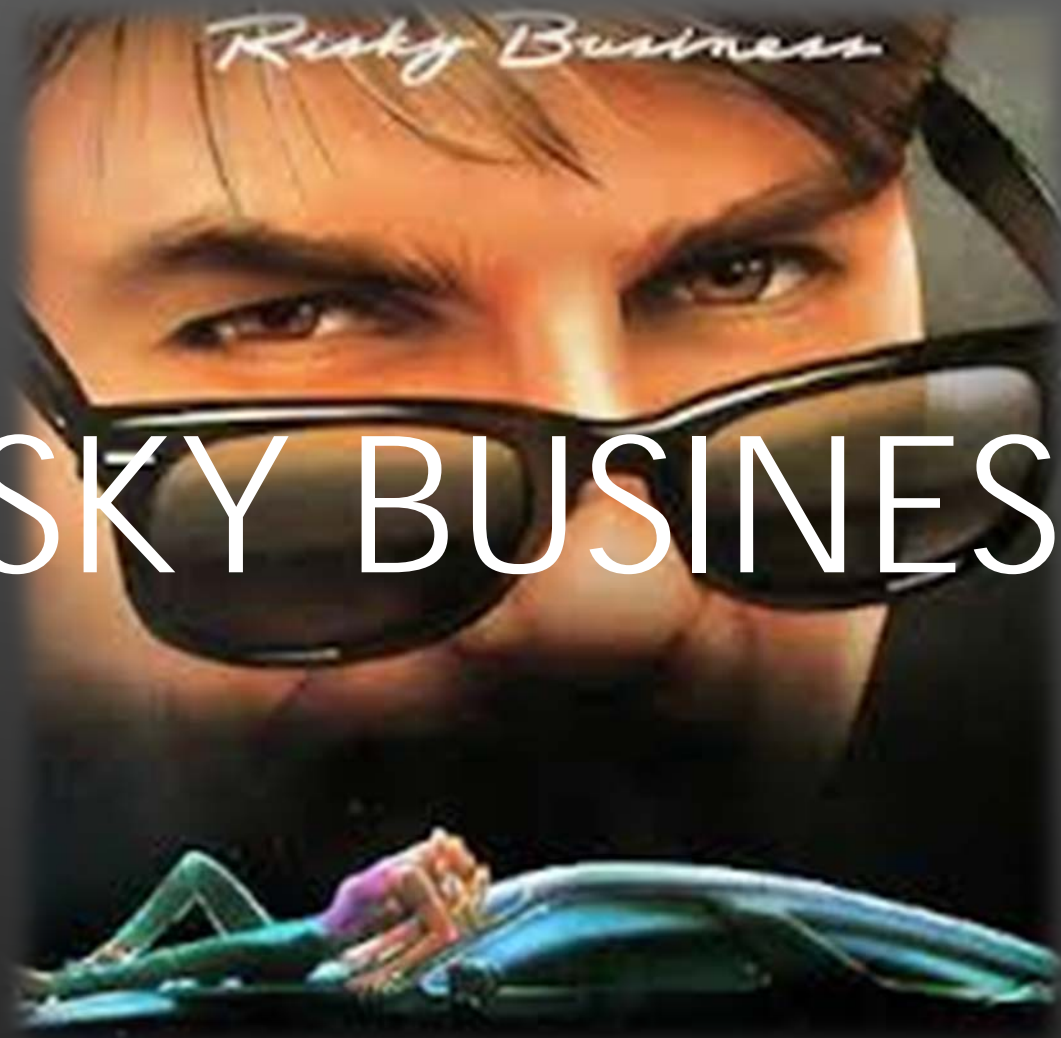# RISKY BUSINESS

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

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RISKY BUSINESS?

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
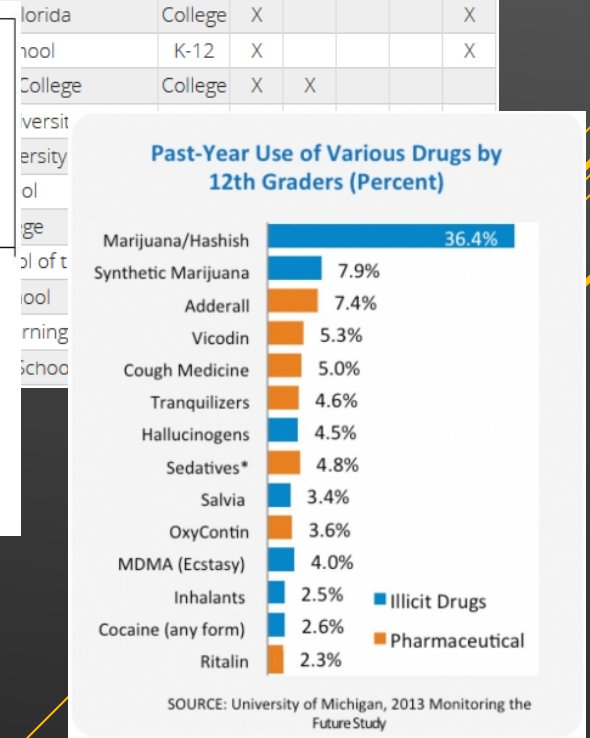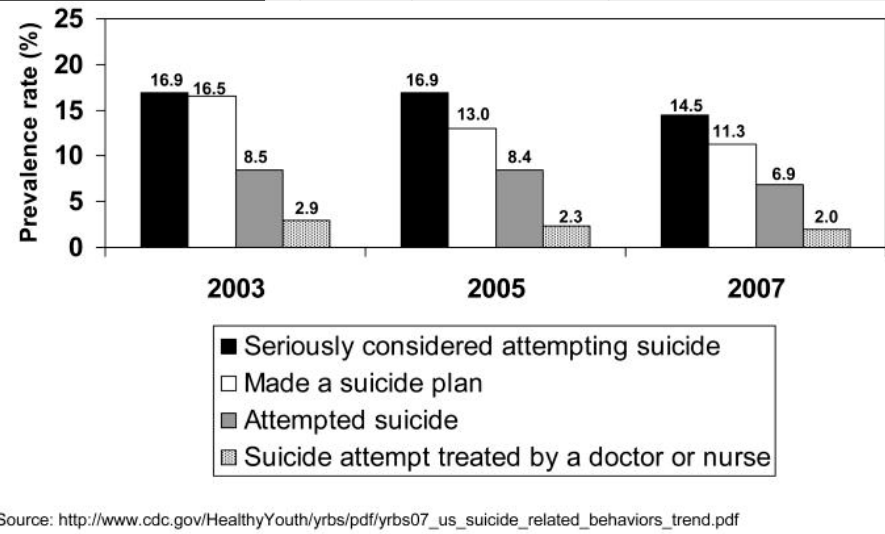(De Guzman, et al)

