HEEL PRESSURE INJURY RISK FACTORS IN THE HOSPITALIZED PATIENT

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Disclosures

• Board of Directors: National Pressure Ulcer Advisory Panel & American Professional Wound Care Association
• Advances in Skin & Wound Care, Editorial Advisory Board
• Monument Analytics, Consultant

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Heels are a common PI location
  • #2 site\textsuperscript{1,2,3,4,5,6}
  • Most frequently occurring location for DTPIs (41\%) compared to sacrum (19\%) & buttocks (13\%)\textsuperscript{7}
  • Despite global efforts to ↓ occurrence, they persist
HPI Risk Factors in the Hospitalized Patient - Purpose

• **Primary aim**
  – Replicate our previous research, which found 4 significant & independent predictors for HPIs in the hospitalized patient, using a larger, more diverse population:
    • DM, Vascular Disease, Admission Braden $\leq 18$, Immobility$^8$

• **Secondary aim**
  – Create an enabler for a heel-specific assessment
HPI Risk Factors in the Hospitalized Patient

**Design:** Retrospective, case-control study (main & validation analyses) using the NY Statewide Planning & Research Cooperative System (SPARCS) – 1/1/14 – 6/30/15

**Inclusion Criteria**
Hospitalized adult patients ≥ 18 years old (w/ & w/out HPIs)

**Exclusion Criteria**
- Patients w/ heel vascular wounds
- Obstetric & Psychiatric patients
- Children < 18 years old
  - Prone to device-related PIs\textsuperscript{9,10,11}
- Previous research - 0.1\%\textsuperscript{8}

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**HPI Risk Factors in the Hospitalized Patient – Sample Size**

**SPARCS (1/1/2014-6/30/2015)**

- 2,301

- CAPIs
- CAPIs & HAPIs mix
- Incomplete HPI data (364 removed)

- 1,937
  - 403 cases HAHPIs
  - 1,534 controls (w/out any PIs)

**Main Analysis – 1,697**
- 323 cases w/ HPIs
- 1,374 controls w/out HPIs

**Validation Analysis – 240**
- 80 cases w/ HPIs
- 160 controls w/out HPIs
HPI Risk Factors in the Hospitalized Patient - Variables

- Impaired nutrition (ICD-9 codes)
- Obesity conditions (ICD-9 codes)
- Vascular disease (ICD-9 codes)
- ESRD (ICD-9 codes)
- Neuropathy (ICD-9 codes)
- Perfusion issues (ICD-9 codes)
- DM diagnosis I/II (ICD-9 codes)
- Surgery (ICD-9 codes)
- Immobility (ICD-9 codes)
- Mechanical ventilation (ICD-9 codes)
- ICU stay
- Lower extremity fractures (ICD-9 codes)
- Age

Demographics
sex, race, age, admitting diagnosis, TTL LOS

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HPI Risk Factors in the Hospitalized Patient - Methods

**Main Analysis**

- Series of univariate & bivariate analyses - select predictor variables
- Series of forward stepwise regression analyses - select variables significantly & independently associated w/HPI
- Final forward stepwise regression analysis - create final model
- ROC curve to assess model accuracy

**Validation Analysis**

- Model tested - data unrelated to model development
# HPI Risk Factors in the Hospitalized Patient - Results

## Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Main analysis (n = 1,697)</th>
<th>Validation analysis (n = 240)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases (n = 323)</td>
<td>Controls (n = 1,374)</td>
</tr>
<tr>
<td></td>
<td># patients (%)</td>
<td># patients (%)</td>
</tr>
<tr>
<td><strong>Age, mean (sd)</strong></td>
<td>74.4 (15.4)</td>
<td>55.8 (21.5)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 - 64</td>
<td>78 (24.1)</td>
<td>852 (62.0)</td>
</tr>
<tr>
<td>≥ 65</td>
<td>245 (75.9)</td>
<td>522 (38.0)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>175 (54.2)</td>
<td>838 (61.0)</td>
</tr>
<tr>
<td>Male</td>
<td>148 (45.8)</td>
<td>536 (39.0)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish/Hispanic origin</td>
<td>1 (0.3)</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Other</td>
<td>305 (94.4)</td>
<td>1295 (94.3)</td>
</tr>
<tr>
<td>Unknown</td>
<td>17 (5.3)</td>
<td>70 (5.1)</td>
</tr>
<tr>
<td><strong>Length of stay (median days)</strong></td>
<td>18.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
### HPI Risk Factors in the Hospitalized Patient - Results

