Nebraska Healthcare Quality Forum
May 9, 2013
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Case Study: Choosing a Fall Risk Assessment
CAPTURE Falls Funding Statement

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Objectives

• Explain sensitivity, specificity, and predictive value of a fall risk assessment
• Explain how changing the cutoff score of a fall risk assessment affects its ability to predict who will and will not fall
• Based on a case study from a Nebraska Critical Access Hospital, explain how to conduct a retrospective chart review to compare sensitivity, specificity, and predictive value of fall risk assessment tools.
Case Study: St. Francis Memorial Hospital

• Baseline survey
  • No one accountable for fall risk reduction
  • Clinical judgment used to assess fall risk

• Newly formed interprofessional fall risk reduction team
  • Sense of urgency to choose fall risk assessment tool for integration into EMR
  • Used work sheet created by CAPTURE Falls project
Case Study: St. Francis Memorial Hospital

• Reviewed records from 2011 and 2012
  • 26 patients fell
  • 37 patients did not fall
• Determined Scores for 3 tools using 2 cut points for each tool
  • John Hopkins Fall Risk Assessment Tool$^{1,2}$
  • Morse Falls Scale$^{3-5}$
  • Fall Risk Assessment Scoring System (FRASS)$^{6,7}$
## Comparing Assessments

<table>
<thead>
<tr>
<th>TOOL</th>
<th>Age</th>
<th>Mobility Subjective</th>
<th>Mobility Objective</th>
<th>Sensory Impairment</th>
<th>Mentation/Cognition</th>
<th>Elimination</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRASS</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hendrichs II</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Johns Hopkins</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Morse</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Schmid</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOOL</th>
<th>Prior Fall History</th>
<th>Meds</th>
<th>Dizziness Vertigo</th>
<th>Male Gender</th>
<th>Secondary Diagnosis</th>
<th>IV/Heparin Lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRASS</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hendrichs II</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Johns Hopkins</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morse</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Schmid</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

| TOTAL         | 2 | 4 | 1 | 1 | 5 | 4 | 1 |

| TOOL          | 4 | 3 | 1 | 1 | 1 | 1 | 1 |

University of Nebraska Medical Center
Test Performance Measure Work Sheet

Worksheet describes the specific steps to take when determining sensitivity, specificity, and predictive values of a tool in YOUR setting.

Requires understanding of the construction and use of a 2 x 2 table

• Combines results of two outcomes
  1. Rows contain the results of your assessment
  2. Columns contain the outcome of interest (fall/no fall)
### General Format of 2 x 2 Table

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Did the patient fall?</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>No Fall</td>
<td>Total</td>
</tr>
<tr>
<td>+ Result</td>
<td>a (true +)</td>
<td>b (false +)</td>
<td>a + b</td>
</tr>
<tr>
<td>- Result</td>
<td>c (false -)</td>
<td>d (true -)</td>
<td>c + d</td>
</tr>
</tbody>
</table>

Row total = # of pts with + test result

Row total = # of pts with - test result

Column total = # of pts who fell

Column total = # of pts who DID NOT fall

Sensitivity = $\frac{a}{a+c}$

Specificity = $\frac{d}{d+b}$

PV+ = $\frac{a}{a+b}$

PV- = $\frac{d}{c+d}$
Test Performance Measures

Sensitivity is the test’s ability to obtain a positive test when the target condition is really present, or the true positive rate, and it tells the clinician how good the test is at correctly identifying patients with condition of interest (ie will fall).

Specificity is the test’s ability to obtain a negative test when the condition is really absent, or the true negative rate, and it tells the clinician how good the test is at correctly identifying the absence of a condition (ie will not fall).
Test Performance Measures

Sensitivity and specificity have limitations due to false positives and false negatives.

Choosing cut points that generate the highest scores for positive and negative predictive value minimizes false positive and false negative findings.
Test Performance Measures

Positive predictive value is the probability that a person who tests positive actually has the condition of interest (ie they fell).

Negative predictive value is the probability that a person who tests negative does not have the condition of interest (they did not fall).
Step by Step…You can do it!

