RISKY BUSINESS

AN ANALYSIS OF INDICATORS FOR HIGH RISK BEHAVIOR IN ADOLESCENTS BASED ON THE IOWA YOUTH SURVEY

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RIS KY BUS IN ESS?
High-risk behaviors are those that can have adverse effects on the overall development and well-being of youth, or that might hinder their future success and development (De Guzman, et al).

This includes both behaviors that cause immediate physical injury as well as behaviors with cumulative negative effects.
Nationwide, there has been an increase in awareness regarding high risk behaviors among adolescents

Some of the more prominent behaviors include substance abuse, suicide ideation, and violent outbursts

School shootings, in particular, are an increasingly common occurrence

EXAMPLES OF HIGH RISK BEHAVIOR AMONG ADOLESCENTS IN THE U.S.
 OUTLINE

- Describe the data set
- Specify the project goals
- Explain the approach utilized for the data analysis
- Discuss the results of the analysis
- Summarize the results and profile high risk youth
- Propose options for future work

Introduction | Data Set | Goals/Expectations | Approach | Results | Conclusions
The data set is a compilation of the Iowa Youth Survey from the years 2005 and 2008. The survey covers 412 school districts in the state of Iowa. The overall data set contains 338 variables. This study selected 5 outcome variables (high risk behaviors) and 6 explanatory variables (indicators) for analysis. Cleaning of data resulted in 165,233 complete observations for analysis (from an original 195,845 observations).
**OUTCOME VARIABLES (BINARY)**

- **DEP_ALC**: Student is currently dependent on alcohol
- **DEP_DRUG**: Student is currently dependent on any illegal drugs obtained without a prescription
- **WEAPON**: Student has carried a weapon such as a gun, knife, or club onto school property
- **SUICIDE_IDEATION**: Student has considered, planned, or attempted suicide
- **VIOL_ANGER**: Student has used physical violence on someone because they made them angry
EXPLANATORY VARIABLES (ORDINAL)

- **PRIDE**: Student feels he/she does not have much to be proud of (Strongly Agree, Agree, Disagree, Strongly Disagree)
- **HAPPY_HOME**: Student feels he/she has a happy home (Strongly Agree, Agree, Disagree, Strongly Disagree)
- **LIVING_SITUATION**: Student’s self-reported living situation (With Parents, With Grandparents/Relatives, With Foster Parents, In Shelter Care, In a Residential/Group Home, Independent Living, Other)
- **MAKING_FRIENDS**: Student believes he/she is good at making friends (Strongly Agree, Agree, Disagree, Strongly Disagree)
- **EMPATHY**: Student cares about the feelings of others (Strongly Agree, Agree, Disagree, Strongly Disagree)
- **CVDN**: Student feels there is a lot of crime, violence, or drugs in his/her neighborhood (Strongly Agree, Agree, Disagree, Strongly Disagree)
POTENTIAL CONFOUNDERS (Nominal and Ordinal)

- **SURVEY_YEAR**: 2005, 2008
- **GRADE**: 6th, 8th, 11th
- **GENDER**: Male, Female
- **ETHNICITY**: White, African American, American Indian or Alaska Native, Asian/Pacific Islander, Hispanic or Latino, Other

RANDOM EFFECTS (School district level clustering)

- **ENCODED_SCHOOLDIST**: Coded indicator for school district
Characterize bivariable and multivariable associations of pre-determined risk factors and behaviors

Determine the effect of school district level clustering on each association

Create profiles to aid in the development of intervention programs by identifying potentially high risk students
Data were analyzed using logistic regression and generalized estimating equations (PROC LOGISTIC and PROC GENMOD in SAS)

- Logistic regression was used to fit univariable and multivariable models to characterize each association
- Generalized estimating equations were used to assess the effect of school district level clustering on each relation

- The Bayesian Information Criterion (BIC) was utilized to assess the strength of each variable in both the univariable and multivariable models
- Results were graphically summarized (in R) using odds ratios
<table>
<thead>
<tr>
<th>Univariable Gen Mod Min/Max</th>
<th>Pride</th>
<th>Happy Home</th>
<th>Living Situation</th>
<th>Making Friends</th>
<th>Empathy</th>
<th>CVDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Dependence</td>
<td>0.001677</td>
<td>0.001401</td>
<td>0.001577</td>
<td>0.001684</td>
<td>0.001468</td>
<td>0.001132</td>
</tr>
<tr>
<td>Drug Dependence</td>
<td>0.003706</td>
<td>0.003791</td>
<td>0.003456</td>
<td>0.003727</td>
<td>0.003477</td>
<td>0.002379</td>
</tr>
<tr>
<td>Weapon Carrying</td>
<td>0.002961</td>
<td>0.002671</td>
<td>0.002707</td>
<td>0.003327</td>
<td>0.001962</td>
<td>0.001368</td>
</tr>
<tr>
<td>Suicide Ideation</td>
<td>0.016693</td>
<td>0.016990</td>
<td>0.016718</td>
<td>0.016628</td>
<td>0.016575</td>
<td>0.016896</td>
</tr>
<tr>
<td>Violent Anger</td>
<td>0.006613</td>
<td>0.006050</td>
<td>0.006341</td>
<td>0.007211</td>
<td>0.005020</td>
<td>0.004085</td>
</tr>
</tbody>
</table>

