Early Identification Of Problem Youth Using Teacher Rated Aggression

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A Public Health Perspective On Identifying And Intervening With Multi-problem Youth

- Efficient method for early identification for those youth most at-risk
- School setting as context for identification and intervention
- Nested approach for identification and intervention
Baltimore Prevention Program: Design For First Stage Trials

- 19 elementary schools, 43 first grade classrooms
- Two cohorts of first grade children, about 1000 each
- Five urban areas, varied in ethnicity and SES from low to low - middle
- 3 to 4 matched schools in each urban area
- Random assignment within each urban area of schools, teachers, and children
Overview Of Presentation

- **Ultimate goal:** Efficient method for early identification of youth most at-risk for later problems

- **Series of studies:**
  - Utility of single time point teacher ratings of aggression in predicting multiple problems
    - Gender differences
  - Utility of multiple time points
    - Gender differences
References


Aggression: Risk Factor Vs. Screening Approach

- Risk Factor Approach:
  - using aggression as an antecedent of later violence

- Screening Approach:
  - using aggression to identify individuals at risk for later violence

- While an accurate screening indicator is also most likely to be a strong risk factor for the outcome or at least strongly correlated with the outcome, the opposite is not necessarily true.
## Aggression And Later Violent Arrest

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>Fall 1st</strong></td>
<td>1.37</td>
<td>1.12-1.68</td>
</tr>
<tr>
<td><strong>Spring 1st</strong></td>
<td>1.49</td>
<td>1.18-1.89</td>
</tr>
<tr>
<td><strong>Spring 2nd</strong></td>
<td>1.57</td>
<td>1.25-1.98</td>
</tr>
<tr>
<td><strong>Spring 3rd</strong></td>
<td>2.05</td>
<td>1.61-2.60</td>
</tr>
<tr>
<td><strong>Spring 4th</strong></td>
<td>1.89</td>
<td>1.47-2.43</td>
</tr>
<tr>
<td><strong>Spring 5th</strong></td>
<td>1.88</td>
<td>1.49-2.37</td>
</tr>
</tbody>
</table>
Clinical/Policy Significance Of Risk Factors
(Kraemer et al. 1999, 2002)

- How much difference does it make to those who have the outcome to be correctly classified? ➔ false negatives
- How much difference does it make to those who do not have the outcome to be correctly classified? ➔ false positives
Potency Of Risk Factors

\[ \kappa(r) = \frac{(AD - BC)}{(PQ'u + P'Q'u')} \]  

\( Q = A + C \)
\( Q' = 1 - Q = B + D \)
\( P = A + B \) ➔ Base Rate
\( P' = 1 - P = C + D \)

Sensitivity (Se) = \( \frac{A}{A + B} \)
Specificity (Sp) = \( \frac{D}{1 - P} \)

<table>
<thead>
<tr>
<th></th>
<th>Test (+)</th>
<th>Test (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome (+)</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Outcome (-)</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

- \( \kappa(0) = \frac{(AD - BC)}{(P'Q)} = \frac{(Sp - Q')}{Q} \)
- \( \kappa(0.5) = 2(AD - BC)/(PQ' + P'Q) \) ➔ default for regular ROC
- \( \kappa(1) = \frac{(AD - BC)}{(PQ')} = \frac{(Se - Q)}{Q'} \)

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Three Intervention Scenarios

Scenario 1 (Kappa weight $r=1.0$): Optimal Sensitivity
- Emphasis is on reducing false negatives
- Recommended if the costs of the intervention are high and/or iatrogenic effects are possible

Scenario 2 (Kappa weight $r=0.0$): Optimal Specificity
- Emphasis is on reducing false positives
- Recommended for noninvasive screening or as a “rule out” test and for interventions of very low cost and risk

Scenario 3 (Kappa weight $r=0.5$): Optimal Efficiency
- Places equal emphasis on reducing both false positives and false negatives

More generally, the kappa weight can be set to exactly match the particular screening goal: For example if a false negative outcome were considered 4 times worse than a false positive outcome then $r=4/4+1=0.8$. 
Sensitivity / Specificity - Boys

![Graph showing Sensitivity and Specificity for different grades/semesters for different correlation coefficients (r=0.0, r=0.5, r=1.0).]