This includes both behaviors that cause immediate physical injury as well as behaviors with cumulative negative effects

NOT EXACTLY…

- 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

#	Date	City, State	School Name	Type	Discharged Firearm	Injured 1+ Person	Killed 1+ Person	Attempted Suicide	Committed Suicide
1.	1/08/2013	Fort Myers, FL	Apostolic Revival Center Christian School	K-12	X	X	X		
2.	1/10/2013	Taft, CA	Taft Union High School	K-12	X	X			
3.	1/15/2013	St. Louis, MO	Stevens Institute of Business & Arts	College	X	X		X	
4.	1/15/2013	Hazard, KY	Hazard Community and Technical College	College	X	X	X		
5.	1/16/2013	Chicago, IL	Chicago State University	College	X	X	X		
6.	1/22/2013	Houston, TX	Lone Star College North Harris Campus	College	X	X			
7.	1/31/2013	Atlanta, GA	Price Middle School	K-12	X	X			
8.	2/1/2013	Atlanta, GA	Morehouse College	College	X	X			
9.	2/7/2013	Fort Pierce, FL	Indian River St. College	College	X	X			
10.	2/13/2013	San Leandro, CA	Hillside Elementary School	K-12	X	X	X		
11.	2/27/2013	Atlanta, GA	Henry W. Grady HS	K-12	X	X			
			lorida	College	X				X
			hool	K-12	X				X
			College	College	X	X			

Source: http://www.cdc.gov/HealthyYouth/yrbs/pdf/yrbs07_us_suicide_related_behaviors_trend.pdf

Seriously considered attempting suicide: 2003: 16.9, 2005: 16.9, 2007: 14.5
Made a suicide plan: 2003: 16.5, 2005: 13.0, 2007: 11.3
Attempted suicide: 2003: 8.5, 2005: 8.4, 2007: 6.9
Suicide attempt treated by a doctor or nurse: 2003: 2.9, 2005: 2.3, 2007: 2.0

Past-Year Use of Various Drugs by 12th Graders (Percent)

- Marijuana/Hashish: 36.4%
- Synthetic Marijuana: 7.9%
- Adderall: 7.4%
- Vicodin: 5.3%
- Cough Medicine: 5.0%
- Tranquilizers: 4.6%
- Hallucinogens: 4.5%
- Sedatives*: 4.8%
- Salvia: 3.4%
- OxyContin: 3.6%
- MDMA (Ecstasy): 4.0%
- Inhalants: 2.5%
- Cocaine (any form): 2.6%
- Ritalin: 2.3%

Illicit Drugs
Pharmaceutical

SOURCE: University of Michigan, 2013 Monitoring the Future Study

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

- 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

OUTLINE

- 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)

DATA SET

- 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

VARIABLES

- 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)

VARIABLES

- ▶ 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

VARIABLES

- ▶ 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

ANALYTIC GOALS

- 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

ANALYTIC APPROACH

WITHIN SCHOOL DISTRICT CORRELATIONS

Univariable Gen Mod Min/Max	Pride	Happy Home	Living Situation	Making Friends	Empathy	CVDN
Alcohol Dependence	0.001677	0.001401	0.001577	0.001684	0.001468	0.001132
Drug Dependence	0.003706	0.003791	0.003456	0.003727	0.003477	0.002379
Weapon Carrying	0.002961	0.002671	0.002707	0.003327	0.001962	0.001368
Suicide Ideation	0.016693	0.016990	0.016718	0.016628	0.016575	0.016896
Violent Anger	0.006613	0.006050	0.006341	0.007211	0.005020	0.004085