**Introduction**

**Data Set**

**Goals/Expectations**

**Approach**

**Results**

**Conclusions**

WITHIN SCHOOL DISTRICT CORRELATIONS
### Univariable Models: BIC Differences Between Null and Univariable Models

<table>
<thead>
<tr>
<th>Univariable</th>
<th>Pride</th>
<th>Happy Home</th>
<th>Living Situation</th>
<th>Making Friends</th>
<th>Empathy</th>
<th>CVDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Dependence</td>
<td>6 (474.69)</td>
<td>2 (2174.78)</td>
<td>3 (1157.68)</td>
<td>5 (922.85)</td>
<td>1 (2449.35)</td>
<td>4 (953.37)</td>
</tr>
<tr>
<td>Drug Dependence</td>
<td>6 (337.95)</td>
<td>2 (1984.83)</td>
<td>3 (1311.50)</td>
<td>4 (916.06)</td>
<td>1 (2281.10)</td>
<td>5 (826.74)</td>
</tr>
<tr>
<td>Weapon Carrying</td>
<td>6 (417.98)</td>
<td>2 (3126.54)</td>
<td>5 (1115.30)</td>
<td>4 (1339.82)</td>
<td>1 (4248.40)</td>
<td>3 (1680.51)</td>
</tr>
<tr>
<td>Suicide Ideation</td>
<td>2 (652.35)</td>
<td>1 (799.72)</td>
<td>5 (177.69)</td>
<td>4 (330.17)</td>
<td>3 (363.81)</td>
<td>6 (12.52)</td>
</tr>
<tr>
<td>Violent Anger</td>
<td>5 (1232.34)</td>
<td>2 (4479.16)</td>
<td>6 (947.31)</td>
<td>4 (1334.76)</td>
<td>1 (5867.32)</td>
<td>3 (3208.67)</td>
</tr>
</tbody>
</table>

**Legend:**
- >2000
- 1000 - 2000
- 500 - 1000
- <500
### Multivariable Models: BIC Differences Between Reduced and Full Models

<table>
<thead>
<tr>
<th>Multivariable</th>
<th>-Pride</th>
<th>-Happy Home</th>
<th>-Living Situation</th>
<th>-Making Friends</th>
<th>-Empathy</th>
<th>-CVDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Dependence</td>
<td>5 (146.95)</td>
<td>2 (489.40)</td>
<td>4 (198.621)</td>
<td>6 (92.37)</td>
<td>1 (783.40)</td>
<td>3 (319.83)</td>
</tr>
<tr>
<td>Drug Dependence</td>
<td>5 (85.06)</td>
<td>2 (425.44)</td>
<td>4 (243.50)</td>
<td>6 (34.78)</td>
<td>1 (609.11)</td>
<td>3 (279.38)</td>
</tr>
<tr>
<td>Weapon Carrying</td>
<td>5 (57.88)</td>
<td>2 (957.92)</td>
<td>4 (201.29)</td>
<td>6 (48.78)</td>
<td>1 (1083.88)</td>
<td>3 (545.67)</td>
</tr>
<tr>
<td>Suicide Ideation</td>
<td>2 (338.51)</td>
<td>1 (913.28)</td>
<td>5 (108.25)</td>
<td>4 (74.28)</td>
<td>5 (74.28)</td>
<td>6 (65.59)</td>
</tr>
<tr>
<td>Violent Anger</td>
<td>5 (168.58)</td>
<td>1 (1985.98)</td>
<td>4 (213.86)</td>
<td>6 (107.24)</td>
<td>2 (1953.34)</td>
<td>3 (1136.75)</td>
</tr>
</tbody>
</table>

**Consistently outstanding**
In My Neighborhood There Are Lots of Fights, Crime, or Illegal Drugs

- Alcohol Dependence
- Drug Dependence
- Weapon Carrying
- Suicide Ideation
- Violent Anger

Odds Ratio (Ref: Strongly Disagree)

Student Response

Strongly Agree, Agree, Disagree, Strongly Disagree
I Care About Other People's Feelings

- Alcohol Dependence
- Drug Dependence
- Weapon Carrying
- Suicide Ideation
- Violent Anger

Odds Ratio (Ref. Strongly Disagree)

Student Response: Strongly Agree, Agree, Disagree, Strongly Disagree
For four of the five outcomes (all except suicide ideation), we found that the strongest bivariable association among the indicators was with empathy.

