Entry Errors

11 Bell G, et al. Hosp Pharm, 2012; 47 (10): 771-775

Defining Culture of Safety

- Strategic emphasis on safety
- Mindfulness and resilience
- Teamwork and localized decision-making
- Error-defying systems and redundancy
- Proactive focus and community involvement
- Learning culture
- Safety measurement
- **Just culture**
 - Emphasis on learning and shared accountability for outcomes

11 Cohen MB. Medication Errors, 2nd ed. Washington, D.C. American Pharmacists Association, 2007.

Patient Education

- Empowers the patient to participate in their health care and safeguard against errors
 - Know the names and indications of your medications
 - Read the medication information sheet provided by your pharmacists
 - Do not share your medications
 - Check the expiration date of your medications and dispose of expired drugs
 - Learn about proper drug storage
 - Learn about potential drug interaction and warnings
- When patients take an active and informed role in his or her healthcare, many errors can be prevented

11 Academy of Managed Care Pharmacy. Medication Errors, 2010


Don't be a slice of Swiss Cheese!

11 Picture obtained on 8/20/14 from: <http://www.dhcfoundation.org/what-is-the-swiss-cheese-model-of-harm>

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Prevention *Prevention* Prevention


It is **not** that we are trying to reach
ZERO errors;
but we are trying to reach
ZERO
patient harm.



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**Striving for Zero:
Medication Error Prevention
Strategies**

Haesuk Heagney, PharmD
Medicine/Surgery and Medication Safety Pharmacist
Email: heagneyhaesuk@mayo.edu

Mayo Clinic in Florida
4500 San Pablo Road
Jacksonville, FL 32224-1865
mayoclinic.org