- **Maximum** (purple)
- **Minimum** (green)
- **Global maximum** (red dashed)
- **Global minimum** (blue dashed)
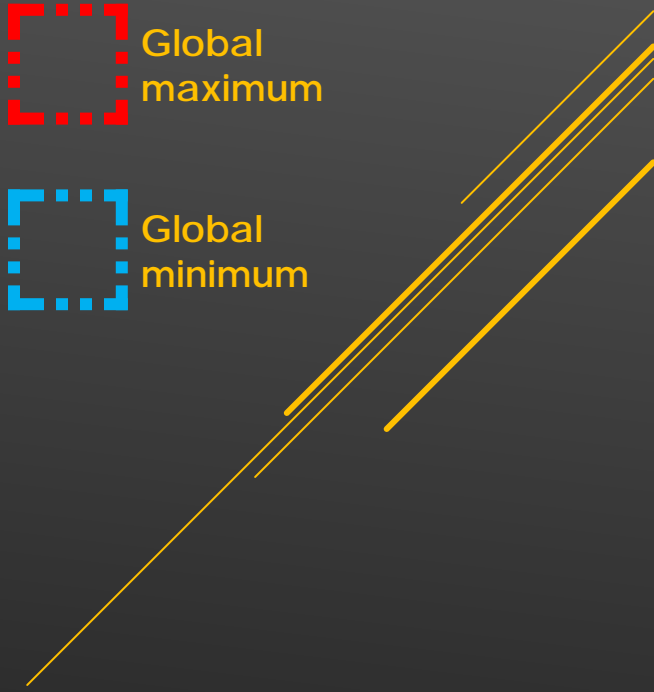
UNIVARIABLE MODELS: BIC DIFFERENCES BETWEEN NULL AND UNIVARIABLE MODELS

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

Legend:
- > 2000
- 1000 – 2000
- 500 – 1000
- < 500
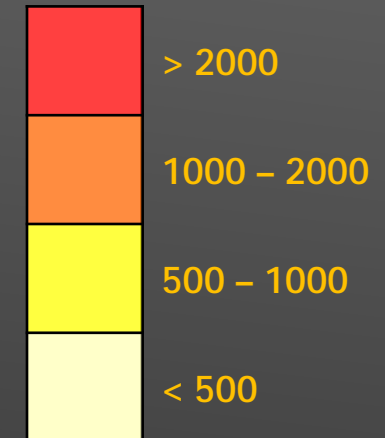
MULTIVARIABLE MODELS: BIC DIFFERENCES BETWEEN REDUCED AND FULL MODELS

