

**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



CLINICAL CASE DISCUSSION

- 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 pharmacotherapy 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.



Order Entry - Patient List

Unit No: H0000004
Acct No: 10000001/00

100.3cm HG: 78.5kg
Allergies/ADRs: E.I.

Order	Qty	Unit	Drug	Prn	Start Date	Time	Adaptions
1	1	IP	Ceftriaxone 500 Mg Po Bid		10/02/08	1:00	Order Date
2							Medications
3							IV Orders
4							Orders
5							Laboratory
6							Di
7							Nursing
8							Dials
9							Diagnosis
10							Modify/View
11							Print
12							Save as Set
13							Refresh
14							Select
15							Back
16							

More

Recent Prescriptions System Alerts Order History
Review/PCI Refill/Cancel Delete



- 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.



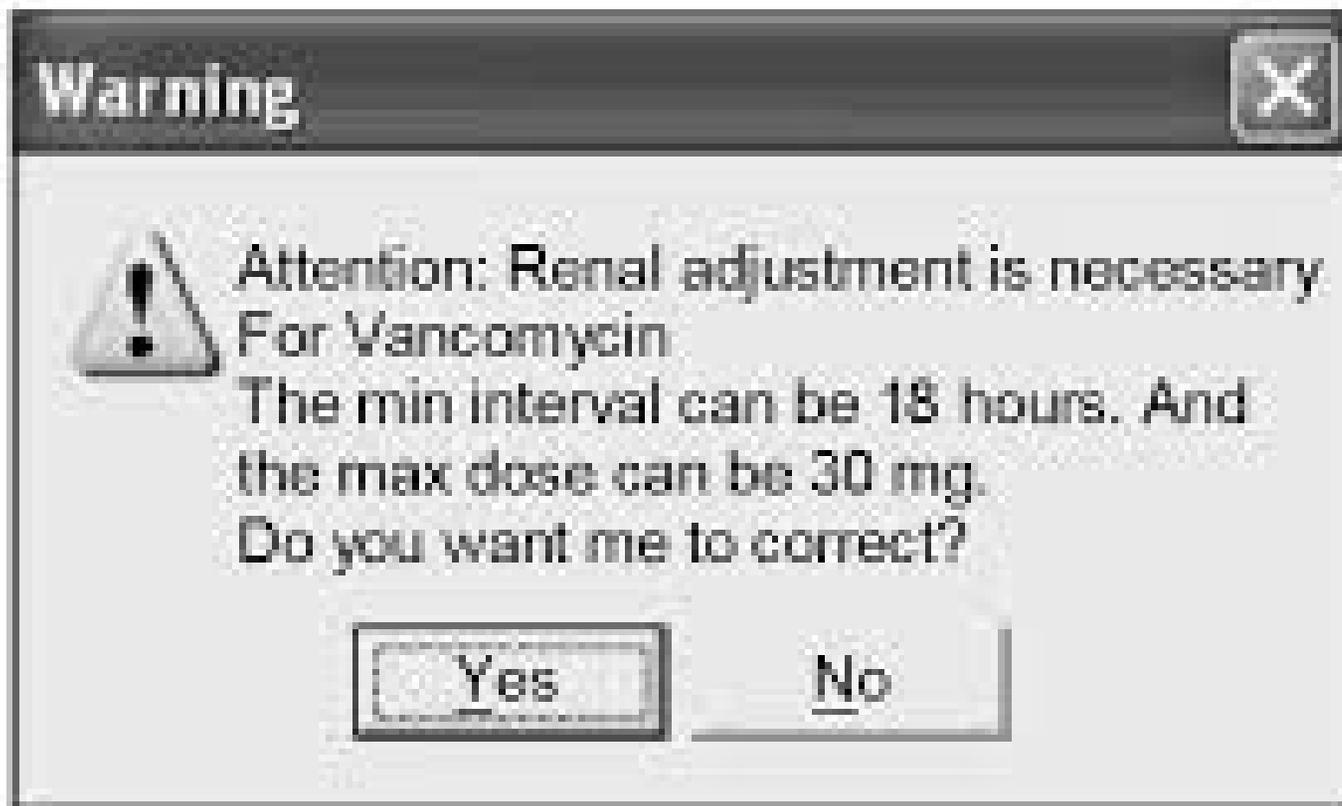
- The case discussed above illustrates how a simple prescribing decision in the long-term care setting can lead to a cascade of errors culminating in an adverse drug event.
- Had a computerized system been in place, such prescribing errors could have been avoided.
- CPOE-CDS is a promising new technology that may be very useful in the setting of longterm Care.