1. Retrospectively identify medical records and other data for 30 – 50 patients who fell within last 2 years.

2. Randomly select records for same number of patients who DID NOT fall during same time period.

3. Use data from the records (prior to the initial fall) to complete the risk assessment tool under consideration for fallers and nonfallers.

Follow directions on worksheet….
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Rating</th>
<th>F / 04 Score</th>
<th>F / 04 Score</th>
<th>F / 04 Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65 - 79 years</td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 and above</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MENTAL STATUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oriented at all times or Comatose</td>
<td>[3]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confused at all times – poor cognition, STM, lack of insight into own safety, impulsive</td>
<td>[4]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent confusion – as above</td>
<td>[8]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMOTIONAL STATUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderately agitated/uncooperative/naive</td>
<td>[2]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severely agitated/uncooperative/naive</td>
<td>[4]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOILETING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent and continent</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catheter/urinary catheter</td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs assistance with toileting</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulatory with urge incontinence or episodes of incontinence</td>
<td>(8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HISTORY OF FALLING WITHIN 6 MONTHS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>[3]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has taken one or two times</td>
<td>[2]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple history of falling</td>
<td>[6]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SENSORY IMPAIRMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blind/Deaf/Visually Not using corrective device</td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTIVITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulates/Transfers without assistance</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulates/Transfers with assist of one or assistive device</td>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulates/Transfers with assist of two</td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertain gait/mobility affected by pain/conditioned</td>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDICATIONS (MEDICATION REFERENCE TABLE OVER PAGE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular/Blood pressure regulators</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti depressants</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychotics</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquilizers/Sedatives</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antiparkinsons/Anti-Convulsants</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioids</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None of the above listed medications</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One of the above listed medications</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two or more of the above listed medications</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add one more point if there has been a change in these medications or dosages in the past five days.</td>
<td>☐</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL SCORE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Risk: Score of 8 – 14 patient is at high risk for falls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score of 15 + patient is at SUPER HIGH risk for falls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document each patient’s fall risk status in the medical history. Implement appropriate fall prevention strategies. (overpage)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FRASS Cutpoint at 8+ High Risk For Falls

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Did the patient fall?</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>No Fall</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>+ Result (FRASS ≥ 8)</td>
<td>a = 26 (true +)</td>
<td>b = 28 (false +)</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>- Result (FRASS &lt; 8)</td>
<td>c = 0 (false -)</td>
<td>d = 9 (true -)</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>37</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity: \( \frac{a}{a+c} = \frac{26}{26} = 100\% \) of fallers had + test (≥ 8)

Specificity: \( \frac{d}{d+b} = \frac{9}{37} = 24\% \) of nonfallers had – test (< 8)

PV+: \( \frac{a}{a+b} = \frac{26}{54} = 48\% \) of those with + test (≥ 8) fell

PV-: \( \frac{d}{c+d} = \frac{9}{9} = 100\% \) of those with – test (< 8) did not fall

Contact us if you need help completing a sensitivity/specificity analysis
FRASS Cutpoint at 15+ High Risk For Falls

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Did the patient fall?</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>No Fall</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>+ Result (FRASS ≥ 15)</td>
<td>a = 17 (true +)</td>
<td>b = 8 (false +)</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>- Result (FRASS &lt; 15)</td>
<td>c = 9 (false -)</td>
<td>d = 29 (true -)</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>37</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity   $\frac{a}{a+c} = \frac{17}{26} = 65\%$ of fallers had + test (≥ 15)
Specificity $\frac{d}{d+b} = \frac{29}{37} = 78\%$ of nonfallers had – test (< 15)
PV+ $\frac{a}{a+b} = \frac{17}{25} = 68\%$ of those with + test (≥ 15) fell
PV- $\frac{d}{c+d} = \frac{9}{38} = 76\%$ of those with – test (< 15) did not fall

Contact us if you need help completing a sensitivity/specificity analysis
### Comparing Results