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

Legend:
- > 2000
- 1000 – 2000
- 500 - 1000
- < 500
- Consistently outstanding
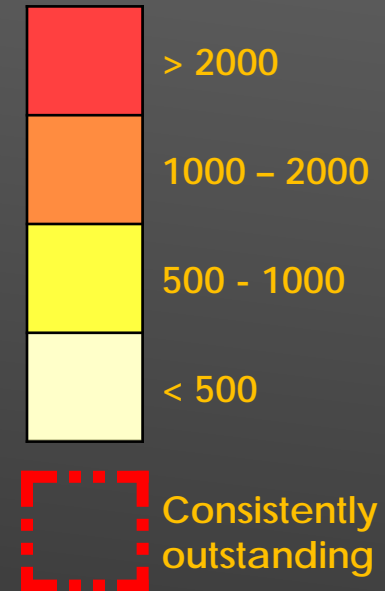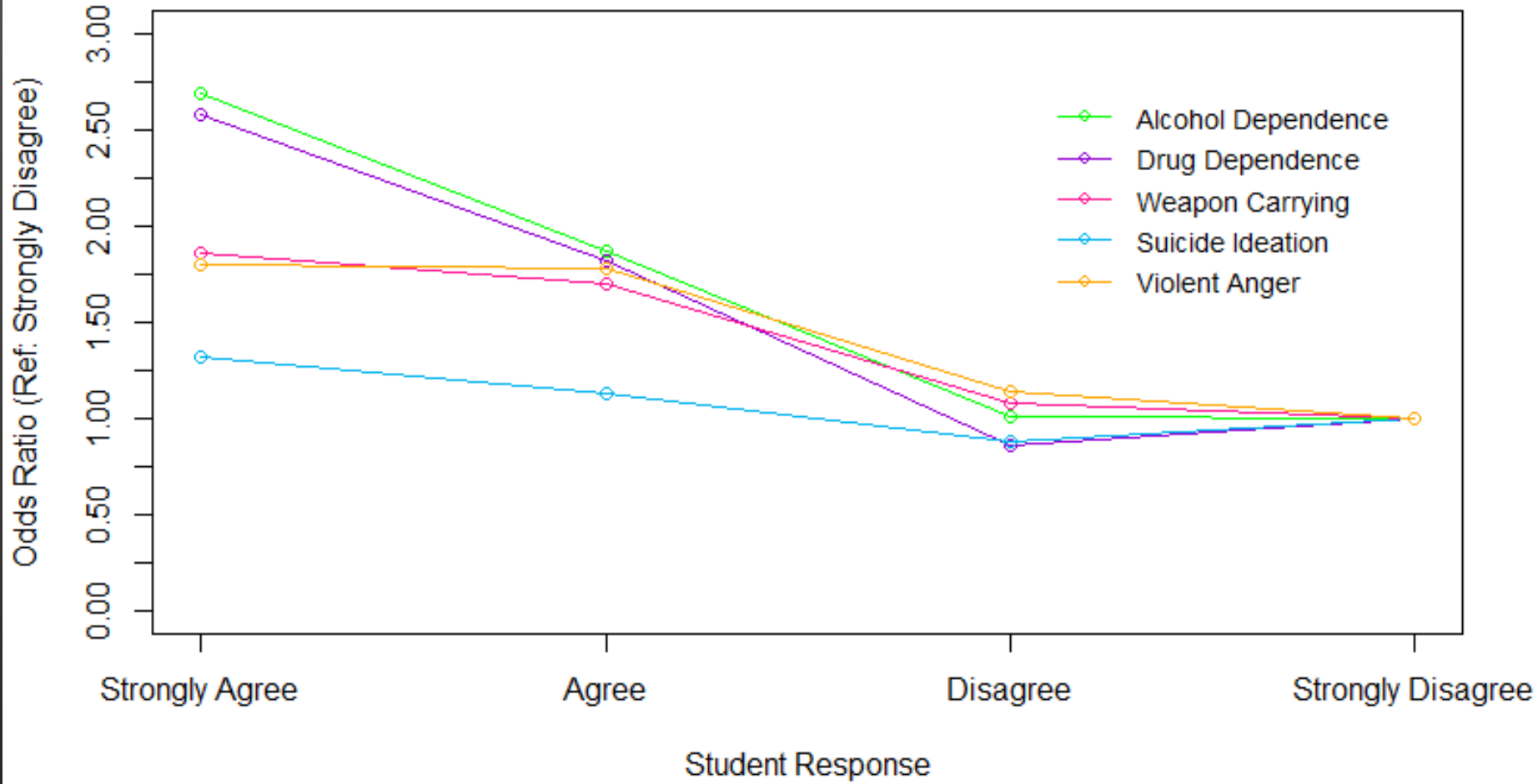
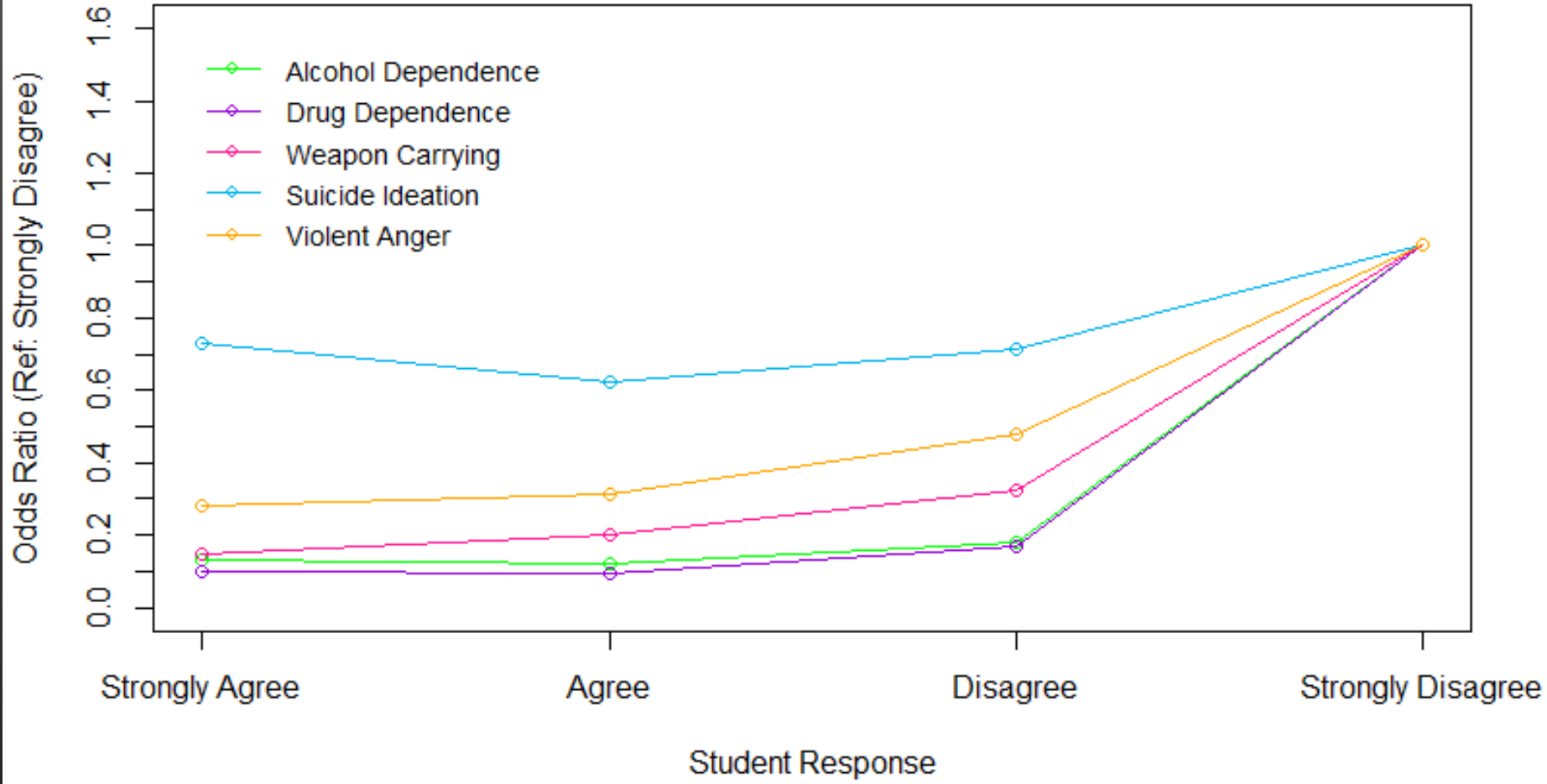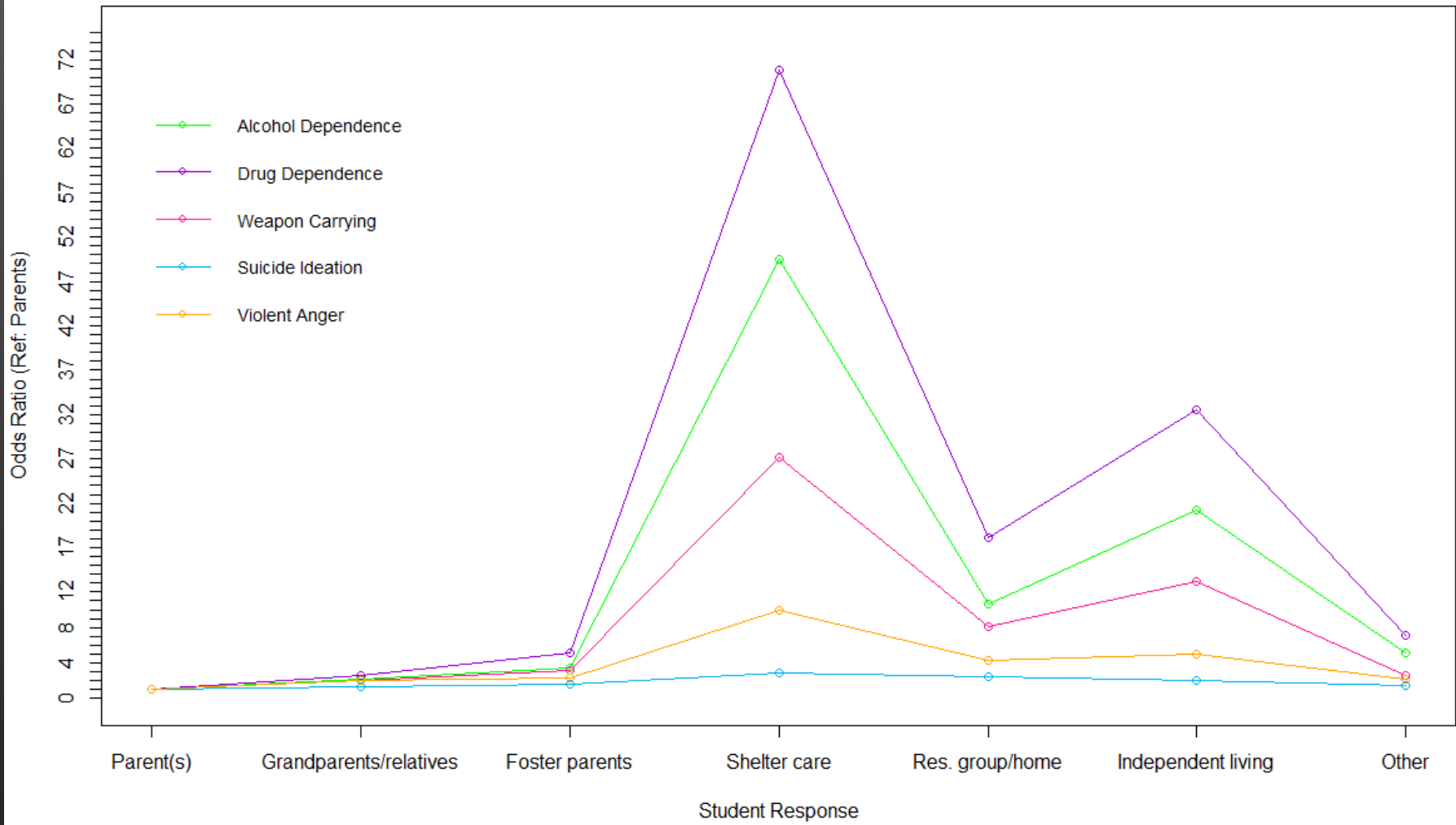In My Neighborhood