Reducing Medication Risks of Electronic Medication Systems

Geriatric Grand Rounds

Program Date: August 10, 2012

Topic: Reducing Medication Risks of Electronic Medication Systems

Presenter: Laura Finn, CGP, FASCP, Consultant Pharmacist  
Adjunct Associate Professor of Pharmacy Practice  
Philadelphia College of Pharmacy  
l.finn@usciences.edu

Program Objectives:

- Discuss ways prescribers can be alert to potential sources of error in using electronic medication systems
- Describe areas in medication reconciliation where electronic health records are most prone to medication error risks
- Identify the role of the prescriber in the prevention of medication errors, improving therapy adherence and achievement of positive outcomes
- Develop an awareness for potential sources of medication errors in prescribing, processing and administering medication orders with electronic systems

Course Outline: (attached)

Teaching Method: Interactive discussion

“The great aim of education is not knowledge but action.” H. Spencer

I have no actual or potential conflict of interest in relation to this program.  
~ Laura A. Finn
Introduction to Electronic Medication Systems - Benefits

- Standardization of patient electronic health record
- E-prescribing (elimination of pharmacists’ need to read illegible handwriting)
- Prescribing alerts and warnings on drug selection, dosing, interactions – Decision Support software
- Reporting of adverse drug events
- Transfer of health information between care sites
- Bar-coding technology in our dispensing systems
- Ease of administration with the electronic MARs in our institutional practices
- Better address medication adherence outcomes

What are the medication safety Risks with electronic medication systems?

Like pharmacists, as prescribers, you are educated to always be aware of both risks and benefits.

Expectation is that electronic prescribing, medication order processing, administration, and monitoring will reduce medication errors.

Benefits are readily apparent but unsuspecting health care professionals may be less aware of the risks.

What are the risks?

Could electronic systems do not contribute to medication errors and negative outcomes?

- Role of electronic order entry in contributing to medication choice errors
- Warning fatigue, excessive warnings
- Medication reconciliation concerns
- Lack of accuracy on med lists for consulting disciplines
- Role of electronic records in unnecessary medication use
- Decisions based on inaccurate, incomplete, outdated electronic health information
- New technology “learning curve” and alterations to workflow

Patient Scenario #1: Telephone order by attending MD on Thursday: “to hold warfarin dose today and then decrease warfarin by 0.5mg daily and recheck INR in 1 week”

Original order was 3.5mg daily. Nurse entered order to hold today's dose. Order entry into electronic system took 23 minutes and resulted in 52 warnings, but no call from releasing pharmacist. Repeat INR=1.2.

Discussion: How could this error be prevented?

Multiple Sources for error with contributions of electronic medication system

Prescriber Nurse Releasing Pharmacist Dispensing Pharmacist System
Why should prescribers get involved in identifying these risks?

Positive outcomes from medication use will only occur if the best choice of therapeutic option is followed by proper dispensing, safe administration and appropriate monitoring for the patient whether self-administered at home or administered in an institution. Need to acknowledge that a potential exists for medication errors throughout that process.

By recognizing the potential for medication errors, prescribers can identify their own role in preventing them as well as educate other disciplines on their role in preventing medication errors.

Professional Core Objectives Required for Medicare and Medicaid Incentives:
1. Include Use of CPOE
2. Implement Drug-Drug and Drug-Allergy interaction checks
3. Maintain an up-to-date problem list of current and active diagnoses
4. Generate and transmit permissible prescriptions electronically
5. Maintain an active medications list
6. Maintain an active medications allergy list
7. Record demographics
8. Record vital signs and chart changes
9. Record smoking status
10. Report ambulatory clinical quality measures
11. Implement clinical decision support rules as determined by eligible professional
12. Provide patients with an electronic copy of their health information
13. Provide clinical summaries for patients for each office visit
14. Capability to exchange key clinical information electronically (ex. Problem list, medication list, test results) among care providers and patient authorized entities
15. Protect electronic health information by use of certified technology

First look at where medication problems/errors traditionally occur.

Study published in JAMA, analyzing adverse drug events, identified the phases of medication use where adverse drug events traditionally occur: ¹

![Bar chart showing percentages of medication errors in various stages of use: 39% prescribing, 12% transcription, 11% dispensing, 38% administration.]

Reducing Medication Risks of Electronic Medication Systems

**Determine ways to identify potential problems:**
- Analysis of Medication Errors and Near Misses
- Root Cause Analysis
- Failure Mode and Effects Analysis

**Medication errors - often multifactorial with multiple opportunities to prevent!**

**Questions to ask ourselves:**

1. What types of problems can occur with e-prescribing / CPOE?
2. How do we identify potential problems and create systems to prevent them?
3. How do we safely utilize electronic medication administration systems in our institutional practice settings?
4. Do electronic systems label medications in a manner easily understood by our patients?
5. Do electronic med administration systems track medication use in a meaningful way?

