Medication Safety Update
Using Electronic Systems to Improve Patient Outcomes
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Objectives:

- Identify ways prescribers can be alert to systems-based sources of error in using electronic medication systems
- Develop an awareness for potential sources of medication errors in prescribing, processing and administering medication orders with electronic systems
- Recognize the role of the prescriber in preventing medication errors and improving patient medication outcomes
Expectations for Electronic Medication Systems

- **E-prescribing** – expected to save $27 billion annually in prevention of 2 million adverse drug events

  But......

  - Must fully and effectively implement the technology AND
  - Obtain maximum functionality

Expectations for Electronic Medication Systems

- **Electronic prescribing** – may result in 50% reduction in medication errors compared to: handwritten, faxed and verbal medication orders which require transcription into electronic system

Expectations for Electronic Medication Systems

- New technology = New opportunities for errors
- Errors differ from manual system


- “Work-arounds” may bypass significant safety features
- Can technology contribute to medication errors?

ISMP. Computerized order entry (e-prescribing) survey(part 2) Improving how systems are used. Long-Term Care AdviseERR. 2015;3(3)1-3.
Expectations for Electronic Medication Systems

- Who’s watching out for those system-based errors?
- Will these errors impact patient outcomes?
- Are health care professionals aware of the new error potential?
- What’s the prescriber’s role in error prevention?
Who’s entering medication orders?

- CPOE – Physician
- ...Prescriber
- ...Provider
- New term CMOE

Computerized Medication Order Entry
Scenario 1: Focus on High Risk Medication

- Patient transitioned to skilled facility for Post-Acute Care
- Patient on fluconazole, ciprofloxacin and warfarin
- INR on Friday afternoon = 2.9
- Resident was taking 2mg M,W,F and 2.5mg TTSS but unclear if this was communicated to prescriber.
- On-call prescriber phone order for: “Change warfarin to 1.5mg PO daily and repeat INR Monday”.
- Handwritten order placed in chart and order entered by 3-11 nurse into computer. Pharmacy directly received computerized order from LTC.
How well do you READ computerized orders before approving them?

- Friday – Nurse used Interim med supply for 1.5mg dose
- Order on electronic MAR appears as:
  
  **Warfarin** Oral tablet 3mg  Take 1.5 tablet PO daily.
  
  **Special instructions:**
  
  Coumadin 1.5mg daily PO and recheck INR on Monday.
- Sat and Sunday – Patient received pharmacy-provided doses of 4.5mg each day
- 4.5mg is triple the ordered dose of 1.5mg
- Monday morning – **Attending physician reviewed electronic order and electronically “signed it”**.
Root Cause Analysis - RCA

- Medication Choice from Drop Down Menu

**Nurse entering order** was aware of mg dose needed but not of dosage forms available.

1. No choice for 1.5mg, thus 3 mg was chosen.
2. 1.5 was chosen for dosage. “Thought mg was to follow”.
3. Quantity type did not allow change from set **tablet** as did not allow choice of mg -only available as tablet.
4. Nurse attempted to highlight dose in special instructions. (conflicted with order)
Root Cause Analysis - RCA

- **Releasing pharmacist** never received or viewed written order and neglected to identify discrepancy in special instructions.

- First and second order **checks by other nurses** did not identify discrepancy in computerized order or between paper order and printout of computerized order.

- **Nurses administering** Sat and Sun doses did not catch discrepancy on Med Pass mode of electronic MAR

- **Attending physician approved/ signed** computerized order without notice of discrepancy in dose.

- **What role did electronic system play in this error?**
Root Cause Analysis - RCA

- **What role did electronic system play in this error?**
- Electronic systems can provide a “real time” update to order and MAR with off site approval of order by attending MD. (Benefit)
- Comparison to old “paper system” where order would have been faxed to pharmacy to enter drug into profile and pharmacist would choose medication dosage strength and complete labeling directions.
- Nurse would transcribe order exactly as prescribed to the MAR.
- Attending physician would view the original written telephone order.
Challenges of CMOE

- Does electronic system require different approach for prescriber who is ordering medication?
  - Who is entering order? competency?
    - Entering of dose into electronic system varies:
      dosage strength (mg) vs dosage form
    - Metric system requires entry of:
      $\frac{1}{2}$ tablet = 0.5 tablet
      $1 \frac{1}{2}$ tablet = 1.5 tablet
  - Be aware of how order is entered and choices following numeric value of dose.

Ex. 5mg morphine sulfate concentrate 100mg/5 mL
Record 5mP PO 4/6th July
Challenges of CMOE - Azithromycin

- Are you familiar with the medication nomenclature and templates for medication ordering?
- Do you interpret drug-drug interaction warnings?