There Are Lots of Fights, Crime, or Illegal Drugs
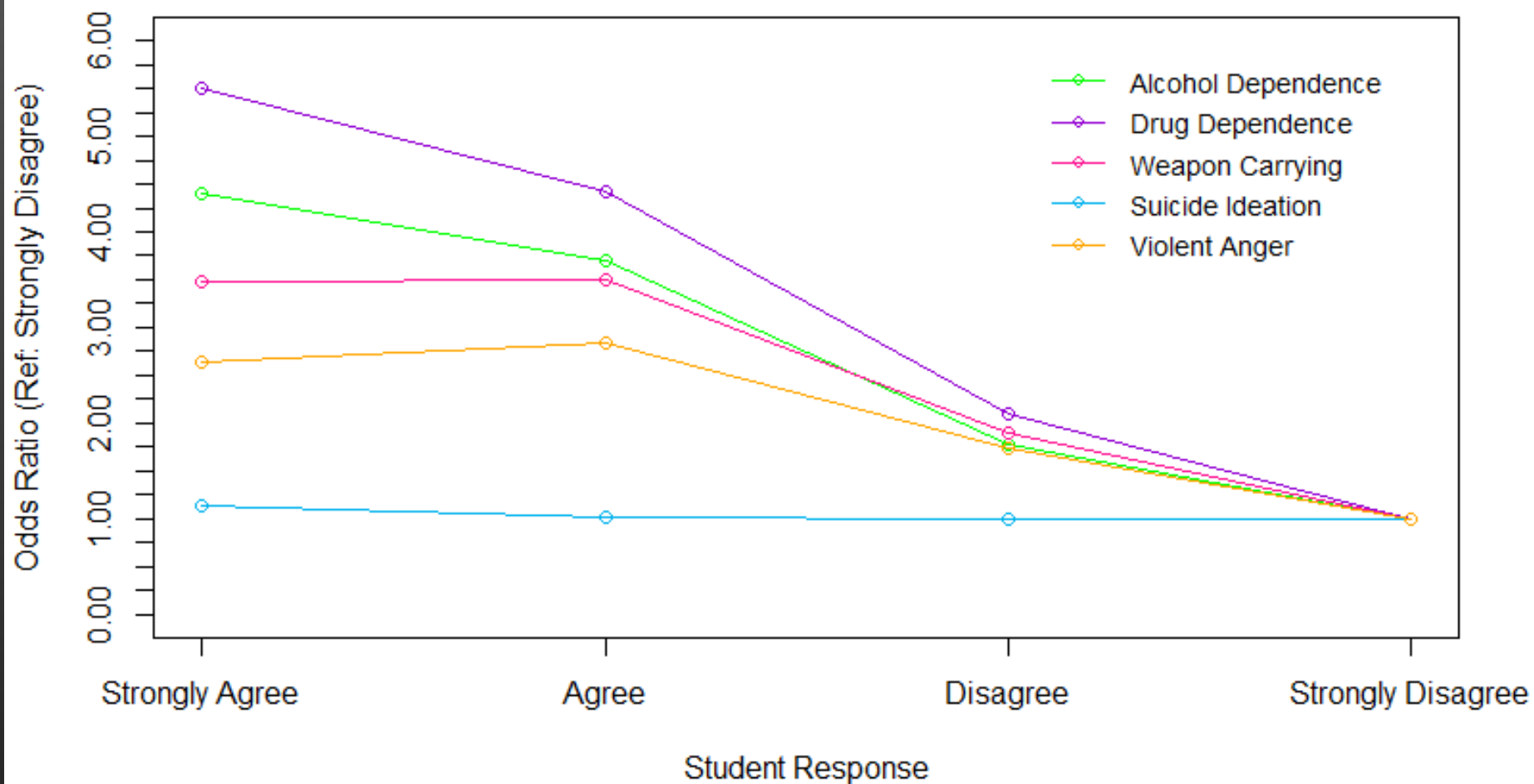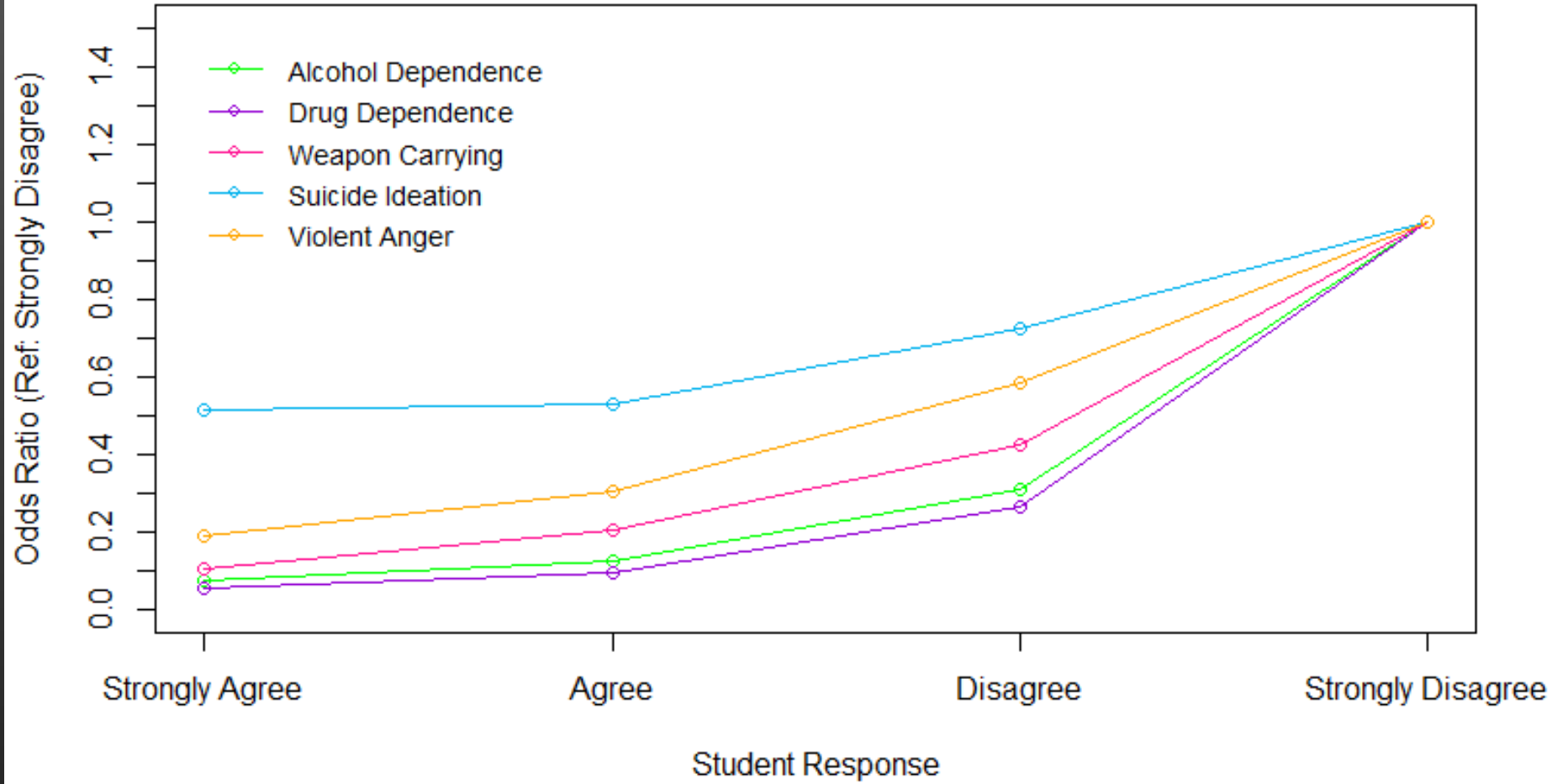
I Am Good at Making Friends