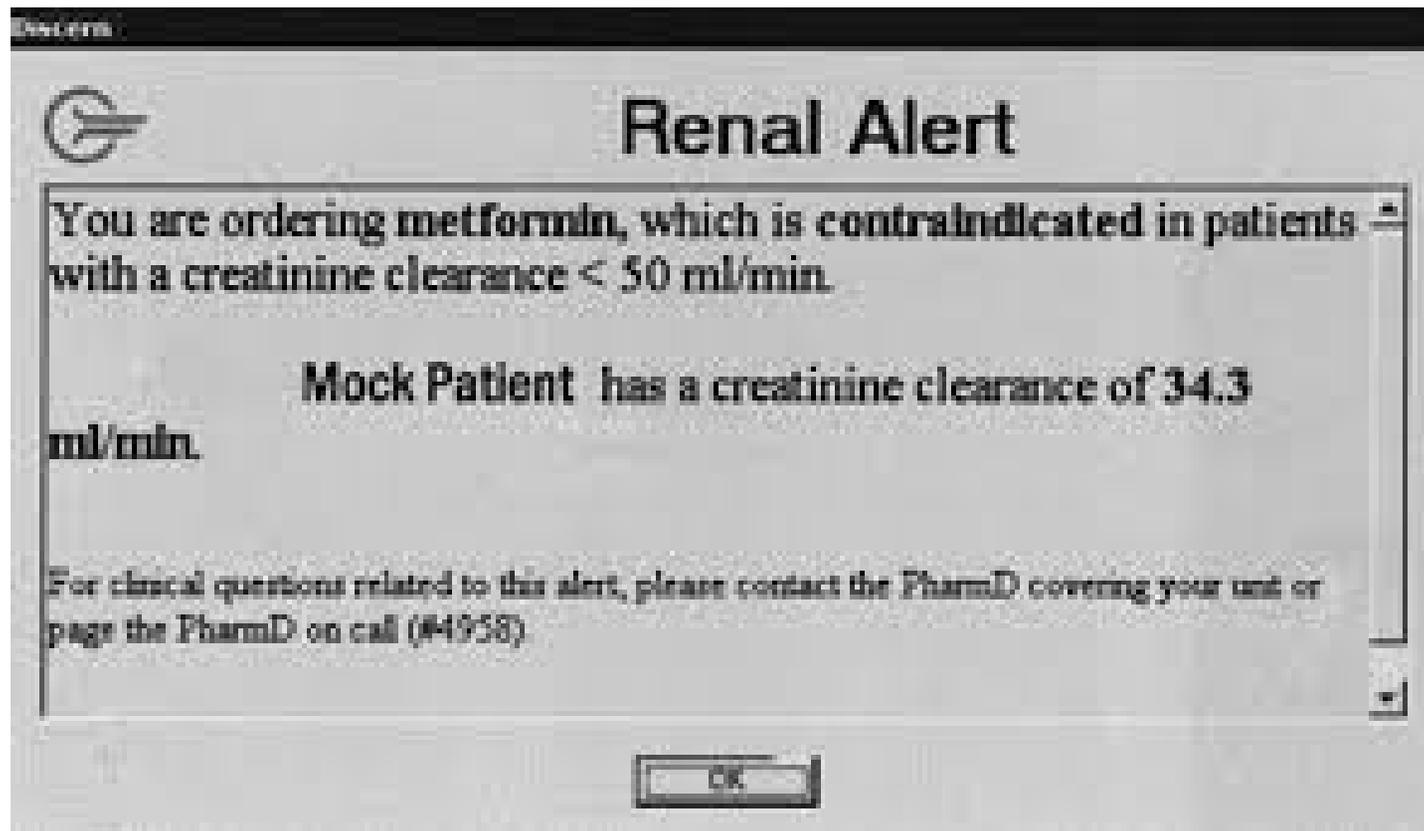
- A key advantage of CPOE is that decision support can be provided when drug therapies are ordered, even remote.
- If the physicians in question had access to a CPOE-CDS system, the patient's outcome might have been quite different.



EXAMPLE 1



EXAMPLE 2



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



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THANK YOU