**Azithromycin Scenario A**

Order Entry: azithromycin Zpak 250mg tablets chosen by MD
- Expectations that Zpak dosing would apply
- MD chose from regular medication menu not template thus order became:

  Azithromycin Zpak 250mg tablet 1 PO daily.

- Results: incorrect Zpak directions
Challenges of CMOE - Azithromycin

- **Are you familiar with** the medication nomenclature and templates for medication ordering?
- **Do you interpret drug-drug interaction warnings?**

**Azithromycin Scenario B**

- **Order Entry:** azithromycin Zpak template chosen by MD
- **Expectations:** azithromycin 250mg Two tablets on day 1 and 1 tablet on days 2-5
- **Results:** Time changed for starting drug resulted in default stop time on day 2 which allowed both 500mg dose + 250mg dose to appear on Day 2 of MAR for Nurse to administer
- **Misinterpretation of “span” of first order for 500mg.**
Challenges of CMOE - Azithromycin

• Are you familiar with the medication nomenclature and templates for medication ordering?
• Do you interpret drug-drug interaction warnings?

Azithromycin Scenario C
• Chest X-ray results called to On call prescriber late evening.
• New order for azithromycin 500mg PO daily x 7 days
• Moderate Drug warning of potential duplicate therapy is triggered and bypassed
• Dose of azithromycin is taken from interim drug supply.
• Results: Patient at risk for QT prolongation due to concurrent clarithromycin therapy for PUD treatment.
Do you have accurate and complete information before prescribing?

On call telephone prescribing especially dangerous:
- Unfamiliar with patient
- Often reacting to significant change or lab result
- Interpretation of warnings may occur on site but not viewed by prescriber

Azithromycin Scenario C
1. Was on call prescriber informed of complete medication list including current antibiotic treatment?
2. First dose from Interim Supply bypassed pharmacist’s review and release.
3. How was moderate drug warning interpreted?
Do you have accurate and complete information before prescribing?

Return to warfarin Scenario 1:

- Resident INR becomes therapeutic on warfarin 2mg daily but today’s INR=1.15
- What dose will on call prescriber choose?
  - Antibiotics, fluconazole were discontinued last week at time of last INR.
  - Anticoagulant log includes no reference to the 3 potentially interacting anti-infectives which may have contributed to elevated INRs.
- What are we learning?
Do you have accurate and complete information before prescribing?

- If this patient were to be transferred to acute care, would the admitting physician have:
  - accurate current medication list?
  - history of recently discontinued medications including antibiotics, lab results?

- Are your decisions based on inaccurate medication history? Could diagnosing and prescribing occur based on misperceptions?
Medication Safety with Electronic Technology

Will our electronic systems and technology improve medication safety and decrease potential for medication errors?

- Prescribing - medication choice errors, order entry
- Warning fatigue, excessive warnings
- Medication reconciliation discrepancies, duplication
- 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
Medication Safety with Electronic Technology

System-based sources of Medication Errors may contribute to negative patient outcomes:

- Prescribing
- Medication Reconciliation at Care Transitions
- Administration
- Monitoring

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Health IT Patient Safety Action & Surveillance Plan - July 2013

www.healthit.gov/sites/default/files/safety_plan_master.pdf
Scenario 2: Focus on Order Entry and Care Transitions  *Acute to Post-Acute*

Patient with long history seizure disorder was transitioned after hip fracture surgery to post acute care with a medication list of 14 routine drugs including:

- Pantoprazole
- Phenobarbital
- Phenytoin
- Pravastatin

Computerized signed physician orders at LTC:

- 13 routine medications including pantoprazole, phenobarbital, pravastatin
Scenario 2: Acute to Post-Acute

- Patient was well known only to attending physician at rehab site who signed orders and documented admission H&P.
- Patient was controlled on high, stable doses of 2 seizure medications prior to admission.
- Did physician review medication list at time of signing?
- Resident had significant seizures on day 6 of rehab resulting in hospitalization, followed by discharge to another rehab facility with subsequent fall, return to hospital and second hip fracture.
Medication Safety with Electronic Technology

Root Cause Analysis - RCA

- Nurse transcribed printed hospital discharge into a hand-written med list included phenytoin order but this was not entered into computer.
- **Two nurses checked** electronic orders but did not view the original hospital or discharge orders or written list.
- Pharmacist reviewed electronic medication list – no access to discharge or hand-written med list.
- Telephone approval of written medication list by on call prescriber.
- **Attending physician approved/ signed computerized list of medications with missing phenytoin.**
Medication Safety with Electronic Technology

- Analysis of errors and near misses leads to Process Improvement with goal to prevent future medication errors.
- New protocol for Medication Reconciliation “Interact” System for Post Acute Care transition
- Prescriber Awareness: Read and verify medication list and be aware of all medications being signed/approved.
Definition of Medication Error

The National Coordinating Council for Medication Error Reporting and Prevention (NCCMRP) uses this definition:

“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.”
Medication Error – “May be related to:

- Professional practice,
- Health care products,
- Procedures,
- **Systems**,  

Includes:

*prescribing, order communication*, product labeling, packaging, nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use”. (NCCMERP)
Medication Safety- Organization and Individuals

Organizational and Individual Commitment:

- Need for leaders of health care organization to make medication safety a **high priority**
- Regardless of the organization, individuals still have the obligation to promote medication safety
- ISMP: “For prevention efforts to be effective, they must become a priority.”
- What about you?
Medication Safety – Multidisciplinary Approach

What can we do as part of the health care team engaged in actions to improve medication safety?