I Care About Other People's Feelings
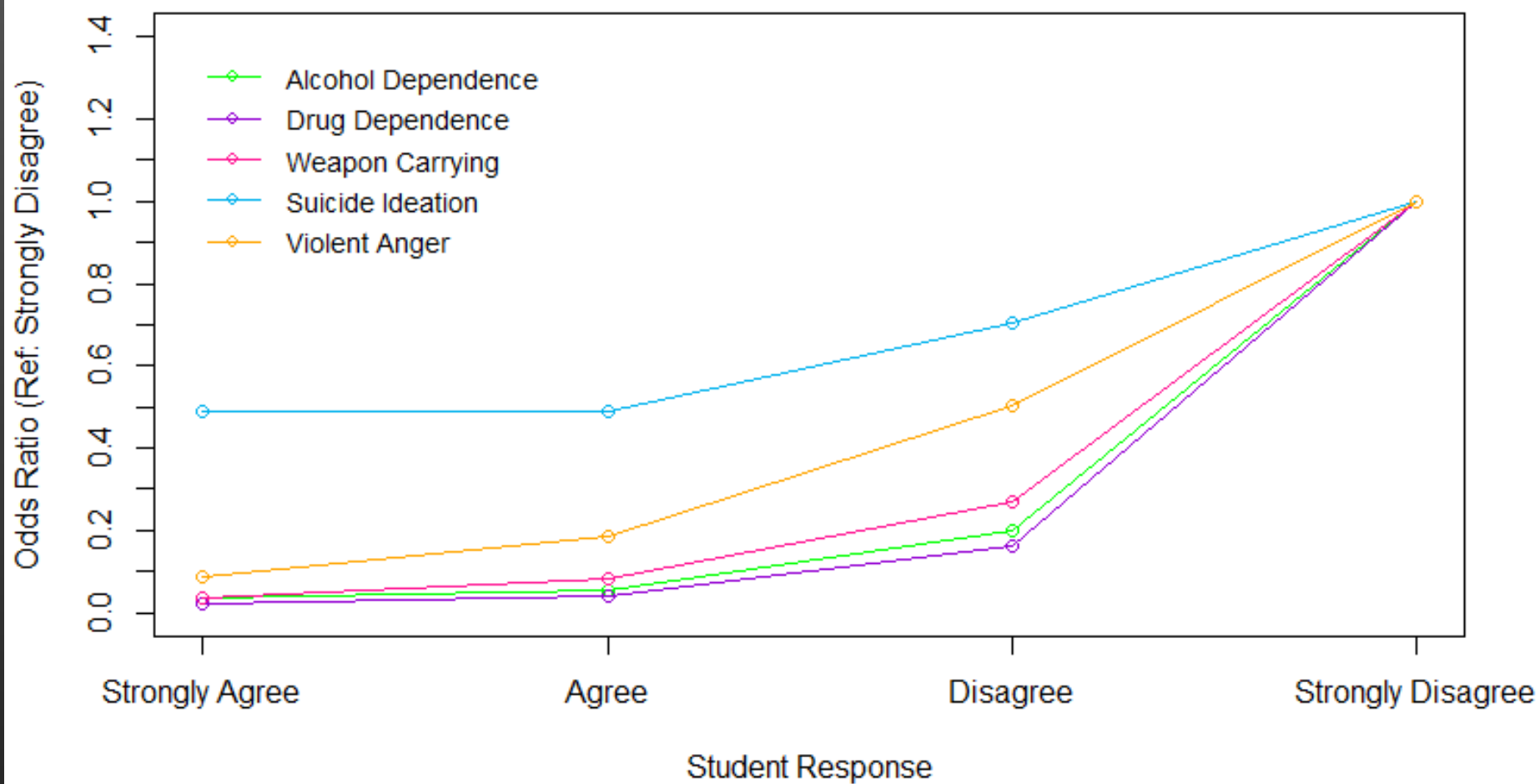
- For four of the five outcomes (all except suicide ideation), we found that the strongest bivariable association among the indicators was with empathy

