CLINICAL DECISION RULES TO IMPROVE THE DETECTION OF ADVERSE DRUG EVENTS IN EMERGENCY DEPARTMENT PATIENTS

BC Patient Quality and Patient Safety Forum
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I do not have an affiliation (financial or otherwise) with any commercial organization that has a direct or indirect connection to the content of my presentation.

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Introduction

Adverse drug events (ADEs)

“Unintended and harmful events arising from the use or misuse of medications.”

- 4th-6th leading cause of death in Canada/US. (Lazarou, 1996)
- Leading cause of emergency hospitalization. (Budnitz, 2012)
- High health services use and double the cost compared to other patients, after controlling for known confounders. (Hohl, 2011)
Background

We know that:

- 12% ED visits are caused by ADEs. (Zed, 2008)
- 40-50% of ADEs are not identified as drug-related by emergency physicians. (Hohl, 2005 & 2010)
- Screening for “potential” medication-related problems in well patients in the community has not been associated with improvement in patient-oriented outcomes. (Holland, 2005. “HOMER Trial”)
Background

• Why community-based medication review not as effective as we’d like: (Holland, 2006)
  – Patients are well.
  – Integrated resources not available: Linked lab data, health records (diagnostic imaging, consultant records etc.) with drug dispensing records.
  – Isolated providers – poor uptake of recommendations.

• Conclusion: Medication review needs to happen in a different care setting.
Background

• The ED *may* be an ideal setting:
  – Patients self-refer with acute and unexpected medical problems (*i.e.*, ADEs) because they are not well.
  – GPs will send their sick patients to the ED.
  – Open 24/7 and universally accessible.
  – Required resources, including highly-trained clinical pharmacists are readily available.
  – Prevalence of disease is high (12%) – higher yield.
  – Increasing trend to increase pharmacy staffing levels.
Background

• The following *challenges* exist:
  – High volume of ED patients – Can’t screen everyone.
    • Can we find efficiencies?
    • Based on research data, many admitted patients are *not* at high-risk for ADEs, but many discharged patients (i.e., *those* with complex co-morbidities are.)
  – Throughput – Can it be done without increasing ED congestion by prolonging ED length of stay?
    • Can you do it while patients are waiting for other things?
  – Does it help the patient? Does it help the system?
**CURRENT MODEL**

Patient Presents to the ED

1. Triage nurse
2. ED nurse
3. Emergency Physician
4. +/- Consultant(s)

ED Pharmacists assess patients according to their admission status and non-evidence-based criteria. 64% of patients who have an ADE are sent home without seeing a pharmacist.

**PROPOSED CHANGES**

Patient Presents to the ED

1. Triage nurse
2. ED nurse
3. Emergency Physician
4. +/- Consultant(s)

ADE risk status identified

LOW

HI

Usual care

Medication Reconciliation & ADE Screening

Home

Admitted
Objective

• To derive clinical decision rules (CDR) that can be used by an ED nurse at triage to rapidly identify a patient who is at high-risk of an adverse drug event.
Methods

• Prospective multicentre cohort study.

• Included:
  – ≥19 years of age
  – English speaking or translator available
  – Taking prescription or over-the-counter medication within 2 weeks.

• Excluded:
  - Duplicate visits
  - Intentional self-poisoning
  - Left AMA
  - Scheduled revisits (IV antibiotics)
  - Violent
  - Transferred directly to admitting service

• Enrolment:
  – systematic sampling algorithm to create a representative sample.
  – data collection 24/7 during the data collection period.
Triage/ED: nurses collected data on predictor variables using standardized forms.

ED: pharmacist assessment

ED: physician assessment

Interviewed

After the visit:

Concordance of assessments: Dx final.

Discordance/Uncertainty: independent adjudication committee.
2289 patients approached.
1591 patients enrolled:
- 65 (4.1%, 95%CI 3.2-5.2%) with moderate or severe Adverse drug reaction; 131 with an adverse drug event.

