IS THE BRADEN MOBILITY SUBSCALE ALONE AS PREDICTIVE AS THE BRADEN SCALE?

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DEVASTATING EFFECTS OF PRESSURE ULCER

Pressure injury can cause pain, severe infection, long hospital stays or risk of death

Pieper, Langemo & Cuddigan 2009

Spinal Injury Network, accessed 2011
IMPACT OF PRESSURE INJURY

- Number of PU: 2.5 million
- Cost: $9.1 to $11.6 billion per year in the US
- Cost to individual: $20,900 to $151,700 per PU
- Lawsuit: 17,000 annually (2nd after wrongful death, > falls or emotional distress)
- Complications: Severe pain, serious infections
- Death: About 60,000 per year as a direct result of PU

Additional Cost for managing patients with pressure injury is estimated at AUD$12.2 million in Western Australia
PREVENTING PRESSURE INJURY ~

Assess risk of pressure injury using risk assessment scale like the Braden scale
(Braden scale has been well validated in many studies to predict risk of pressure injury)

Institute preventive interventions to patient’s identified as ‘at risk’ for developing pressure ulcer

At the study site - Pressure injury is assessed routinely on admission using the Braden scale
# BRADEN RISK ASSESSMENT SCALE (ABRIDGED VERSION)

<table>
<thead>
<tr>
<th>BRADEN SCORE</th>
<th>SENSORY</th>
<th>MOISTURE</th>
<th>ACTIVITY</th>
<th>MOBILITY</th>
<th>NUTRITION</th>
<th>FRICTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Impairment</td>
<td>4</td>
<td>Rarely Moist</td>
<td>4</td>
<td>4 No Limitation</td>
<td>4 Excellent</td>
</tr>
<tr>
<td>3</td>
<td>Slightly Impaired</td>
<td>3</td>
<td>Occasionally Moist</td>
<td>3</td>
<td>3 Slightly Limited</td>
<td>3 Adequate</td>
</tr>
<tr>
<td>2</td>
<td>Very Limited</td>
<td>2</td>
<td>Moist</td>
<td>2</td>
<td>2 Very Limited</td>
<td>2 Probably Adequate</td>
</tr>
<tr>
<td>1</td>
<td>Completely Limited</td>
<td>1</td>
<td>Constantly Moist</td>
<td>1</td>
<td>1 Immobile</td>
<td>1 Very Poor</td>
</tr>
</tbody>
</table>

## Braden Score

<table>
<thead>
<tr>
<th>Braden Score</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 9</td>
<td>Very high risk</td>
</tr>
<tr>
<td>10 - 12</td>
<td>High risk</td>
</tr>
<tr>
<td>13 – 14</td>
<td>Medium risk</td>
</tr>
<tr>
<td>15 - 16</td>
<td>Low risk</td>
</tr>
<tr>
<td>≥ 17</td>
<td>No risk</td>
</tr>
</tbody>
</table>
PROBLEMS WITH USING RISK ASSESSMENT SCALE (1)

- Comprise of many subscales
- Complex scoring

• Nurses to consider all risk factors independent of the scores obtained on any validated pressure ulcer prediction scales

Lyder 2008 – AHRQ publication
PROBLEMS WITH USING RISK ASSESSMENT SCALE (2)

Findings of a systematic review found Braden scale:
• Most validated
• Best predicted pressure injury compared to Clinical Judgment, Norton and Waterlow scales

BUT

Use of validated risk assessment scale appears to have no significant effect on incidence of pressure injury

Pancorbo-Hidalgo, 2006

Predicting risk of pressure ulcer ≠ Reducing incidence of pressure ulcer

Anthony, 2010
IS THERE AN ALTERNATIVE? (1)

In a 3 arm cluster randomised study in Riyadh, Saudi Arabia evaluated effectiveness of Braden Scale

Clinical Judgment vs Braden Scale

✓ RR=0.478
(95% CI: 0.279 – 0.82, p=0.009)

× RR=0.657
(95% CI: 0.384 – 1.123, p=0.167)

BUT

Limitations of Clinical Judgment
× Lacks structure
× Inconsistent assessment
× Issues with reliability and repeatability

(Saleh, 2008)

Pancarbo-Hidalgo, 2006
IS THERE AN ALTERNATIVE? (2)

Nurses implement preventive interventions based on assessment of patient’s mobility impairment

Fisher et al 2004

Immobility is a significant risk factor for pressure ulcer development

Lindgren, 2004
IS THERE AN ALTERNATIVE? (3)