- 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

INDICATOR CONCLUSIONS

- 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

	Maximum	Minimum
Alcohol Dependence	98.9 %	2.4 %
Drug Dependence	98.4 %	0.7 %
Weapon Carrying	97.4 %	3.7 %
Suicide Ideation	91.4 %	11.3 %
Violent Anger	92.6 %	5.7 %

MAX/MIN PROBABILITIES FOR HIGHEST/LOWEST RISK TEENS
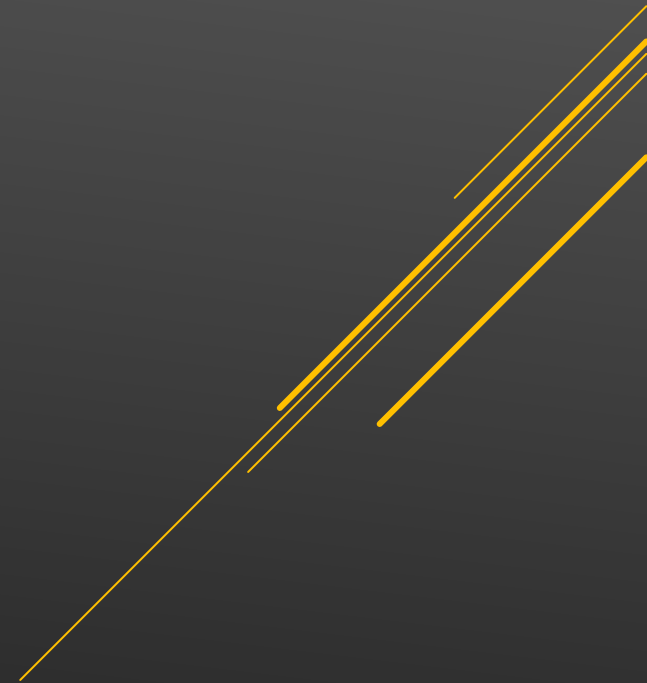
- Our selected indicators were not as strongly associated with suicide ideation as with our other outcomes

- 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.

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Efron, B, and Gous, A. "Scales of Evidence for Model Selection: Fisher versus Jeffreys." *Model Selection*, IMS Monograph Series, Volume 38, edited by P Lahiri: 208-246.

Fors, SW, and Rojek, DG. "A Comparison of Drug Involvement between Runaways and School Youths." *Journal of Drug Education* 21.1 (1991): 13-25.

Lewinsohn, PM; Rohde, P, and Seeley, JR. "Adolescent Suicidal Ideation and Attempts: Prevalence, Risk Factors, and Clinical Implications." *Clinical Psychology: Science and Practice*, 25 Jan. 2006.

Neath, AA, and Cavanaugh, JE. "The Bayesian Information Criterion: Background, Derivation, and Applications." *Wiley Interdisciplinary Reviews: Computational Statistics* 4.2 (2012): 199-203.

REFERENCES

- 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)

BAYESIAN INFORMATION CRITERION
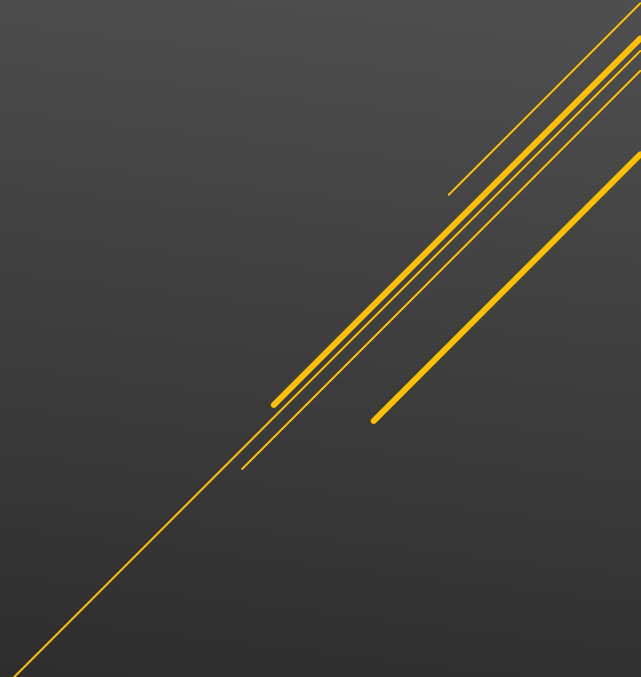
- For two models considered *a priori* equally probable, the difference in BIC values provides a rough approximation to 2 log BF, where BF is the Bayes factor
  - Specifically, let M1 and M2 denote two models, and let BF12 denote the Bayes' factor in favor of model 1 relative to model 2
  - Let BIC1 and BIC2 respectively denote the BIC values for models M1 and M2
  - BIC2 – BIC1 approximates 2 log BIC12

BAYESIAN INFORMATION CRITERION

MAXIMUM LIKELIHOOD ESTIMATES

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

Maximum	
Minimum	

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

ALCOHOL DEPENDENCE: MAXIMUM LIKELIHOOD ESTIMATES