<table>
<thead>
<tr>
<th>Kappa</th>
<th>1F</th>
<th>1S</th>
<th>2S</th>
<th>3S</th>
<th>4S</th>
<th>5S</th>
</tr>
</thead>
<tbody>
<tr>
<td>R=0.0 (OSP)</td>
<td>0.785</td>
<td>0.360</td>
<td>0.487</td>
<td>0.782</td>
<td>0.775</td>
<td>0.611</td>
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<tr>
<td>R=0.5 (OE)</td>
<td>0.135</td>
<td>0.177</td>
<td>0.273</td>
<td>0.381</td>
<td>0.283</td>
<td>0.319</td>
</tr>
<tr>
<td>R=1.0 (OS)</td>
<td>0.580</td>
<td>0.525</td>
<td>0.728</td>
<td>0.692</td>
<td>1.000</td>
<td>0.711</td>
</tr>
</tbody>
</table>

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Decision Tree for Boys (Kappa weight $r=0.5$)

415 Total Cases
22.65% with outcome

N=207
Sctag031 $lt$ 3.18
14.5% (n=30)

N=67
Sctag031 $ge$ 3.18
52.2% (n=35)

N=157
Sctag051 $lt$ 3.09
10.8% (n=17)

N=22
Sctag051 $ge$ 3.09
40.9% (n=9)
Sensitivity / Specificity - Girls

<table>
<thead>
<tr>
<th>Kappa</th>
<th>1F</th>
<th>1S</th>
<th>2S</th>
<th>3S</th>
<th>4S</th>
<th>5S</th>
</tr>
</thead>
<tbody>
<tr>
<td>R=0.0 (OSP)</td>
<td>0.199</td>
<td>0.287</td>
<td>0.113</td>
<td>0.221</td>
<td>0.166</td>
<td>0.312</td>
</tr>
<tr>
<td>R=0.5 (OE)</td>
<td>0.130</td>
<td>0.140</td>
<td>0.134</td>
<td>0.193</td>
<td>0.117</td>
<td>0.310</td>
</tr>
<tr>
<td>R=1.0 (OS)</td>
<td>0.390</td>
<td>0.372</td>
<td>0.416</td>
<td>0.693</td>
<td>0.621</td>
<td>0.803</td>
</tr>
</tbody>
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Decision Tree for Girls (Kappa weight r=0.5)

845 Total Cases
6.39% with outcome

N=579
Sctag051 lt 3.18
5% (n=29)

N=52
Sctag051 ge 3.18
34.6% (n=18)
Conclusion: Utility of Single Time Points

- Based on teacher rated aggression, boys at-risk for violence can be identified more accurately and earlier than girls, when the emphasis is on reducing false positives or false negatives.
- When the emphasis is on reducing both false negatives and positives, the screening utility found for both boys and girls is limited.
Utility of Multiple Time Points: General Growth Mixture Modeling (Muthén 2004)
Cohort 1 Control Boys (n=337)

BIC=5322.214, Entropy=0.823

88.5% ASPD
34.9% ASPD
14.3% ASPD
## Level of Identification Accuracy

### Area Under the Curve

<table>
<thead>
<tr>
<th>Test Result Variable(s)</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>cprob1</td>
<td>.429</td>
</tr>
<tr>
<td>cprob2</td>
<td>.776</td>
</tr>
<tr>
<td>cprob3</td>
<td>.310</td>
</tr>
</tbody>
</table>
Future Steps

- Determine the Sensitivity/Specificity of later outcome in the General Growth Mixture Framework
  - How many time points are need to reach sufficient levels of sensitivity/specificity?

- Which items of the TOCA-R construct show the highest utility in identifying problem youth?
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