**Identify Areas of Potential Errors in the Medication Use System:**

**IOM report Hazards of Technology:**
- Urged greater oversight by government and private sector over HIT
- Recognition that difficulty with new technology can lead to mistakes
- Incessant warnings on drug interactions can lead to “alert fatigue” in prescribers
- Med admin scanners – nurses may not be using their eyes to identify meds and patients
- Software vendors “nondisclosure clauses” may decrese sharing of error-prone software issues
- Hold harmless clauses force risk on the customer not software vendor

**Prescribing Issues - Decision Support Software:**

Although prescriber decision support software may assist in appropriate medication choice, the software needs input of accurate information.

Is patient specific information current? Diagnoses, conditions, height, weight, lab values, allergies, intolerances, use of PRN medications

**Role of electronic order entry in contributing to medication choice errors**

**What does CPOE stand for?**

Computerized Physician Order Entry became Computerized Prescriber Order Entry which has become Computerized Provider Order Entry

Who defines “Provider”?

In institutional setting, prescriber may still be ordering verbally, over telephone or using paper to write an order which is then entered into the medication system by another health care professional, often a nurse in Long Term Care setting
**Risk:** Order interpretation takes place at the nursing station and then nurse’s entry of Rx order is viewed by the releasing and/or dispensing pharmacist. Original paper order or transcription of the verbal order may not be viewed by the pharmacist at all. (Warfarin Example #1)

In many settings, order entry, choice of actual medication product and dose conversions are no longer done by dispensing pharmacists. Order entry professional will interpret the prescriber’s order, choose product from drop down menu, calculate dose & complete directions to be used for labeling & MAR and review/interpret computerized warnings.

With computerized prescriber entry, this may not even be completed by a physician or NP, PA prescriber. RN or LPN may be interpreting orders for entry into computer for physician to electronically sign. Nurse may be unfamiliar with multiple choices seen in drop down menu.

**Risk:** If order entry or electronic prescription is not entered by prescriber and the pharmacist is not involved in the medication choice, is the health care professional sufficiently trained to choose correctly?

- Product choice may result in wrong drug or duplicate therapy.
- Lack of awareness of dosage forms, concentrations, salts that are available may result in inappropriate choice.
- Lack of review of paper order including consultant/hospital discharge/care transition orders by a pharmacist. The order interpretation responsibility may fall solely on the nurse in institutional setting.

**Examples: Improper selection of medication product or dosing**

**a. Wrong medication chosen:** amoxicillin is chosen instead of amoxicillin clavulanate; Prednisolone 5mg PO daily was dispensed for a patient when the actual physician’s discharge order was for prednisone 5mg oral tablet. Nurse reviewed a hospital discharge summary and entered medication via clicking drug on drop down menu. Twenty one entries appeared when pred was entered into drop down menu and Prednisolone appeared before prednisone.

**b. Lack of cross-reference** between brands, generic, drug classes in menu choice leads to poor drug choice: Bactrim® single strength is hand written order but nurse chooses SMX TMP DS administer 0.5 tab

**c. Choice of concentration:** prescriber states order in mg but menu choice includes multiple concentrations, nurse (order entry personnel) must choose concentration and then calculate mL for dosing amount

  ex. lorazepam topical gel (compounded and available as both 1mg/mL and 0.5mg/mL) Nurse chooses the first choice of 1mg/mL and notes dose of 0.5mg. Directions read administer 0.5mL. Pharmacy compounds syringes of 1mg/mL containing volume of 1mL. Nurses administer entire syringe.

**d. Difficulty in choosing** salts of medication, diluent, unfamiliarity with available doses

ex. valproic acid formulations, doxycycline hyclate or doxycycline monohydrate
Even simple non-prescription medications can appear confusing in a drop down menu choice:

**Mylanta Supreme®** - calcium carbonate 400mg with Mg hydroxide 135mg / 5 mL
Mintox® (substituted for Mylanta®,) Aluminum hydroxide 200mg, Magnesium hydroxide 200mg, simethicone 20mg / 5mL Note 30mL Mylanta Supreme ®= 2400mg Calcium carbonate

Acetaminophen Children’s Oral Elixer 160mg/5mL
Acetaminophen oral elixir 160mg/5mL
Acetaminophen oral liquid 160mg/5mL
Acetaminophen oral solution 160mg/5mL

Potassium CL CR Capsule Extended Release 10 MEQ
Potassium CL CR Tablet Extended Release 10 MEQ
Potassium Chloride Crys CR Oral Tablet Extended Release 10 MEQ

Acetaminophen Extra Strength Oral Tablet 500mg
Acetaminophen Non Aspirin Oral Tablet 500mg
Acetaminophen Oral Tablet 500mg

**Recommendations:**
- **Review system to focus means for reducing medication errors**
- **READ carefully before signing written or electronic orders.**
- Work with pharmacy to remove problem-creating choices.
- Be sure system is using Tall man lettering.
- Acknowledge the need for order entry staff to be educated on medication selection and verification procedures.
- System needs more checks/balances

**Problem:** Electronic Health Records may contribute to med reconciliation errors
**Estimated greater than 50% medication errors occur at time of care transition** -


**Two common unintended changes to regimen:**
1. Omissions of preadmission meds
2. Previously discontinued meds reinitiated

Source: Tam et al. 2005 “Frequency, Type and Clinical Importance of Medication History Errors at Admission to Hospital: A Systematic Review”

Patients with several conditions (multiple medications prescribed by different physicians) – Need to reconcile the prescribed regimen with what a patient is actually taking and to understand why there is a difference between the two.