<table>
<thead>
<tr>
<th>Braden subscale</th>
<th>Preventive Interventions</th>
<th>Repositioning</th>
<th>Angle of bed below 30°</th>
<th>Pillows or foam wedges</th>
<th>Mattress</th>
<th>Heels off bed/float</th>
<th>Chair cushion</th>
<th>Padding between bony prominence</th>
<th>Consult Dietitian</th>
<th>Protect skin from moisture</th>
<th>Protect skin from friction &amp; shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory perceptual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1)1.76(NS)</td>
<td>(1) 1.94</td>
<td>(1) 20.84(NS)</td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2)1.98</td>
<td>(2) 0.98</td>
<td>(2) 2.39</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3)0.776</td>
<td>(3) 0.41(NS)</td>
<td>(3) 1.7</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1) 2.92</td>
<td>(1) 2.92</td>
<td>(1) 2.92</td>
<td>(1) 2.89</td>
</tr>
<tr>
<td>Nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) 2.89</td>
<td>(2) 2.89</td>
<td>(2) 2.89</td>
<td>(2) 2.09</td>
</tr>
<tr>
<td>Friction-Shear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3) 1.69</td>
<td>(3) 1.69</td>
<td>(3) 1.69</td>
<td></td>
</tr>
</tbody>
</table>

Nurses choose 7 out of 10 pressure ulcer preventive interventions based on the Braden mobility subscale. (Magnan, 2009)
SYSTEMATIC REVIEW

Intervention

Exposure to Braden mobility subscale or equivalent

Comparator

Exposure to full Braden scale or equivalent (within the same study)

Outcome

Incidence of Pressure Injury
MOBILITY IMPAIRMENT AND LIKELIHOOD OF PRESSURE INJURY

11 Cohort studies with comparable groups

- Meta-analyses and narrative synthesis favoured no exposure to impaired mobility assessed using mobility assessment

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Impaired mobility</th>
<th>No Impaired mobility</th>
<th>Odds Ratio</th>
<th>M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumgarten 2006 (1)</td>
<td>130</td>
<td>792</td>
<td>71</td>
<td>2439</td>
</tr>
<tr>
<td>Houwing 2004 (2)</td>
<td>63</td>
<td>119</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Kwong 2005</td>
<td>9</td>
<td>223</td>
<td>0</td>
<td>206</td>
</tr>
<tr>
<td>Sayar 2005 (3)</td>
<td>19</td>
<td>127</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Webster 2010 (4)</td>
<td>6</td>
<td>39</td>
<td>6</td>
<td>235</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1300</td>
<td>2895</td>
<td>100.0%</td>
<td>6.39 [4.77, 8.54]</td>
</tr>
<tr>
<td>Total events</td>
<td>227</td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: $\chi^2 = 3.12$, df = 4 (P = 0.54); $I^2 = 0%$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: $Z = 12.50$ (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MOBILITY ASSESSMENT VS VALIDATED FULL RISK ASSESSMENT SCALES AND LIKELIHOOD OF PRESSURE INJURY

• One study favoured the use of mobility subscale assessment over the full RAPS scale (Modified Norton scale) (Lindgren, 2004)

• One study showed comparable results of likelihood of pressure injury for mobility assessment and Braden Scale (Perneger, 2002)
THE STUDY
IMPETUS FOR USING BRADEN MOBILITY SUBSCALE AS ASSESSMENT TOOL

• Using the Braden mobility subscale as an assessment of pressure injury is a novel idea – Systematic review found no studies found that has used or suggested the use of the Braden mobility subscale alone as an assessment tool.

• Easy to use. Only 4 levels of scores – higher probability for more accurate assessment. Reduce nurses’ time (+++)

• Potential benefit to patients as nurses would be more keen to use mobility assessment – as it is assessed frequently as part of the routine nursing assessment - more effective screening.

