Crystal Ball or Waste of Time?
ICU Prediction Tools

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Format

- Case
- Prediction rule definition
- Methodology
- “User’s guide to prediction rules”
- 15 622 rules published in 2005*

John Smith (85 yo male)

- 82/48, 134 sinus, 34 with increased WOB, 89% on 100%
- Lactate 8.4
- 7.13 / 64 / 15
- Creatinine 325
- Received a fluid bolus and appropriate antibiotics
John Smith’s Expressed Wishes

- Very clear with wife over the years

- Does NOT want life support if case is “futile” or if he will not be able to return to independent living

- What will you tell his wife? How will you and John Smith’s wife make this decision together?
Practical SDM Questions

- What is John Smith’s ICU / hospital mortality?

- What are the chances of John returning home to live with his wife?
Will this DCD Patient Die Within the Time Frame?

- Inform family discussion
- Inform procurement teams
- Emotional costs
- Logistics
- Optimal allocation of resources
Clinical Prediction Tool Definition

- “decision making tool derived from original research and incorporates 3 or more variables from the history, physical examination, or diagnostic tests”

- Help physicians with diagnostic and therapeutic decision making

- New rules are being produced all the time....

  - Stiell et al.
Prediction Rule Steps

1. Is there a need for a decision rule?
   - Condition prevalence
   - Variation in practice
   - Attitudes of clinicians
   - Clinical certainty of clinicians

Stiell et al.
2. Was Rule Derived According to Methodologic Standards?

- Definition of outcome
- Definition of predictor variables
- Reliability of predictor variables
- Subject selection
- Sample size
- Sensibility of rule
- Accuracy of rule

Stiell et al.
3. Has Rule Been Prospectively Validated?

- Prospective validation
- Subject selection
- Rule accuracy
- Rule reliability
- Physicians’ interpretation
- Potential effect

Stiell et al.
Has the Rule Been Successfully Implemented into Clinical Practice?

- Effect on Use
- Accuracy of Rule
- Acceptability of Rule
Additional Considerations

5. Would Use of the Rule be Cost Effective?

6. How Will the Rule be Disseminated and Implemented?

Stiell et al
Types of Prediction Models

- Univariate analysis (Glasgow score + pancreatitis)
- Multivariate analysis (odds ratios)
- Nomograms (Rumack-Matthew for Acetaminophen)
- Recursive partitioning

Table 2. Wells Prediction Rule for Diagnosing Pulmonary Embolism: Clinical Evaluation Table for Predicting Pretest Probability of Pulmonary Embolism*

<table>
<thead>
<tr>
<th>Clinical Characteristic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous pulmonary embolism or deep venous thrombosis</td>
<td>+1.5</td>
</tr>
<tr>
<td>Heart rate &gt;100 beats per minute</td>
<td>+1.5</td>
</tr>
<tr>
<td>Recent surgery or immobilization</td>
<td>+1.5</td>
</tr>
<tr>
<td>Clinical signs of deep venous thrombosis</td>
<td>+3</td>
</tr>
<tr>
<td>Alternative diagnosis less likely than pulmonary embolism</td>
<td>+3</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>+1</td>
</tr>
<tr>
<td>Cancer</td>
<td>+1</td>
</tr>
</tbody>
</table>

**Any High Risk Factors?**

ANY of the following:
- Age ≥ 65 years
- Dangerous Mechanism
- Paresthesias in extremities

None?
You may proceed...

**Any Low Risk Factors?**

ANY of the following:
- Simple rear-end MVC
- Sitting position in ED
- Ambulatory at ANY TIME
- Delayed (i.e. not immediate) onset of neck pain
- Absence of midline C-spine tenderness

One of the above?
Excellent... proceed with ROM

Able to Rotate Neck actively?

i.e. Rotate neck 45 degrees left & right.

Great!
Based on the CCR...

**Pt has high risk factor?**

Well... then you should get....

**Not even one?**

Then... they aren’t low risk!

**Radiography**

**Can’t move their neck?**

Then... they aren’t low risk!

**No Radiography**
Better than Clinician Judgement Alone

Tool Complexity vs Simplicity

- Management of continuous variables
  -- categorize them
  -- maintain continuity
Clearly Defined Population

- Prognosis in critically ill elderly
  - office visit with GP
  - nursing home patients
  - inpatients not referred to ICU
Receiver-operating characteristic (ROC) curve
Dynamic versus Static Outcome

- Canadian CT Head, C-Spine Rules
- Wells’ Criteria for PE
- Rumack Nomogram for Acetaminophen

Figure 2: Observed Versus Expected Probability of Hospital Mortality in Critically Ill Elderly Medical Patients

Ball et al. Submitted. 2015
“Self-Fulfilling Prophecies”

- AKI in the critically ill elderly
- Very strong association with mortality in this population
- Causality?
Summary

- *External* validation prior to clinical implementation
- Static vs dynamic targets
- Clearly defined population
Questions?