- Encourage error reporting and analysis of near misses – Just Culture
- Improve degree of reporting and system analysis of near misses
- Educate other practitioners on error prevention and error causes
- Overall medication management is only as good as the “weakest link” in your practice.
- Who takes the evening, weekend call??
- Who enters the complex medication orders?
Medication Safety – Multidisciplinary Approach

- Utilize standard methods for medication error and near miss analysis:
  - Root Cause Analysis - RCA
  - Failure Mode and Effects Analysis – FMEA

- Need to improve the system not just the performance of individuals

- Learn from other errors reported through PSOs (public safety organizations) like ISMP and published accounts of errors

- Proactively review your systems and make changes to decrease potential for medication errors
Scenario 3: Focus on Care Transitions

Acute to Post-Acute (update)

- Patient 94 yr old with immobility post-op ankle fracture
- Enoxaparin 100mg/mL SQ daily x 14 days
- Patient received 100mg daily.... til RPh review on day 9
- Orthopedic Rx indicated dose = 40mg daily

Problem: Interpretation of concentration as the dose
- Due to incomplete medication order upon discharge
- med list (signed by prescriber)
- Lack of dosage in medication order
- Nurse at Rehab site interpreted concentration as dose.
Misinterpretation of Drug or Dose

Interpretation of concentration as the dose

• Update – After 1 ½ years, working with hospital medication reconciliation and care transitions committees, report of hard stop in place to require dose not just concentration of liquids!
Focus on High Risk Medications

- Anticoagulants
- Insulin and Oral diabetes medications
- Antibiotics
- Cardiovascular medications
- Anti-seizure medications
- Liquids with a concentration
- Unusual Dose/Dosing - 2 capsules, 1 ½ tabs, 0.5 tab or ¼ tab, variable dose
- Narcotics
- Narrow therapeutic window
- Combination Medication Products
Potential Sources of Medication Errors

Prescribers can impact safe medication orders:
- Review post-acute discharge medications before signing
- Do the orders make sense?
- Ex. furosemide 80mg take 0.75 tablet daily.
- Recognize incomplete orders, concentration but no dose—Keppra ® 100mg/mL, Lantus ® 100 units/mL
- Recognize pitfalls such as prescribing in mg but provider order entry in mL. Who makes dose conversion?
- Be aware of look alike / sound alike medications.
Recognize duplicate medication orders

- Post-acute discharge medications included both the combination brand name product + the individual drugs for HIV treatment
- Doubling a dose can have significant negative outcomes when you look at the dosing range and drug interaction potential and significant adverse effects.

- Spiriva ® (tiotropium) + Duoneb ® (combination of albuterol + ipatropium)
- Who is reviewing drug-drug interaction alert?
- Lack of recognition of drug – drug warning for duplication in inhaled anticholinergic drug class or warning fatigue from viewing excessive warnings?
Warnings and Alerts

• If interpreted at point of care by provider entering order, can be helpful if acted upon properly.
• System needs review for threshold and specificity to reduce those not clinically significant.
• Create “hard stops” to prevent the most outstanding patient safety errors.
• When bypassed, expectation is that pharmacist will interpret.
• Advise safety team to review reasons for bypassed warnings frequently.
• What is your threshold for displaying mild, moderate, severe drug – drug interactions?
• Is alert system customizable?
E-Prescribing – System improvements

- Removal of problem creating menu choices from order entry drop down menu.
- Use of Tall Man lettering to reduce risks of improper choice for look alike medications.
  - Cyclopentalate chosen for cyclosporine
- Review of default times/ dates on order entry
  - Zpak® day 1 default time
- Review templates for accuracy
  - Error in Zpak® template = 6 days of azithromycin
- Set policy to not keep multiple EMR open.
  - Ex. levothyroxine started on the wrong spouse
  
  *Dose was increased when no change in TSH on spouse not receiving the medication for 6 weeks.*
E-Prescribing Concerns

• Accuracy in reviewing choices from drop down menu:
  patient name drug dose
drug name drug dosage form
drug salt # tablets PO (0.5 tablet dose)...
start dates/times stop dates/times

MD wrote Rx: lorazepam 0.25mg PO q 6 hours PRN anxiety

• Dose entered into computer as:
  **Ativan 0.5mg Give 0.25 tablet** PO every 6 hr PRN anxiety.
  Special instructions: Give one tablet 0.25mg po q 6 hr PRN.