Additionally, a perceived unhappy home life was strongly associated with dependence, violent anger, and a student's chances of carrying a weapon on school grounds.

Finally, we found that neighborhoods with crime, violence, and drugs were linked with a student's predisposition to violent anger.
Based on our data analysis, we conclude that a potentially high risk student would...

- Lack a sense of self-pride
- Feel they do not have a happy home
- Currently live in shelter care or independently
- Have difficulty making friends
- Lack concern for the feelings of others
- Come from neighborhoods with crime, violence, or drugs

HIGH RISK STUDENT PROFILE
<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Dependence</td>
<td>98.9 %</td>
<td>2.4 %</td>
</tr>
<tr>
<td>Drug Dependence</td>
<td>98.4 %</td>
<td>0.7 %</td>
</tr>
<tr>
<td>Weapon Carrying</td>
<td>97.4 %</td>
<td>3.7 %</td>
</tr>
<tr>
<td>Suicide Ideation</td>
<td>91.4 %</td>
<td>11.3 %</td>
</tr>
<tr>
<td>Violent Anger</td>
<td>92.6 %</td>
<td>5.7 %</td>
</tr>
</tbody>
</table>
Our selected indicators were not as strongly associated with suicide ideation as with our other outcomes.

Further research indicates that suicide ideation has been linked to alcohol and drug dependence (Brent, et al. and Lewinsohn, et al).

- A preliminary univariable model of suicide ideation versus alcohol and drug dependence yields meaningful results: OR 2.196 and 2.648; BIC differences of 397.35 and 381.75.

Additionally, further research confirms that adolescents in shelter care are at higher risk of drug dependence, potentially due to higher tolerance of illicit behaviors among peers (Fors, et al.).

**Areas of Future Research**
THANK YOU!
Brent, DA; Perper, JA; Moritz, G; Allman, C; Friend, A; Roth, C; Schweers, J; Balach, L, and Baugher, M. "Psychiatric Risk Factors for Adolescent Suicide: A Case-Control Study." Journal of the American Academy of Child & Adolescent Psychiatry 32.2 (1993): 521-29.

De Guzman, MR, and Bosch, KR. "High-Risk Behaviors Among Youth." Publication: High Risk Behavior Among Youth.


In modeling frameworks based on very large sample sizes, the Bayesian information criterion (BIC) is arguably a more appropriate criterion for model comparison than the Akaike information criterion (AIC) or frequentist test statistics.

- As the sample size grows, AIC and other frequentist inferential procedures will evaluate an effect to be increasingly important.

- BIC, and other objectivist Bayesian inferential methods, follow the principle of sample size coherency: the tenet that any assessment of the importance of an effect should be somewhat consistent across sample sizes (Efron and Gous, 2001).
For two models considered a priori equally probable, the difference in BIC values provides a rough approximation to $2 \log BF$, where BF is the Bayes factor.

- Specifically, let $M_1$ and $M_2$ denote two models, and let $BF_{12}$ denote the Bayes’ factor in favor of model $1$ relative to model $2$.
- Let $BIC_1$ and $BIC_2$ respectively denote the BIC values for models $M_1$ and $M_2$.
- $BIC_2 - BIC_1$ approximates $2 \log BF_{12}$. 

**Bayesian Information Criterion**
### MAXIMUM LIKELIHOOD ESTIMATES

<table>
<thead>
<tr>
<th>DEP_ALC</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIDE</td>
<td>0.3951</td>
<td>0.1316</td>
<td>-0.227</td>
<td>-0.2997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAPPY HOME</td>
<td>-0.6409</td>
<td>-0.3415</td>
<td>0.1889</td>
<td>0.7935</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIVING SITUATION</td>
<td>-0.9233</td>
<td>-0.5934</td>
<td>-0.3252</td>
<td>1.1202</td>
<td>0.1054</td>
<td>0.6889</td>
<td>-0.0726</td>
</tr>
<tr>
<td>MAKING FRIENDS</td>
<td>0.0987</td>
<td>-0.2594</td>
<td>-0.3108</td>
<td>0.4715</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMPATHY</td>
<td>-0.9837</td>
<td>-0.5661</td>
<td>0.2728</td>
<td>1.277</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVDN</td>
<td>0.4567</td>
<td>0.284</td>
<td>-0.2069</td>
<td>-0.5338</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{1i} + \beta_{2i} + \cdots + \beta_{6i}
\]