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>All Patients (n=1591)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age, years (SD)</td>
<td>51.4 (20.3)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>810 (50.9%)</td>
</tr>
<tr>
<td>Admitted to hospital (%)</td>
<td>287 (18.1%)</td>
</tr>
<tr>
<td>General Practitioner (%)</td>
<td>1358 (86.2%)</td>
</tr>
<tr>
<td>Median No. Medications (IQR)</td>
<td>2 (1,5)</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Potential Predictor Variables</th>
<th>Odds Ratio</th>
<th>Kappa/ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age cutoff $\geq 80$</td>
<td>1.96 (1.24, 3.07)</td>
<td>1 (1,1)</td>
</tr>
<tr>
<td>On $\geq 3$ prescription medications</td>
<td>2.27 (1.56, 3.22)</td>
<td>0.84 (0.70, 0.97)</td>
</tr>
<tr>
<td>Use of over-the-counter medications</td>
<td>0.80 (0.53, 1.21)</td>
<td>0.35 (0.13, 0.58)</td>
</tr>
<tr>
<td>Taking anticoagulant/antiplatelet agent</td>
<td>1.59 (0.88, 2.87)</td>
<td>0.83 (0.65, 1)</td>
</tr>
<tr>
<td>Taking antiarrhythmics</td>
<td>1.51 (0.74, 3.10)</td>
<td>0.38 (-0.18, 0.93)</td>
</tr>
<tr>
<td>Medication changes within 28 days</td>
<td>2.05 (1.42, 2.96)</td>
<td>0.61 (0.38, 0.84)</td>
</tr>
<tr>
<td>On antibiotics in the last 7 days</td>
<td>1.80 (1.15, 2.80)</td>
<td>0.79 (0.56, 1)</td>
</tr>
<tr>
<td>Last hospitalization within 28 days</td>
<td>2.17 (1.34, 3.53)</td>
<td>0.76 (0.54, 0.98)</td>
</tr>
<tr>
<td>Regular general practitioner</td>
<td>0.70 (0.40, 1.25)</td>
<td>0.94 (0.82, 1)</td>
</tr>
<tr>
<td>Self-reported compliance</td>
<td>0.32 (0.18, 0.56)</td>
<td>0.59 (0.41, 0.76)</td>
</tr>
</tbody>
</table>
ADR Rule:

Does the patient have:
- ≥1 comorbid condition, or
- been on antibiotics in the past 7 days?

If yes, proceed to:

Has the patient had:
- a medication change in the past 28d, or
- is the patient 80 years of age or older?

If yes, pharmacist referral recommended.

No further work-up recommended.

Sensitivity: 90.8% (95%CI 81.4-95.7%)
Specificity: 59.1% (95%CI 58.7-59.3%)
Proportion CDR+: 42.5% (95%CI 40.5-45.4%)
Proportion requiring pharmacist referral: 27.9%
Conclusions

• Patients who present to the ED, can be risk-stratified for their risk of ADRs and ADEs using a very brief nursing assessment at triage.

• 22-28% of patients will screen high-risk and require assessment by a pharmacist/medication specialist to pick up $\geq 90\%$ of ADRs up from the present 50-60%.

• The validity, feasibility, acceptability and treatment effect of implementing this rule needs to be evaluated.

• This strategy can be adapted to other settings.
Ongoing Work

- We have implemented the CDR at triage in 3 EDs in the Lower Mainland by:
  - Mapping the work process at triage to understand how to incorporate the CDR at triage.
  - Develop the IT interface at triage to enable screening and electronic flagging.
  - Starting Nov 14th pharmacists started doing medication review and ADE screening on high-risk patients in the ED.
ADR Rule:

Does the patient have:
- ≥1 comorbid condition, or
- been on antibiotics in the past 7 days?

Yes

Has the patient had:
- a medication change in the past 28d, or
- is the patient 80 years of age or older?

Yes

Pharmacist referral recommended.

No

No further work-up recommended.

Sensitivity: 90.8% (95%CI 81.4-95.7%)
Specificity: 59.1% (95%CI 58.7-59.3%)
Proportion CDR+: 42.5% (95%CI 40.5-45.4%)
Proportion requiring pharmacist referral: 27.9%
**ADR Rule:**

<table>
<thead>
<tr>
<th>ADVERSE DRUG REACTION CLINICAL DECISION RULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you taken any medications in the past 2 weeks?</td>
</tr>
<tr>
<td>□ Yes □ No → LOW-RISK</td>
</tr>
<tr>
<td>Do you have <strong>either:</strong></td>
</tr>
<tr>
<td>□ Yes □ No → LOW-RISK</td>
</tr>
<tr>
<td>Have any pre-existing medical problems? OR</td>
</tr>
<tr>
<td>Been on antibiotics in the past 7 days?</td>
</tr>
<tr>
<td>Are you 80 years or older? OR</td>
</tr>
<tr>
<td>Have you changed your medications in the past 28 days?</td>
</tr>
<tr>
<td>□ Yes □ No → LOW-RISK</td>
</tr>
<tr>
<td>HIGH RISK</td>
</tr>
<tr>
<td>Bed</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>A14</td>
</tr>
<tr>
<td>B07</td>
</tr>
<tr>
<td>01</td>
</tr>
<tr>
<td>B01</td>
</tr>
<tr>
<td>B04</td>
</tr>
<tr>
<td>B09</td>
</tr>
<tr>
<td>CH-I</td>
</tr>
<tr>
<td>A06</td>
</tr>
<tr>
<td>B12</td>
</tr>
<tr>
<td>P/D-S</td>
</tr>
<tr>
<td>B06</td>
</tr>
<tr>
<td>A05</td>
</tr>
<tr>
<td>ST-C</td>
</tr>
<tr>
<td>B10</td>
</tr>
<tr>
<td>08</td>
</tr>
<tr>
<td>A03</td>
</tr>
</tbody>
</table>
Snapshot of CDR Implementation at Triage:

<table>
<thead>
<tr>
<th></th>
<th>Number of ED patients</th>
<th>Number of blank screens</th>
<th>Proportion Screened</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VGH (Sept 14&lt;sup&gt;th&lt;/sup&gt;)</strong></td>
<td>27,172</td>
<td>769</td>
<td>&gt;99%</td>
</tr>
<tr>
<td><strong>RHS (Oct 26&lt;sup&gt;th&lt;/sup&gt;)</strong></td>
<td>10,437</td>
<td>3,113</td>
<td>29.8%</td>
</tr>
<tr>
<td><strong>LGH (Nov 16&lt;sup&gt;th&lt;/sup&gt;)</strong></td>
<td>8,915</td>
<td>687</td>
<td>&gt;99%</td>
</tr>
</tbody>
</table>
Snapshot of CDR Implementation at Triage:

<table>
<thead>
<tr>
<th></th>
<th>Number of ED patients</th>
<th>Accuracy 12/11</th>
<th>Accuracy 01/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGH (Sept 14(^{th}))</td>
<td>27,172</td>
<td>84%</td>
<td>79%</td>
</tr>
<tr>
<td>RHS (Oct 26(^{th}))</td>
<td>10,437</td>
<td>79%</td>
<td>82%</td>
</tr>
<tr>
<td>LGH (Nov 16(^{th}))</td>
<td>8,915</td>
<td>93%</td>
<td>91%</td>
</tr>
</tbody>
</table>
## Triage Time

<table>
<thead>
<tr>
<th></th>
<th>Pre Implementation (mm:ss)</th>
<th>Post Implementation (mm:ss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGH (Nov 16th)</td>
<td>6:40 (SD 3:02)</td>
<td>4:59 (SD 2:09)</td>
</tr>
</tbody>
</table>
Snapshot of CDR Implementation at Triage:

<table>
<thead>
<tr>
<th></th>
<th>Number of ED patients screened</th>
<th>Number of ED patients high-risk</th>
<th>Proportion High-Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGH</td>
<td>26,403</td>
<td>7,269</td>
<td>27.5%</td>
</tr>
<tr>
<td>(Sept 14th)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RHS</td>
<td>7,324</td>
<td>2,104</td>
<td>28.7%</td>
</tr>
<tr>
<td>(Oct 26th)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LGH</td>
<td>8,228</td>
<td>3,024</td>
<td>39%</td>
</tr>
<tr>
<td>(Nov 16th)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Snapshot of the Implementation of Medication Review by Pharmacists

<table>
<thead>
<tr>
<th></th>
<th>Number of Med Reviews Done</th>
<th>Number of ADEs indentified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VGH</strong></td>
<td>1,252</td>
<td>204</td>
</tr>
<tr>
<td>(Nov 14\textsuperscript{th})</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RHS</strong></td>
<td>410</td>
<td>30</td>
</tr>
<tr>
<td>(Dec 12\textsuperscript{th})</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LGH</strong></td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>(Feb 1\textsuperscript{st})</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How well are we picking up ADEs?

<table>
<thead>
<tr>
<th></th>
<th>ADE miss-rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGH &amp; RHS</td>
<td>25/214 (12.3%)</td>
</tr>
</tbody>
</table>

VGH/RHS determined by systematic sampling of low-risk group that would normally not be seen by pharmacists.

Based on two prior studies the ADE miss rate by physicians is 40-50%.
### PharmaNet Profile

**PATHNET, DESMOND**  
**PHONE:** BC-9401416336  
**DOB:** 1944 Dec 25  
**Sex:** M

#### Training DB/ED  
Site ID: HNPSE Network ID: 5001800120

**Please select which type of report to view:**  
- PharmaNet Standard profile  
- Cumulative by Date  
- By DIN  
- Most Recent Profile per Medication

**Include data for:**  
- Previous months: 14  
- Recent prescriptions: All prescriptions  
- Selected drugs: Show all drugs

### Adverse Reaction: 3 found

**ETHICHLOVRINOL**  
**DIN:** 19  
**WATERIN SODIUM**  
**200 MG CAPSULE**  
**ABBOTT LABS**  
**4 MG TABLET**  
Reported by: Patient, 2008 Apr 23

**Furosemide**  
**40 MG TABLET**  
**NU-PHARM INC**  
**30.0 @ 1.000/day**  
**One tablet daily**  
**2012 Jun 5**  
**Rx: Filled**

**Furosemide**  
**40 MG TABLET**  
**APOTEX INC**  
**30.0 @ 1.000/day**  
**One tablet daily**  
**2012 Jun 1**  
**Rx: Filled**

**Medication Review Pharmacist C**  
**PRINDEO 002**  
**UNKNOWN**  
**10.0 @ 1.000/day**  
**10 AM/PM**  
**2012 Jun 1**  
**Rx: Filled**

**Amlodipine Besylate**  
**5 MG TABLET**  
**BAYPHARM INC**  
**1000.0 @ 1.000/day**  
**Rx: Filled**
Stay Tuned

- Preliminary data on feasibility, acceptability and workload implications for pharmacists by mid April.
- Preliminary estimate of effect on downstream health services utilization in 2013.