• Attending physician signed medication orders.
Potential Sources of Medication Errors

E-Prescribing Concerns— (not drug choice related)

Who has access to your prescribing system?

- Who is updating with guidelines, FDA warnings, support software
- Height / Weight software alerts may be missed resulting in dosing errors (mix up ht in cm instead of wt in kg)
- Transposing numerals in height or weight
- Duplication if errors in transmission occur
Transfer of Medication Errors to EHR

Error with human / software interface

- If wrong medication / drug class is chosen from drop down menu, will the error can be transferred to other electronic health records?
- Allergy to Penicillin becomes allergy to penicillamine.
  - How much HIT is “cut and pasted”?

Care Transitions


- 653 Medicare beneficiaries discharged from hospital to SNFs for max 35 days post-acute care
- 22% experienced an adverse event
- additional 11% harmed during SNF stay
- 59% events identified as preventable by MD review

Half who experienced harm returned to hospital for treatment

At a cost to Medicare Aug 2011 = $208 million

Extrapolated to over $2 Billion in yr 2011
Care Transitions

- Increasingly a focus due to bundled payments, ACOs, penalties for readmissions...
- “up to 70% care transitions resulted in discrepancies” - 1/3 having potential to harm

Archives of Internal Medicine June 2012

What is the role of electronic medication systems in Improving Care Transition Outcomes?
Verifying Post Acute Discharge Medication Orders

- Inability to determine if stopped medications were “purposely discontinued for a reason” or “inadvertently missed”
- **Need for review of discharge summary and medication reconciliation at same time of transition to home or post-acute site.**

(with all the patient’s information in one place)
Post-Acute Discharge Orders

• Lack of defined duration / stop date – Difficult to determine start dates/stop dates
  ◦ Variable stop dates based on next cardiology visit, orthopedic visit, etc.
  ◦ Ex. amiodarone 200mg bid until cardiology appointment

• Unclear anticoagulation orders
  ◦ Hospital discharge post DVT: medication orders for rivaroxaban 15mg PO BID and rivaroxaban 20mg PO daily. Both administered (50mg daily) until caught error upon refill.
  ◦ Need to indicate start dates and stop dates for clarity.

ISMP. New and Novel oral anticoagulants have not-so-novel risks. Long-Term Care AdviseERR 2015; 7(3)1-3.
Missed or inaccurate information input upon hospital admission

May result in incorrect information upon discharge:

- Clinical decisions may be based on inaccurate information.
- Hospital treatment may reflect inaccurate dose from point of admission.
- Ex. mirtazapine 15mg 0.5 tab hs
- Untreated medical conditions upon discharge (These can be unintentional discontinuation, errors of omission)

Missed or inaccurate information input upon hospital admission

- Use of most recent hospitalization discharge meds as admission meds for newest hospital admission resulting in restart or documentation as “home meds” those that were discontinued or altered during outpatient time.

- Consultant Practices (cardiology, neurology, urology, endocrinology...) may also be using outdated lists by consulting practices.
Joint Commission 2015 Patient Safety Goals

NPSG.04.01

“Improve the Safety of Using Medications.”

NPSG.05.01

“Reduce the likelihood of patient harm associated with the use of anticoagulant therapy.”

NPSG.03.06.01

“Maintain and communicate accurate patient medication information.”

- IOM – “Electronic Prescribing and Monitoring for Errors in All Care Settings is Essential”
Medication Safety with Electronic Technology

Adverse Event and Error Reporting:

- FDA MedWatch Form is available at: www.fda.gov/medwatch/how.htm

- USP-ISMP MERP (Medication Error Reporting Program)
  www.ismp.org/orderforms/reporterrortoismp.asp

- Essential that we report incidents related to Health Information Technology.
Medication Safety with Electronic Technology

- Improve your patients’ outcomes through appropriate and safe medication use.

- Increase awareness among your colleagues with examples of the potential errors that may occur and how to screen for them.

- **Team Focus on multi-factorial causes** when identifying potential errors and the necessary changes to prevent recurrence.

- Use technology to reduce medication errors but beware of how technology may contribute to errors.
References

References

- Radley DC, Wasserman MR, Olsho LE, Shoemaker SJ, Spranca MD, Bradshaw B. Reduction in medication errors in hospitals due to adoption of computerized provider order entry systems. *J Am Med Inform Assoc.* 2013;20(3):470-6. doi:10.1136/amiajnl-2012-001241. [http://jamia.bmj.com/content/early/2013/01/27/amiajnl-2012-001241.full](http://jamia.bmj.com/content/early/2013/01/27/amiajnl-2012-001241.full)
Resource

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

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

H. Spencer

Thank You!

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