Optimizing and reconciling medications requires **substantial investments of time along with electronic data sharing among practitioners** — neither of which is widely available in today’s model
- Financial incentives - Reward providers for coordinating care
- “Meaningful use” of HIT that needs to cross locations of care - accurate data shared across settings
Patient Scenario #2 Antidepressants

Patient Scenario #3 lisinopril

Errors at Transition of Care: - Misinterpretation of current outpatient records.

Patient Scenario #4
Phenytoin 100mg bid 9am, 6pm and phenytoin 100mg 1pm as special instruction time in electronic MAR of assisted living facility. Resident with therapeutic level = 13.8 in April.

Upon hospital admission, order input as phenytoin 100mg bid. 5 days in hospital and 4 days at skilled care facility before pharmacist chart review detected change in dose. Level checked day 10 was phenytoin = 4.6.

Problem: Data entry persons may have insufficient knowledge of the Computer Ordering Process

Risk: Incorrect start and stop times (medication order span) may lead to medication errors

Patient Scenario #5
Patient taking warfarin 5mg and INR called to physician’s office with return call at 5:50. Nurse is instructed to hold today’s 5mg dose and enters order at 6:01pm for a one time dose of warfarin 10mg today and return to 5mg tomorrow. However the next day, both 10mg and 5mg dose appear on the electronic med administration software resulting in dose of 15mg. What went wrong?

Recommendations: Create system with redundancy in medication safety; require double checks and sufficient training, pharmacists have a role in reviewing orders completely.

Patient Scenario #6 Levofloxacin
IV levofloxacin 750mg upon admission day 1 then changed to 750mg PO given at 0800 on day 2 but further changed to 1000 (due to fluoroquinolone time policy to avoid admin with minerals) Second dose given 1000 on day 2 (same nurse)
Labs showed moderate Renal dysfunction – order changed to 750mg PO q 48 hours.
Dose on day 3 and discharged to skilled care with illegible order for 750mg PO q 48 hours x ds?
Entered into computer to start next day since no date or time of last dose.

Potential for misinterpretation of warnings upon order entry:

Problem: Warnings are being interpreted at point of care which can be helpful if interpreted and acted on properly. When bypassed, require vigilance by releasing pharmacist to interpret response.

Risk: Excessive warnings, difficulty in interpreting warnings, improper response to warnings may result in medication errors. Risk of warning fatigue.
Underuse of Dispensing Pharmacist Dose alerts

**Problem:** Does your pharmacy system warn of wrong route of administration, contraindications based on patient’s disease or condition or over-dosage based on patient’s weight?

**Example:** ISMP computer survey of 182 pharmacy systems in both 1998 and 2005. Compared to the similar study in 1998 - fewer systems in 2005 provided drug alerts due to patient’s age, weight or body surface area. 


Drug allergy potential for error

**Risks:** Does your hospital system maintain allergies from a past admission? For a readmission, is allergy verification required?

**Problem:** New allergic reaction may have occurred since last admission and the allergies may need a prompt to be updated.

Do pharmacy systems allow for documentation of type of allergic reaction and intolerances?

**Example:** nitrofurantoin causing nausea or amoxicillin causing diarrhea documented as drug allergy

Potential for errors in medication administration by patient or home caregiver:

**Problem:** Labels may be difficult to understand due to small print, mail order bottles /labels all looking alike, directions not easily interpreted

**Risks:** Patient may be confused about how much medication to take.

**Example:** “Take 0.5 tablet…” Data entered for medication order may be user friendly to prescriber and pharmacy but is it user friendly for the outpatient to understand?

Potential for errors in medication administration by nurse or institutional caregiver:

**Problem:** Nurse administers medications which are displayed on computer screen to be given during the time slot chosen for medication administration. This does not include the entire MAR and may decrease nurse’s awareness of entire medication regimen including PRN medications, medications given on other shifts, medication time changes, new orders.

**Examples:**
- PRN dose changed to routine – both administered
- Weekly med missed – Dose documented as not available
Patient Scenario #7:
Patient with nausea, loss of appetite – Evening nurse called attending physician and spoke with on call provider
New order for promethazine suppositories
Recent order for:

Recommendations:
- Medication nurse should review entire MAR, easy access to MAR during medication administration program.
- Prescriber needs access to recent medication changes before ordering new medications.
- When a weekly medication is skipped, system should alert subsequent users.

Monitoring Systems: Does your electronic system track total daily dosing or medications with maximum dosing?
Example: acetaminophen, dextromethorphan

Takes a Team and YOUR input to reduce the risks for medication errors.

Questions and Discussion:

References:


THANK YOU!

It is my hope is that this educational program will inspire you to action in improving medication use. l.finn@usciences.edu

For more information:

- Website of resources: www.ismp.org Institute for Safe Medication Practices