Errors Associated with the Use of E-Prescribing

Eric Poon MD, MPH
IS Director of Clinical Informatics,
Associate Physician,
Brigham and Women’s Hospital, Boston, MA
Assistant Professor, Harvard Medical School

Supported by a grant from the Risk Management Foundation
Agenda

- Errors associated with e-prescribing
  - Taxonomy with examples
  - Contributing factors
E-Prescribing Comes of Age!

- Strong evidence that electronic prescribing in the inpatient setting prevents serious medication errors
  - Emerging evidence in the ambulatory setting
- Significant interest at the local, state, and federal level
  - 100% e-prescribing target for PCPs and specialists at Partners Healthcare
  - Use of e-prescribing as P4P metric
  - National efforts
Unintended Consequences: The Underbelly of Healthcare Information Technology (HIT)

- Events or outcomes that are neither anticipated nor the specific goals of the associated HIT
  - May be negative or positive
- Best studied more recently in the inpatient setting
  - New errors from use of inpatient CPOE has received significant attention
New Errors: Revisiting an Old Phenomenon

- New errors observed in the inpatient setting (Koppel, Han, Ash)
  - Extend and severity not fully understood in the outpatient setting

- Study goals
  - Develop taxonomy to classify errors
  - Describe contributing factors
Range of Errors Associated with e-prescribing
Key Components of a prescription

- Drug product
- Dose
- Frequency
- Route
- Dispensing quantity
- Refill quantities
- Instructions
- Identification and authentication of prescriber

BRIGHAM INTERNAL MEDICINE ASSOCIATES
ERIC GON-CHEE POON M.D.
75 FRANCIS ST. BOSTON, MA 02115
617-732-8040

Name: BRIDGET MAY OETEST DOB: Feb 13, 1934 Sex: F EWH# 11489866
Address: 11 MAIN STREET
          BOSTON, MA 02115 Date: 06/01/2008

RX
ASPIRIN (ACETYLSALICYLIC ACID) 325MG TABLET
Sig: 2 TABLET (650 MG) PO QD
Dispense: **50** Tablet(s)
Instructions: Special
Refills: **2**
Signature: ERIC GON-CHEE POON M.D.

*Interchange mandated unless the practitioner writes the words NO SUBSTITUTION in this space.*
Methods

- **Drafting of Taxonomy**
  - 2 sets of electronic prescriptions with errors reviewed
    - Convenience sample at CRICO site 1, collected by outpatient pharmacist and medical director of adult primary care practice (200+ prescriptions)
    - Electronic prescription reviewed at CRICO site 2 as part of AHRQ-funded project to evaluate new e-prescribing standards

- **Validation of Taxonomy**
  - 2 focus groups with community pharmacists

- **Contributing factors**
  - Recreation of prescriptions with errors in native system
  - Consultation with informatics and IT professionals
Drug Product Errors

- Incomplete Drug Name
- Strength Omitted or Error in Strength
- Incorrect Drug Chosen and Script Manually Altered
Error in Product Strength

ATENOLOL - fatigue, / PRAVASTATIN - muscle pains, / zocor - muscle pain, / Lipitor - muscle pains,

Calcium + D (500 ELEM. CA) (CALCIUM CARBONATE 1250 MG (500MG ELEM CA)/ VIT D 125 MG 500-200 TABLET
Sig: PO QD

Order by Dose
Frequency: QD

Order by Str/Form
PRN:

Take:
Duration: __________ day(s)

Dispense: __________ Tablet(s)
Start Date: __________

Refills: 5
End Date: __________

Additional Directions

Comments (This will not print on prescription)
Dose Errors

- Dose Omitted
- Incorrect Dose
- Ambiguity in Sig Field
- Dose Incomplete
- Overdose
- Underdose
Ambiguous Dose

11.25mg once a day, or 7.5mg once a day?
Ambiguity in Sig Field

Which do you trust? The computer or the provider’s Spanish?
Route Errors

- Incorrect Route
- Omitted and Should Be PO
- Omitted and should be Other Route
Route Incorrect

Underlying cause: Inadequate synonym support in medication lookup ‘Nuva ring’ (not recognized) vs ‘Nuvaring’ (recognized)
Frequency Errors

- Frequency Omitted
- Frequency Changed
Ambiguous frequency with incorrect hand-written alteration

*Interchange mandated unless the practitioner writes the words 'No substitution' in this space.*
Special Instructions

