CLINICAL APPLICATION OF A COMPUTERIZED SYSTEM FOR PHYSICIAN ORDER ENTRY WITH CLINICAL DECISION SUPPORT TO PREVENT ADVERSE DRUG EVENTS IN LONG-TERM CARE

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OVERVIEW

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INTRODUCTION

- A simple prescribing decision can initiate unforeseen outcomes.
- A cascade of unintended events can end in the development of a serious adverse drug event.
- Some times, elimination of a medication from patient’s therapy could be beneficial and safe for him.
Evidence obtained in the acute care hospital sector suggests that drug safety can be improved by means of computerized physician order entry (CPOE) with clinical decision support (CDS).

Such improvements might be particularly important in long-term care.
WHAT IS CPOE-CDS?

- Electronic entry of physician orders and instructions for treatment
- Order entry at point-of-care or off site
- Communication over a network to medical staff
- Integration of various departments (radiology, laboratory, etc..)
What is CPOE, continued

- Replacer of hand-written orders
- Immediate alerting of allergies or contraindications at point of entry
- Real-time clinical decision support
- Supports access to patient data
For example, if a physician enters an order for an antidepressant drug for a patient already taking multiple psychoactive medications, the CDS system would display a warning about the potential for over sedation, confusion, delirium and falls.

It would then advise the physician to evaluate the need for each psychoactive medication, indicate those already prescribed and suggest prescribing the lowest feasible dose of the new drug.
- CPOE-CDS is being used with success in acute care facilities.
- Use of CPOE was recommended in a 1999 Institute of Medicine report on reducing medical error, and one study found that CPOE reduced serious medication errors by 55%.
In 2000, the State of California passed a bill (California Senate Bill 1875) mandating that urban hospitals implement technological programs to reduce error (e.g., CPOE) by 2005.

Implementation of such applications has been recommended as well by such US organizations as the Leapfrog Group (www.leapfroggroup.org) and the National Quality Forum.
New strategies are needed to improve prescribing practices in extended care.

In long-term care facilities, patients have been prescribed more than 6 concurrent drug therapies.

Such a high frequency of drug combinations among people of advanced age and who are often in frail condition markedly increases their potential for adverse events.
ADVANTAGES

- Direct entry of orders and treatments
- Replaces handwritten orders
- Cross reference for potential drug-interactions or allergies
- Reduces wait times for patients
- Improves compliance with best practices
- Ready access to patient data
ADVANTAGES- CONT

- Improves patient safety
- Potential to improve efficiency
- Cost saving benefits by:
  - Reducing number of duplicate tests
  - Reducing errors
DISADVANTAGES

- Cost
- User resistance
- Personalization for individual hospitals
- Potential for integration issues with other systems
- Disruption of workflow with employee training
An 89-year-old woman had a medical history of atrial fibrillation, stroke, dementia and hypertension.

Her medications included warfarin, the dosage of which her clinician has been adjusting to maintain her international normalized ratio (INR) in the range of 2.0–3.0.

When a fever developed, another physician prescribed cephalexin (500 mg oral, 4 times a day for 7 days) for a presumed urinary-tract infection.
The next morning (day 2), her primary care physician was telephoned with the results of a day 1 test: INR 1.75.

He accordingly increased the patient’s daily dose of warfarin from 4 mg to 5 mg.

He was not told that cephalexin was ordered in the previous evening by the covering physician.

One week later, the patient’s INR was 13.8.
The next day, the patient became short of breath.

When chest radiography revealed an infiltrate, the covering physician ordered amoxicillin/clavulanate (625 mg by mouth every 12 hours for 10 days).

The next day, she passed tarry stool, then omeprazole was initiated empirically.

The following morning, the patient’s hemoglobin measurement was 8.3 g% and her INR, 11.3.

The primary care physician was notified, and the patient received 10 mg of vitamin K by injection, which resulted in a decline in her INR to 0.9.
ERRORS

- Most prescribing errors are made at the ordering and monitoring phases of the process of pharmaco therapeutic care.
- Errors 1 and 2 occurred at the ordering stage.
ERROR 1

- The covering physician prescribed cephalexin without considering that the patient was taking warfarin, a drug that interacts with cephalexin to increase international normalized ratios (INRs); the potential interaction was not noticed when the new therapy was ordered.
**ERROR 2**

- When the primary care provider increased the dose of warfarin, he was unaware that the covering physician had prescribed cephalexin.
Errors 3 and 4 occurred at the monitoring stage.

- The physician failed to order vitamin K in response to an elevated INR (error 3).
- Close monitoring was not provided after amoxicillin/clavulanate and warfarin were ordered, which are known to interact (error 4), and which led to an elevated INR.
- **Error 5** occurred at the ordering stage again, when the physician ordered omeprazole in response to a gastrointestinal bleed without considering that the bleed may have been related to the elevated INR.
- **Error 6** was to consider that the patient had been hard to manage, when in fact the issues were predictable.
Let us now consider what might have happened to the patient if the physicians have entered the drug orders directly into a computer using CPOE-CDS.
An on-call physician is contacted by phone and asked to order a prescription for the patient for a urinary-tract infection.

Then the on-call physician goes to his computer, logs in to the secure CPOE system and enters an order to prescribe cephalexin.

A CDS warning appears on the computer screen stating that this patient is taking warfarin, which may interact with cephalexin to produce an elevated INR.
<table>
<thead>
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<th>Order</th>
<th>Pri Ser Date</th>
<th>Time</th>
<th>Allergies</th>
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**Rule Processing**

**WARNING - BLEEDING RISK**  **DRUG INVOLVED: CEPABILEX**

This drug interacts with WARFARIN. Repeat the INR in 3 days. Consider reducing warfarin dose.
The system suggests that the physician order a test for INR level in 3 days and to decrease the recommended dose for the warfarin.

Accordingly, the physician orders a follow-up INR test and lowers the maintenance dose.
The case discussed above illustrates how a simple prescribing decision in the long-term care setting can lead to a cascade of errors culminating in an adverse drug event.

Had a computerized system been in place, such prescribing errors could have been avoided.

CPOE-CDS is a promising new technology that may be very useful in the setting of long-term Care.
A key advantage of CPOE is that decision support can be provided when drug therapies are ordered, even remote.

If the physicians in question had access to a CPOE-CDS system, the patient’s outcome might have been quite different.
EXAMPLE 1

Attention: Renal adjustment is necessary for Vancomycin.
The min interval can be 18 hours. And the max dose can be 30 mg.
Do you want me to correct?

Yes  No
EXAMPLE 2

Renal Alert

You are ordering metformin, which is contraindicated in patients with a creatinine clearance < 50 ml/min.

Mock Patient has a creatinine clearance of 34.3 ml/min.

For clinical questions related to this alert, please contact the PharmD covering your unit or page the PharmD on call (#4958).
SUMMARY

- Adverse drug events are common in long-term care.
- Most errors occur at the ordering and monitoring stages of the prescribing process.
- Computerized physician order entry with clinical decision support has the potential to reduce medication errors, which could lead to a decrease in adverse events.
REFERENCES

THANK YOU