<table>
<thead>
<tr>
<th>HPI stage (ICD-9)</th>
<th>Main (n=323) # PIs (%)</th>
<th>Validation (n=80) # PIs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1 (707.21)</td>
<td>69 (21.4)</td>
<td>22 (27.5)</td>
</tr>
<tr>
<td>Stage 2 (707.22)</td>
<td>99 (30.7)</td>
<td>21 (26.3)</td>
</tr>
<tr>
<td>Stage 3 (707.23)</td>
<td>16 (5.0)</td>
<td>4 (5.0)</td>
</tr>
<tr>
<td>Stage 4 (707.24)</td>
<td>13 (4.0)</td>
<td>4 (5.0)</td>
</tr>
<tr>
<td>Unstageable (707.25)</td>
<td>92 (28.5)</td>
<td>25 (31.3)</td>
</tr>
<tr>
<td>Unspecified (707.20)</td>
<td>34 (10.5)</td>
<td>4 (5.0)</td>
</tr>
</tbody>
</table>
# HPI Risk Factors in the Hospitalized Patient - Results

Main analysis results - significant & independent predictors of HPI, N=1,697

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Regression Coefficient</th>
<th>SE</th>
<th>P</th>
<th>Odds Ratio</th>
<th>95% CIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>0.33</td>
<td>0.16</td>
<td>0.03</td>
<td>1.4</td>
<td>1.0 - 1.9</td>
</tr>
<tr>
<td>Vascular Disease</td>
<td>1.12</td>
<td>0.27</td>
<td>0.001</td>
<td>3.1</td>
<td>1.8 – 5.2</td>
</tr>
<tr>
<td>Perfusion Issues</td>
<td>1.02</td>
<td>0.16</td>
<td>&lt;0.001</td>
<td>2.8</td>
<td>2.1 – 3.8</td>
</tr>
<tr>
<td>Impaired Nutrition</td>
<td>1.92</td>
<td>0.26</td>
<td>&lt;0.001</td>
<td>6.9</td>
<td>4.1 – 11.5</td>
</tr>
<tr>
<td>Age ≥ 65</td>
<td>1.20</td>
<td>0.16</td>
<td>&lt;0.001</td>
<td>3.3</td>
<td>2.4 – 4.6</td>
</tr>
<tr>
<td>Mechanical Ventilation</td>
<td>2.05</td>
<td>0.32</td>
<td>&lt;0.001</td>
<td>7.7</td>
<td>4.2 – 14.3</td>
</tr>
<tr>
<td>Surgery</td>
<td>0.61</td>
<td>0.16</td>
<td>&lt;0.001</td>
<td>1.8</td>
<td>1.3 – 2.5</td>
</tr>
</tbody>
</table>
HPI Risk Factors in the Hospitalized Patient - Results

AUC=84.2

ROC Curve

Sensitivity

1 - Specificity

Diagonal segments are produced by ties.

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HPI Risk Factors in the Hospitalized Patient - Limitations

- Retrospective design
- Dataset
  - Data quality issues
  - Coding errors
HPI Risk Factors in the Hospitalized Patient - Summary

• Primary Aim
  – Identified 7 risk factors

• Secondary Aim
  – Enabler created (mnemonic)
Thank You Research Team!

Co-Investigators
Dr. Elizabeth Ayello, PhD, RN, CWON, ETN, MAPWCA, FAAN
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Data Analyst
Daniel Smith, MA

Biostatistician
Linda Rolnitzky, MS
THANK YOU
References