• If the Braden mobility subscale is found to be comparable to the full Braden scale, it would make significant contribution to the way nurses perform pressure injury risk assessment.
RESEARCH QUESTION

Is the Braden Mobility subscale comparable to the Braden Scale in predicting Pressure Injury?
SETTING

1000 bed acute care tertiary hospital in Singapore
METHOD

Study Design

- Retrospective Case-Control

Sample size calculation

- Effect size was computed based on means of 2.61 (SD=0.78) and 2.91 (SD=0.48) for patients with and without incidence of pressure injury (Chan, 2009), power 80%, significance 0.05

Sample Size

- 200 inpatient’s medical records

Data collection period

- October 2011 to July 2012 - 11 months
TARGET POPULATION

Inclusion criteria
- Adult patients
- Case
  - Hospital acquired pressure injury reported in the electronic hospital occurrence report
- Control
  - No pressure injury

Exclusion criteria
- Paediatrics patients
- Has pressure injury on admission
- Pressure injury acquired from the Operating Room or Emergency Room
MATCHING CRITERIA

- Gender – Male / Female (62%)
- Age - < 65 / ≥ 65 (64%) (p=0.099)
- Surgery – No / Yes (44%)
- Length of stay – 2 to 21 days/ ≥22 days (56%) (p = 0.396)
- Had been to ICU/HD – No / Yes (27%)
RESULTS
Accidental findings of 61 records of unreported hospital acquired pressure injury that were excluded from control group
Stage I = 52
Stage II = 9

100 cases identified in e-HOR
Stage I = 31
Stage II = 68
Stage III = 1

86 cases reported in e-HOR at 1<sup>st</sup> occurrence
Stage I = 20
Stage II = 65
Stage III = 1

14 cases remained
Stage I = 6
Stage II = 7
Stage III = 1

11 cases reported in e-HOR at 2<sup>nd</sup> occurrence
Stage I = 3
Stage II = 7
Stage III = 1

3 cases remained
Stage I = 1
Stage II = 2

2 cases reported in e-HOR at 3rd occurrence
Stage II = 2

1 case remained
Stage I = 1

1 case reported in e-HOR at 4th occurrence
Stage I = 1
Data Analysis Plan

1. Braden Scale
2. Other Braden subscales
3. Other significant variables

Braden Mobility subscale
Pressure Injury
# Predictor of Pressure Injury: Comparison Between Braden Scale vs Braden Mobility Subscale

<table>
<thead>
<tr>
<th>Models</th>
<th>Odds ratio (95% CI)</th>
<th>p (Omnibus tests)</th>
<th>R square</th>
<th>Percentage correct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Braden Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Model 1: Cut-off score ≤ 16  
(Low risk or higher) | 3.350  
(1.772 to 6.332) | <0.001  
(p<0.001) | 7.1% to 9.5% | 62.5% |
| Model 2: Cut-off score ≤ 14  
(Moderate risk or higher) | 3.5  
(1.595 to 7.679) | 0.002  
(p=0.001) | 5.3% to 7.1% | 59% |
| Model 3: Cut-off score ≤ 12  
(High risk or higher) | 8.647  
(1.922 to 38.898) | 0.005  
(p<0.001) | 5.9% to 7.9% | 56.5% |
| Model 4: Cut-off score ≤ 9  
(Very high risk) | 4.125  
(0.453 to 37.573) | 0.209  
(p=0.160) | 1% to 1.3% | 51.5% |
| **Braden Mobility Subscale** | | | | |
| Model 1: Cut-off score ≤ 3  
(Slightly limited mobility or worse) | 2.827  
(1.440 to 5.548) | 0.003  
(p=0.002) | 4.7% to 6.3% | 59.2% |
| Model 2: Cut-off score ≤ 2  
(Very limited mobility or worse) | 5.231  
(2.664 to 10.270) | <0.001  
(p<0.001) | 12.3% to 16.4% | 66.5% |
| Model 3: Cut-off score = 1  
(Immobile) | 6.056  
(1.307 to 28.073) | 0.021  
(0.007) | 3.6% to 4.8% | 54.5% |
ACCURACY OF BRADEN SCALE VS BRADEN MOBILITY SUBSCALE

Source of the Curve
- Braden scale
- Braden Mobility Subscale
- Reference Line

### Braden scale

- **AUC = 0.681** (95% CI: 0.608 to 0.754)

### Braden mobility subscale

- **AUC = 0.691** (95% CI: 0.618 to 0.765)

---

### Optimal Cut-off Scores

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (95% CI)</th>
<th>PPV (95% CI)</th>
<th>NPV (95% CI)</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Braden Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 17</td>
<td>0.56 (0.462 - 0.653)</td>
<td>0.73 (0.636 - 0.807)</td>
<td>0.675 (0.568 - 0.766)</td>
<td>0.624 (0.534 - 0.706)</td>
<td>0.645</td>
</tr>
<tr>
<td><strong>Braden Mobility Subscale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2</td>
<td>0.48 (0.385 - 0.577)</td>
<td>0.85 (0.767 - 0.907)</td>
<td>0.762 (0.644 - 0.85)</td>
<td>0.62 (0.537 - 0.697)</td>
<td>0.665</td>
</tr>
</tbody>
</table>
DO OTHER BRADEN SUBSCALES ADD TO THE PREDICTIVE MEASURE?