<table>
<thead>
<tr>
<th>Tool (Cut Point)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+ Predictive Value</th>
<th>- Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johns Hopkins (6+)</td>
<td>100%</td>
<td>0%</td>
<td>41%</td>
<td>0%</td>
</tr>
<tr>
<td>Johns Hopkins (13+)</td>
<td>89%</td>
<td>41%</td>
<td>51%</td>
<td>83%</td>
</tr>
<tr>
<td>Morse (45+)</td>
<td>100%</td>
<td>24%</td>
<td>48%</td>
<td>100%</td>
</tr>
<tr>
<td>Morse (75+)</td>
<td>50%</td>
<td>70%</td>
<td>54%</td>
<td>67%</td>
</tr>
<tr>
<td>FRASS (8+)</td>
<td>100%</td>
<td>24%</td>
<td>48%</td>
<td>100%*</td>
</tr>
<tr>
<td>FRASS (15+)</td>
<td>65%</td>
<td>78%</td>
<td>68%**</td>
<td>76%</td>
</tr>
</tbody>
</table>

*100% of those who tested negative DID NOT fall

**68% of those who tested positive DID fall
Case Study Summary

Plan to use FRASS and Modify SENSORY IMPAIRMENT

- Add decreased lower extremity sensation (i.e., diabetic peripheral neuropathy, anesthetic nerve blocks, previous CVA)

Identify those patients with a score of 8 – 14 as high risk for falls: if score < 8, patient probably will not fall (Of the 9 with a score < 8, none fell).

Identify those patients with a score of 15+ as at very high/severe risk for falls; if score 15+, patient will likely fall if interventions are inadequate; of those patients who scored 15+, 68% actually fell.
Case Study Summary

Why did we do this?

1. Sense of urgency...we were not using a validated instrument, needed to integrate into EMR

2. Would have used what was most common...Morse without any objective rationale

3. Group of people willing to change; take initiative and evaluate instruments
Case Study Summary

How did we implement this change?

1. Step by step worksheet provided by CAPTURE Falls Project
2. Set date for group of 7 to meet for 3 hours
3. Anne Timmerman pulled charts (26 fallers; 37 non-fallers)
4. 3 different fall risk assessments completed for each chart
5. Used easy to understand tally sheet to record outcomes of chart review
6. Support from DON who asked questions and helped with chart review
# Tally Sheet for FRASS

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Frass 8+</th>
<th>Frass 18+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>No Fall</td>
</tr>
<tr>
<td>Positive Result</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>Negative Result</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Frass 8+</th>
<th>Frass 18+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>No Fall</td>
</tr>
<tr>
<td>Positive Result</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Negative Result</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>
### Tally Sheet for Johns Hopkins, Morse

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Fall</th>
<th>No Fall</th>
<th>Total</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Result</td>
<td>63</td>
<td>0</td>
<td>63</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Negative Result</td>
<td>26</td>
<td>37</td>
<td>63</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Fall</th>
<th>No Fall</th>
<th>Total</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Result</td>
<td>54</td>
<td>9</td>
<td>63</td>
<td>100%</td>
<td>24%</td>
</tr>
<tr>
<td>Negative Result</td>
<td>26</td>
<td>37</td>
<td>63</td>
<td>48%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Johns Hopkins 13+ Assessment Results

<table>
<thead>
<tr>
<th>Assessment Results</th>
<th>Fall</th>
<th>No Fall</th>
<th>Total</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Result</td>
<td>45</td>
<td>11</td>
<td>56</td>
<td>89%</td>
<td>41%</td>
</tr>
<tr>
<td>Negative Result</td>
<td>13</td>
<td>35</td>
<td>48</td>
<td>54%</td>
<td>67%</td>
</tr>
</tbody>
</table>
Case Study Summary

Is this better than our old way of doing fall risk assessment?

1. Staff is educated about fall risk assessment
2. Staff have shared mental model of how to match interventions to fall risk
3. Previous reliance on judgment alone lead to lack of consistency
4. Now moving to focus on improving communication about fall risk across shifts
Questions
References


2. Johns Hopkins tool is copyrighted. Contact: Stephanie S. Poe, spoejhmi.edu


5. Morse Fall Scale is freely available at http://cf.networkofcare.org/library/Morse%20Fall%20Scale.pdf
References


7. Contact Jenny Cook for permission to use, email J.Cook2@cgmc.org.au
CAPTURE Falls
Collaboration and Proactive Teamwork Used to Reduce

http://unmc.edu/patient-safety/capture_falls.htm