The Effects of Harm Events on the Rate of 30-day Readmissions in Surgical Patients

Pridvi Kandagatla, Henry Ford Health System, pkandag2@hfhs.org
Wan-Ting Su, Henry Ford Health System, wsu1@hfhs.org
Indra Adrianto, Henry Ford Health System, IAdrian1@hfhs.org
Christina Shabet, Henry Ford Health System
Jessica Hauesler, Henry Ford Health System

See next page for additional authors

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THE EFFECTS OF HARM EVENTS ON THE RATE OF 30-DAY READMISSIONS IN SURGICAL PATIENTS

Pridvi Kandagatla MD, Wan-Ting Su PhD, Indra AdrianTo PhD, Jack Jordan MS, Jessica Hauesler MA, Ilan Rubinfeld MD

HENRY FORD HEALTH SYSTEM/WAYNE STATE UNIVERSITY
DISCLOSURES

I do not have any relevant financial relationship(s) with any commercial interest that pertains to the content of my presentation.
BACKGROUND

• Hospital readmission rates have been used as a quality benchmark for health systems, but also as a means to bend the healthcare cost curve.

• Readmissions are an increasingly important for improvement.
  – Identification of factors associated with readmission is critical to predict high-risk patients for early interventions.
  – Adverse safety events could place a burden on patients and cause readmissions\(^\text{[1,2]}\).
• **“No Harm Campaign”** innovative approach from Henry Ford Health System (HFHS):
  – Highlighted harmful events

• HFHS e-harm measuring system
  – Over time, harms were labelled electronically, also updated automatically within 24 hours
  – Harms occurring during an inpatient stay can improve our understanding of downstream adverse occurrences (e.g. readmission, mortality, etc.)
OBJECTIVES

- Objective 1:
  Harms

- Objective 2:

- Hypothesis:
  - Inpatient harm events increase the likelihood of readmission in surgical patients.
## METHODS

### Data
- Henry Ford Health System inpatient registry (year 2015-2017) for all hospitals
- Surgical Cohort: 37,566 out of total 105,143 encounter CSNs
  - Exclusion: expired patients

### Variable
- 30-day HFHS readmission
- 23 harm events with converted binary codes
- Others: age, gender, race, and facility (5 hospitals)

### Statistical Analysis
- Descriptive analysis
- Uni-variable/Multi-variable analysis using logistic regression (R software)
## RESULTS — PATIENT CHARACTERISTICS

<table>
<thead>
<tr>
<th>Facility, n (%)[^2]</th>
<th>No Readmission N1 = 34,161 (92.2%)</th>
<th>Readmission N2 = 2,887 (7.8%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital 1</td>
<td>13,979 (89.8)</td>
<td>1,595 (10.2)</td>
<td></td>
</tr>
<tr>
<td>Hospital 2</td>
<td>8,074 (94.1)</td>
<td>502 (5.9)</td>
<td></td>
</tr>
<tr>
<td>Hospital 3</td>
<td>6,374 (94.6)</td>
<td>364 (5.4)</td>
<td></td>
</tr>
<tr>
<td>Hospital 4</td>
<td>4,833 (93.2)</td>
<td>353 (6.8)</td>
<td></td>
</tr>
<tr>
<td>Hospital 5</td>
<td>901 (92.5)</td>
<td>73 (7.5)</td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>1,143 (93.6)</td>
<td>78 (6.4)</td>
<td></td>
</tr>
<tr>
<td>Non-Black &amp; Non-</td>
<td>25,457 (92.6)</td>
<td>2,048 (7.4)</td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[^2]: p-value < 0.001[^3]
RESULTS – HARM EVENTS

- Mucosal Pressure Ulcer
- Central Line Associated Blood Stream Infection
- Clostridium Difficile Toxin Positive
- Internationalized Normalized Ratio > 5
- Catheter-Associated Urinary Tract Infection
- Glucose < 40
- Stage II Pressure Ulcer
- Deep Tissue Injury Pressure Ulcer
- Stage III, IV, Unstageable Pressure Ulcer
- Glucose > 400
- Return to ICU within 48 Hours
- Venous Thromboembolic Event (DVT/PE)
- Blue Alert
- Acute Renal Failure
- Clostridium Difficile PCR Positive
- Benzodiazepine Reversal Administration of benzodiazepine reversal agent
- Bleeding
- Ventilator Associated Event
- Opioid Reversal Administration of opioid reversal agent
- Delirium
- ICU for 24 Hours
- Return to OR after delivery
- Obstetric Hemorrhage