<table>
<thead>
<tr>
<th>Braden subscale</th>
<th>Model 2 (cut-off score ≤ 2)</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% C.I.for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Sensory</td>
<td></td>
<td>.229</td>
<td>.676</td>
<td>.115</td>
<td>1</td>
<td>.735</td>
<td>1.257</td>
<td>.334</td>
</tr>
<tr>
<td>Activity</td>
<td></td>
<td>-.380</td>
<td>.457</td>
<td>.691</td>
<td>1</td>
<td>.406</td>
<td>.684</td>
<td>.279</td>
</tr>
<tr>
<td>Mobility</td>
<td></td>
<td>1.743</td>
<td>.515</td>
<td>11.454</td>
<td>1</td>
<td>.001*</td>
<td>5.714</td>
<td>2.062</td>
</tr>
<tr>
<td>Nutrition</td>
<td></td>
<td>.448</td>
<td>.384</td>
<td>1.366</td>
<td>1</td>
<td>.243</td>
<td>1.566</td>
<td>.738</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-.506</td>
<td>.197</td>
<td>6.623</td>
<td>1</td>
<td>.010</td>
<td>.603</td>
<td></td>
</tr>
</tbody>
</table>

χ² (4, n=200)= 28.41, p<0.001
R² = 13.2% to 17.7%
% correct = 66.5%
DO OTHER SIGNIFICANT FACTORS ADD TO THE PREDICTION?

Backward logistic regression by removing non-significant factors one at a time (x11)

\[ \chi^2 (5, n=200) = 67.8, \ p<0.001 \]
\[ R^2 = 28.8\% \text{ to } 38.3\% \]
\[ \% \text{ correct } = 74.5\% \]

<table>
<thead>
<tr>
<th>Significant Independent Predictor</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discipline Medical</td>
<td>1.251</td>
<td>.407</td>
<td>10.977</td>
<td>2</td>
<td>.004</td>
<td>3.493</td>
<td>1.574 - 7.750</td>
</tr>
<tr>
<td>Discipline Surgical (2)</td>
<td>-.210</td>
<td>.478</td>
<td>.194</td>
<td>1</td>
<td>.660</td>
<td>.810</td>
<td>.318 - 2.067</td>
</tr>
<tr>
<td>Vasopressor (1)</td>
<td>2.204</td>
<td>.537</td>
<td>16.873</td>
<td>1</td>
<td>.000</td>
<td>9.061</td>
<td>3.166 - 25.937</td>
</tr>
<tr>
<td>Braden mobility subscale model 2 (1)</td>
<td>1.782</td>
<td>.381</td>
<td>21.876</td>
<td>1</td>
<td>.000</td>
<td>5.941</td>
<td>2.816 - 12.537</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.361</td>
<td>.280</td>
<td>23.590</td>
<td>1</td>
<td>.000</td>
<td>.256</td>
<td></td>
</tr>
</tbody>
</table>
SUMMARY

• Braden mobility subscale is better at predicting pressure injury than Braden scale

• Braden mobility subscale is the only significant predictor of pressure injury compared to other subscales

• Braden mobility subscale is the second most important predictor of pressure injury. Vasopressors (1) Anaemia (3) Orthopaedics (4)

• Missed reporting of pressure injury events. Not reporting means that pressure injury incidence remains low and not seen as a problem. Resulting in minimal focus on managing/eradicating pressure injury as the problem would not be surfaced.

• 14% of pressure injury not reported at the first occurrence. Adverse event reporting is less than desirable.
CONCLUSION & IMPLICATION TO PRACTICE

Conclusion

- The Braden Mobility Subscale is comparable and perhaps superior to the Braden scale in predicting pressure injury

Implication to Practice

- Replace Braden Scale with the Braden Mobility Subscale as a tool for assessing Pressure Injury risk

- Greater care to be taken of patients in the ICU setting, receiving vasopressors and who are Anaemic. More research is also required in this area

- Explore other more accurate methodology such as cross-sectional study for ascertaining incidence of pressure injury instead of the current voluntary event reporting
REFERENCES (1)


REFERENCES (2)


THANK YOU

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Ms Lin Qian Qian
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