Push-Alert Notifications of Troponin Results to Physician Smartphones: Impact on Emergency Department Patient Flow

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Thank You

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Conflicts of Interest

• None to declare

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Smartphone Push-Alert Notifications

- Reducing ED LOS an ongoing challenge
- Disposition decisions often hinge on labs, particularly troponins
- Push-alert notifications puts results in physician hands as soon as they are available
- Since 2011, ED physicians have access to hospital iPhones with push-alert functions
Push-Alert Program: How It Works
Push-Alert Program: How It Works

- EDIS: Emergency Department Information System
Push-Alert Program: How It Works

- EPR: the Electronic Patient Record
Push-Alert Program: How It Works

- **Lab**
  - Any programmed results

- **EPR**
  - Available to view on desktops

- **EDIS**
  - Identifies MRP

- **Phone**
  - Push-alert to correct physician’s phone
Push-Alert Program: How It Works

To: EDPhysician32 #SB more...

TROponIN T, HIGH SENSITIVITY
May 12, 2015 at 11:49 PM

Name, Location 22.
TROponIN T, HIGH SENSITIVITY
Results NORMAL

TRPThS <5
TRPThS
TRPThS CAUTION: This is a new
high-sensitivity
Initial Roll Out: 2011

- Pre-implementation survey regarding results to include in push-alert program
- ALL troponins (critical, high, normal)
- All other lab tests (e.g. Na, K), critical only
Before-After Study: CAEP 2014

• Median time to disposition for ED patients with chest pain or ACS
• One year before implementation: Jul 2009-Jun 2010
• One year after implementation: Jul 2011-Jun 2012
• Median time dropped 2.55 h to 1.78 h, $p<0.01$

However...

• Other simultaneous initiatives to improve ED LOS

• Post implementation survey of physicians suggested too many alerts, too many interruptions, particularly from troponins (high, normal, critical)
Objective

• Conduct a randomized clinical trial

• Measure the impact of push-alert notifications of troponin results on time to disposition for patients discharged from the ED with chest pain
Methods: Study Setting

- Feb 1 to Oct 15, 2014
- Sunnybrook Health Sciences Centre (SHSC)
- Tertiary care, academic centre, fully affiliated with the University of Toronto
- ED: 58,500 patients annually
- 34% of ED patients have at least one troponin
Methods: Study Design

• Prospective, cluster randomized trial

• Unit of randomization was by physician, unit of analysis was by patient
Methods: Physicians

- Half ED physicians randomized to intervention group:
  - Same fully functional smartphones
  - All critical results (Na, K)
  - All troponin results (critical, high, or normal)

- Half ED physicians randomized to control group:
  - Same fully functional smartphones
  - All non-troponin critical results (Na, K)
  - NO troponin results
Methods: Patients

• Inclusion Criteria:
  – Treated by participating physician during study period
  – Discharged from the ED with chest pain

• Exclusion Criteria:
  – Referred to a specialist before discharge
Methods: Outcome Measure

• For each included patient, we measured the time interval between:
  – Time of the final troponin posting on EPR
  – Time of discharge decision (“discharge ready” on EDIS)
• Compared median time intervals for
  – Patients of physicians in intervention group
  – Patients of physicians in control group
Hypothesis

We hypothesized that physicians in the intervention group would discharge patients faster than physicians in the control group.
Statistics

• “Cluster” randomized trial
  – Individual physicians were clusters
  – Need to account for variability between clusters
  – Mixed Linear Models were used

• Highly skewed data
  – Distribution of the primary outcome (time to discharge decision)
  – We used log transformed data
Results

Eligible Physicians: 34

Consent Obtained: 26

Intervention Group
13 Physicians
563 Patients

Control Group
13 Physicians
562 Patients
# Results: Demographics

<table>
<thead>
<tr>
<th></th>
<th>Intervention Group n=563</th>
<th>Control Group n=562</th>
<th>All patients n= 1125</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females (%)</td>
<td>294 (52.2)</td>
<td>313 (55.7)</td>
<td>607 (54.0)</td>
</tr>
<tr>
<td>Age (Median, IQR)</td>
<td>53.0, (42.0 – 66.0)</td>
<td>54.0, (42.0 - 67.0)</td>
<td></td>
</tr>
<tr>
<td>CTAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2 (0.4)</td>
<td>3 (0.5)</td>
<td>5 (0.4)</td>
</tr>
<tr>
<td>2</td>
<td>412 (73.2)</td>
<td>389 (69.2)</td>
<td>801 (71.2)</td>
</tr>
<tr>
<td>3</td>
<td>147 (26.1)</td>
<td>166 (29.5)</td>
<td>313 (27.8)</td>
</tr>
<tr>
<td>4</td>
<td>2 (0.4)</td>
<td>3 (0.5)</td>
<td>5 (0.4)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>1 (0.2)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>Seen with Resident</td>
<td>190 (33.8)</td>
<td>183 (32.6)</td>
<td>373 (33.2)</td>
</tr>
<tr>
<td>Crowding Measure</td>
<td>1.6 (1.08 – 2.33)</td>
<td>1.73 (1.20– 2.32)</td>
<td></td>
</tr>
</tbody>
</table>
Results: Primary Outcome

Median Time to Discharge Decision

Control: 99.6 minutes
Intervention: 75.6 minutes

Difference = 24 minutes; p = 0.031
Conclusions

• Physicians who received troponin results on their smartphones discharged their patients with chest pain 24 minutes faster than physicians without troponin notifications.

• For these patients, the smartphone push-alert notification system effectively improved flow through the ED.
Limitations

• Cannot measure actual usage of push-alerts
• Unclear extrapolation to other patients, only those discharged home with chest pain
• Potentially to negatively impact LOS of other patients
• Further research is needed to assess impact on overall ED LOS, and in other settings
Thank you!

Questions?