Readmission Rate (%)
<table>
<thead>
<tr>
<th>Harm Type</th>
<th>Unadjusted</th>
<th></th>
<th>Adjusted (Age, Gender, Race, Facility)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>p-value</td>
<td>OR</td>
<td>p-value</td>
</tr>
<tr>
<td>Mucosal Pressure Ulcer</td>
<td>9.71</td>
<td>&lt;0.001</td>
<td>3.15</td>
<td>0.019</td>
</tr>
<tr>
<td>Central Line Associated Blood Stream Infection</td>
<td>7.9</td>
<td>&lt;0.001</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Clostridium Difficile – Toxin Positive</td>
<td>4.75</td>
<td>&lt;0.001</td>
<td>2.96</td>
<td>0.014</td>
</tr>
<tr>
<td>Internationalized Normalized Ratio &gt; 5</td>
<td>4.17</td>
<td>&lt;0.001</td>
<td>1.62</td>
<td>0.234</td>
</tr>
<tr>
<td>Catheter-Associated Urinary Tract Infection</td>
<td>4.12</td>
<td>&lt;0.001</td>
<td>1.5</td>
<td>0.267</td>
</tr>
<tr>
<td>Glucose &lt; 40</td>
<td>3.72</td>
<td>&lt;0.001</td>
<td>2.32</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stage II Pressure Ulcer</td>
<td>3.42</td>
<td>&lt;0.001</td>
<td>1.36</td>
<td>0.071</td>
</tr>
<tr>
<td>Deep Tissue Injury Pressure Ulcer</td>
<td>3.24</td>
<td>&lt;0.001</td>
<td>1.48</td>
<td>0.077</td>
</tr>
<tr>
<td>Stage III, IV, Unstageable Pressure Ulcer</td>
<td>3.23</td>
<td>&lt;0.001</td>
<td>1.3</td>
<td>0.415</td>
</tr>
<tr>
<td>Glucose &gt; 400</td>
<td>3.14</td>
<td>&lt;0.001</td>
<td>2.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Return to ICU within 48 Hours</td>
<td>3.1</td>
<td>&lt;0.001</td>
<td>1.56</td>
<td>0.065</td>
</tr>
<tr>
<td>Venous Thromboembolic Event (DVT/PE)</td>
<td>3.08</td>
<td>0.001</td>
<td>1.82</td>
<td>0.001</td>
</tr>
<tr>
<td>Blue Alert</td>
<td>3.03</td>
<td>&lt;0.001</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Acute Renal Failure</td>
<td>3.01</td>
<td>&lt;0.001</td>
<td>1.91</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bleeding</td>
<td>2.39</td>
<td>&lt;0.001</td>
<td>1.58</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Delirium</td>
<td>1.96</td>
<td>0.001</td>
<td>1.09</td>
<td>0.333</td>
</tr>
<tr>
<td>Obstetric Hemorrhage</td>
<td>0.2</td>
<td>&lt;0.001</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
RESULTS — PREDICTION MODEL

AUC: Area Under the Curve
0.5 — Chance
1.0 — Perfect

AUC = 0.66
- Significant Harm Events
  - Age, Gender, Race, Facility

AUC = 0.70
- Social determinate of health (SDOH)
  - Discharge disposition
  - Charlson comorbidity score

AUC = 0.73
- Brief texts
  - ICD-10, MS-DRG, and APR-DRG
CONCLUSIONS

• Harm events were independent predictors for 30-day readmission

• Using harm events, we developed a prediction model to predict readmission

• Limitations:
  • Single hospital system
  • Small sample size for some harm events

• Future directions:
  • Further refine the prediction model
  • Use a refined prediction model to identify patients at high risk, and intervene
QUESTIONS?

Thank you!