Effect of Computerized Physician Order Entry with Clinical Decision Support on Adverse Drug Events in the Long-term Care Setting

Jerry H. Gurwitz, M.D.
Chief, Division of Geriatric Medicine
University of Massachusetts Medical School
Executive Director
Meyers Primary Care Institute
Worcester, Massachusetts
Co-investigators

Terry S. Field
Paula Rochon
James Judge
Leslie Harrold
Monica Lee
Kathleen White
Jane LaPrino
Janet Erramuspe-Mainard
Martin DeFlorio
Linda Gavendo
Chaim Bell
David Bates
Disclosure Statement

The research reported during this presentation was supported by grants from the Agency for Healthcare Research and Quality. The investigators retained full independence in the conduct of this research.
Adverse Drug Events

Medication Errors

Preventable

ADEs
Introduction

Adverse drug events (ADEs) occur frequently among nursing home residents, and preventable adverse drug events are most commonly associated with errors in medication ordering and monitoring.
Incidence of ADEs in Two Large Academic LTC Facilities

- **Adverse drug events**
  - About 10 ADEs per 100 resident-months
- **Preventable adverse drug events**
  - About 4 preventable ADEs per 100 resident-months

## Error Stage for Preventable ADEs

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering</td>
<td>59%</td>
</tr>
<tr>
<td>Dispensing</td>
<td>5%</td>
</tr>
<tr>
<td>Administration</td>
<td>13%</td>
</tr>
<tr>
<td>Monitoring</td>
<td>80%</td>
</tr>
</tbody>
</table>

What is the right approach?

A systems-based approach
Computerized Clinical Decision Support System (CDSS)

- High-severity drug interactions
- Potentially problematic laboratory test results
- Early identification of adverse drug effects through increased monitoring
- Recommendations regarding geriatric-appropriate dosing
- Recommendations for prophylactic measures

Purpose

The purpose of this study was to evaluate the efficacy of computerized physician order entry with clinical decision support for preventing ADEs in the long-term care setting.
Methods

• Study conducted in two large academic long-term care facilities
• Total of 1229 beds
• Total of 29 resident care units were randomized
  – All units had existing CPOE
  – Units randomized to having the CDSS or not
CPOE with Clinical Decision Support

<table>
<thead>
<tr>
<th>Order</th>
<th>Pri Ser</th>
<th>Date</th>
<th>Time</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>Cephalexin 500 Mg Po Qid</td>
</tr>
</tbody>
</table>

**Rule Processing**

WARNING - BLEEDING RISK DRUG INVOLVED: CEPHALAXIN
This drug interacts with WARFARIN. Repeat the INR in 3 days. Consider reducing warfarin dose.
Methods

Drug-related incidents were detected using multiple methods:

- Review of long-term care facility records in monthly segments
- Computer-generated signals
Computer Generated Signals

- Abnormal laboratory results
  - Elevated INRs, high potassium levels
- Medications (antidotes)
  - Vitamin K, sodium polystyrene sulfonate
- Abnormal drug levels
  - Phenytoin
  - Digoxin
Methods

• Chart reviews were performed by trained clinical pharmacist investigators
• Incidents were classified independently by two physician reviewers:
  – adverse drug event
  – severity
  – preventability
## Results

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Resident-Months</th>
<th>Total ADEs</th>
<th>Preventable ADEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>3803</td>
<td>411</td>
<td>152</td>
</tr>
<tr>
<td>Control</td>
<td>3257</td>
<td>340</td>
<td>126</td>
</tr>
</tbody>
</table>
Effect of CPOE with CDS on ADE Rates

Rate Ratio = 1.04 (95% CI 0.89, 1.20)
Effect of CPOE with CDS on Preventable ADE Rates

- Intervention: 4.0
- Control: 3.9

Rate Ratio = 1.03 (95% CI 0.81, 1.32)
Conclusion

Use of CPOE with this particular computerized clinical decision support system was not found to reduce the occurrence of ADEs in the long-term care setting.
Why?…

- The limits of a first-generation system
- Lack of specificity of alerts – alert burden
- Need to increase scope of system to address a broader range of ADEs
- Need to integrate more clinical information into the clinical decision support system
- Setting the bar too high: ADEs vs errors
Computerized Clinical Decision Support System (CDSS)

- Warnings to reconsider specific drug orders
- Recommendations for laboratory monitoring
- Alerts to monitor closely for selected adverse drug effects

Computer on Wheels - “COW”