- Dose Mismatch
- Drug Product Strength Mismatch
- Dose Form Mismatch
- Frequency Mismatch
- Route Dosage Form Mismatch
- PRN is Indicated in Special Instructions but not in the Sig.
- Duration of Therapy Mismatch
- Quantity Mismatch
- Dose and Frequency Mismatch
- PRN Indication Mismatch
- Previous Special Instructions Carrying over on Renewal
Directions that contradict rest of the prescription

Provider lack of familiarity with ‘alternate dosing’ prescribing method
Factors Contributing to Errors: A Preliminary Look
Categories of Contributing Factors

Technology Factors
- User-interface design
- Medication dictionary
- Data entry form factor

User Factors
- Knowledge deficit about application features
- Knowledge deficit about the prescription
- Multi-tasking
- Improper use of short-cuts
- Improper use of free-text

Environmental Factors
- Lack of time during visit
- Placement of computer equipment
Dissecting an Error

Name: [Redacted]
Address: [Redacted]
Date: 05/01/2003

Rx

NORVASC (AMLODIPINE) 7.5 mg
Sig: 1.5 Tablet(s) PO QD
Dispense: 45 Tablet(s)
Directions: [Redacted]
Refills: 5
Signature: [Redacted]

*Interchange mandated unless the practitioner writes the words 'No substitution' in this space.*
What the prescribing module would have looked like…

- Dose field relatively new to clinicians
- Free Text Entry Possible at the time
<table>
<thead>
<tr>
<th>Date Entered</th>
<th>Start Date</th>
<th>Stop Date</th>
<th>Dose</th>
<th>Freq</th>
<th>Str/Frm</th>
<th>Take</th>
<th>Disp</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>09/17/03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/01/03</td>
<td>04/21/2003</td>
<td>04/21/2003</td>
<td>QD</td>
<td>7.5mg</td>
<td>1 Tablet(s)</td>
<td>45 Tablet(s)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>04/21/03</td>
<td>04/21/03</td>
<td>04/21/03</td>
<td>QD</td>
<td>SMG TABLET</td>
<td>1 Tablet(s)</td>
<td>Tablet(s)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Patient’s BP not well controlled on 5mg of Norvasc qd. Increase to 7.5mg qd.
2. Norvasc only available in 2.5mg, 5mg, and 10mg tablets, not in 7.5mg. Provider entered 7.5mg in the strength/form field.

*Special Instructions:*
Writing prescriptions – do we know how to?

- How much training have you received?
- Has anyone ever shown you this relationship?

\[ \text{Dose} \approx \text{Strength} \times \text{Take} \]

- Lisinopril 40mg po once a day
- Lisinopril 20mg tablets
- Take one tablet a day

Dose \approx \text{Strength} \times \text{Take}
Other common contributing factors

- Medication dictionary issues
  - Wrong/not available product in dictionary
- Multi-tasking/distractions/short-cuts
  - Not seeing/checking what is actually been typed in
  - Keyboard vs. pen;
- Propagation of previous errors
- Carry forward of erroneous information during renewals
Preliminary Recommendations
Possible User Interventions

- Focused training on use of e-prescribing module
  - Hands-on, real-life examples
  - ‘Real life’ context
  - Focus on common errors
  - Ongoing effort
- Education about the prescription
  - Medical students & physicians in training
- Develop mechanism so that prescription errors become teaching tools.
- Develop and disseminate best practices for how to incorporate EMR into the visit
Possible Technology Interventions

- Usability study/pilot before new features go-live
- Explore different form factors for data entry
- Monitor for use of free-text in structured fields
- Formalize mechanism for using prescription errors as opportunities to improve user-interface design
Examples of recent improvements

- Relationship between dose, strength and take made more explicit
- Warning appears when free text instructions are typed in
Concluding Remarks

- E-prescribing has significant potential to improve medication safety
- Like all other technologies, e-prescribing opens doors to new errors.
  - Causation often multi-factorial
  - Frustratingly common-place
- Investment in time, energy and mechanism for interventions
Are we still in denial?

SIGNATURE

*Interchange mandated unless the practitioner writes the words NO SUBSTITUTION in this space.

MD INSISTS THAT THIS IS CLEAN DIRECTIONS!!
Acknowledgements

- Thomas Moniz, RPh
- Jeff Rothschild, MD MPH
- Matvey Palchuk, MD MS
- Matthew Ditmore
- Hans Kim, MD