THE UNIVERSITY OF IOWA

An Analysis of Factors Related to Alcohol, Tobacco, Marijuana, and Drug Use among Adolescents Based on the Iowa Youth Survey

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WHY SHOULD WE BE WORRIED ABOUT SUBSTANCE ABUSE IN ADOLESCENCE?

- Alcohol and drug use in adolescence and early adulthood is acknowledged to be a public health problem worldwide.
- Risk and protective factors for youth substance abuse occur at individual, peer, family, school, and community levels (Hawkins et al., 1992 and Oesterle et al., 2012).

HEALTH RISKS ASSOCIATED WITH SUBSTANCE ABUSE

- **Cigarettes:**
  - Smoking accounts for 1/3 of all cancers, 90% of lung cancers
  - On average, adults who smoke die 10 years earlier than non smokers
- **Alcohol:**
  - May negatively affect brain, heart, liver, pancreas, and immune system
  - May increase the risk of cancers of the mouth, esophagus, throat, liver, and breast
- **Marijuana:**
  - May reduce thinking, memory, and learning functions and affect how the brain builds connections

HEALTH RISKS ASSOCIATED WITH SUBSTANCE ABUSE

- **Inhalants**
  - Can result in damage of the liver, kidney, brain, and bone marrow, and may negatively impact hearing
  - May lead to sudden death
- **Methamphetamines**
  - Negatively affects cardiovascular function and metabolism
  - Leads to extreme weight loss, severe dental problems ("meth mouth"), and skin sores

OUTLINE

- Describe the data set
- Specify the project goals
- Explain the approach utilized for the data analysis
- Discuss the results of the analysis
- Profile high risk youth and summarize the results

Iowa Youth Survey

Iowa Department of Public Health | Iowa Department of Education | Criminal and Juvenile Justice Planning | Office of Drug Control Policy | Iowa Department of Human Services

- The data set is a compilation of the Iowa Youth Survey from the years 2005, 2008, and 2010.
- The survey covers 412 school districts in the state of Iowa.
- The overall data set contains 338 variables.
- This study considers 5 outcome variables (regarding alcohol, tobacco, marijuana, and drug use) and 8 explanatory variables (factors) for analysis.
- Cleaning of data resulted in 242,968 complete observations for analysis (from an original 274,227 observations).

VARIABLES

Outcome (Binary)

- **SMOKED_CIGARETTE:** Student has smoked a cigarette
- **DRANK_ALCOHOL**: Student has drank (more than a few sips) of alcohol (beer, wine, or liquor)
- **TRIED_MARIJUANA**: Student has tried marijuana
- **SNIFFED_GLUE**: Student has tried sniffing glue, breathing contents of aerosol spray cans, or inhaling any other gases or sprays in order to get high
- **TRIED_METH**: Student has tried methamphetamines

VARIABLES

Explanatory

- DEMOGRAPHIC
  - **GRADE**: 6th, 8th,11th, or Other
  - **GENDER**: Male or Female
  - **ETHNICITY**: White, African American, Hispanic or Latino, or Other
- DOMESTIC
  - **LIVING_SITUATION**: Student's self reported living situation (With Parents, With Grandparents/Relatives, With Foster Parents, In Shelter Care or In a Residential/Group Home, Independent Living, Other)

VARIABLES

Explanatory *Continued*

- INVOLVEMENT
  - **PAID_JOB**: Average hours per week the student spent working a paid job (0, 1-2, 3-5, 6-8, 9 or more)
  - **EXCUR_AT_SCHOOL**: Average hours per week the student participated in extracurricular activities at school (0, 1-2, 3-5, 6-8, 9 or more)
  - **EXCUR_OUTSIDE_SCHOOL**: Average hours per week the student participated in extracurricular activities at school or outside of school(0, 1-2, 3-5, 6-8, 9 or more)
- ENGAGEMENT
  - **FINISH_HS**: Student's perception that she or he will finish high school (Strong Agree, Agree, Disagree, Strongly Disagree)

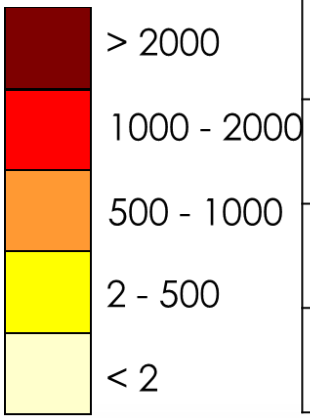
ANALYTIC GOALS

- Characterize bivariable and multivariable associations of substance use outcomes with explanatory variables.
- Create profiles to aid in the development of intervention programs by identifying potentially high risk students.

ANALYTIC APPROACH

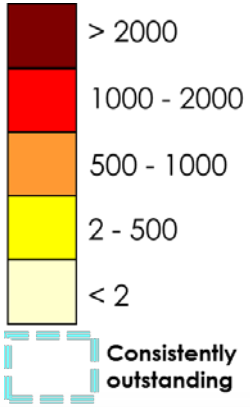
- Data were analyzed using logistic regression (PROC LOGISTIC in SAS)
  - Logistic regression was used to fit univariable and multivariable models to characterize associations
- The Bayesian Information Criterion (BIC) was utilized to assess the strength of each variable in both the univariable and multivariable models
- Results were graphically summarized (in R) using odds ratios
- Maximum likelihood estimates and the inverse logit transform were used to calculate the maximum and minimum probabilities for substance use for the highest and lowest risk teens

UNIVARIABLE MODELS: BIC DIFFERENCES BETWEEN NULL AND UNIVARIABLE MODELS

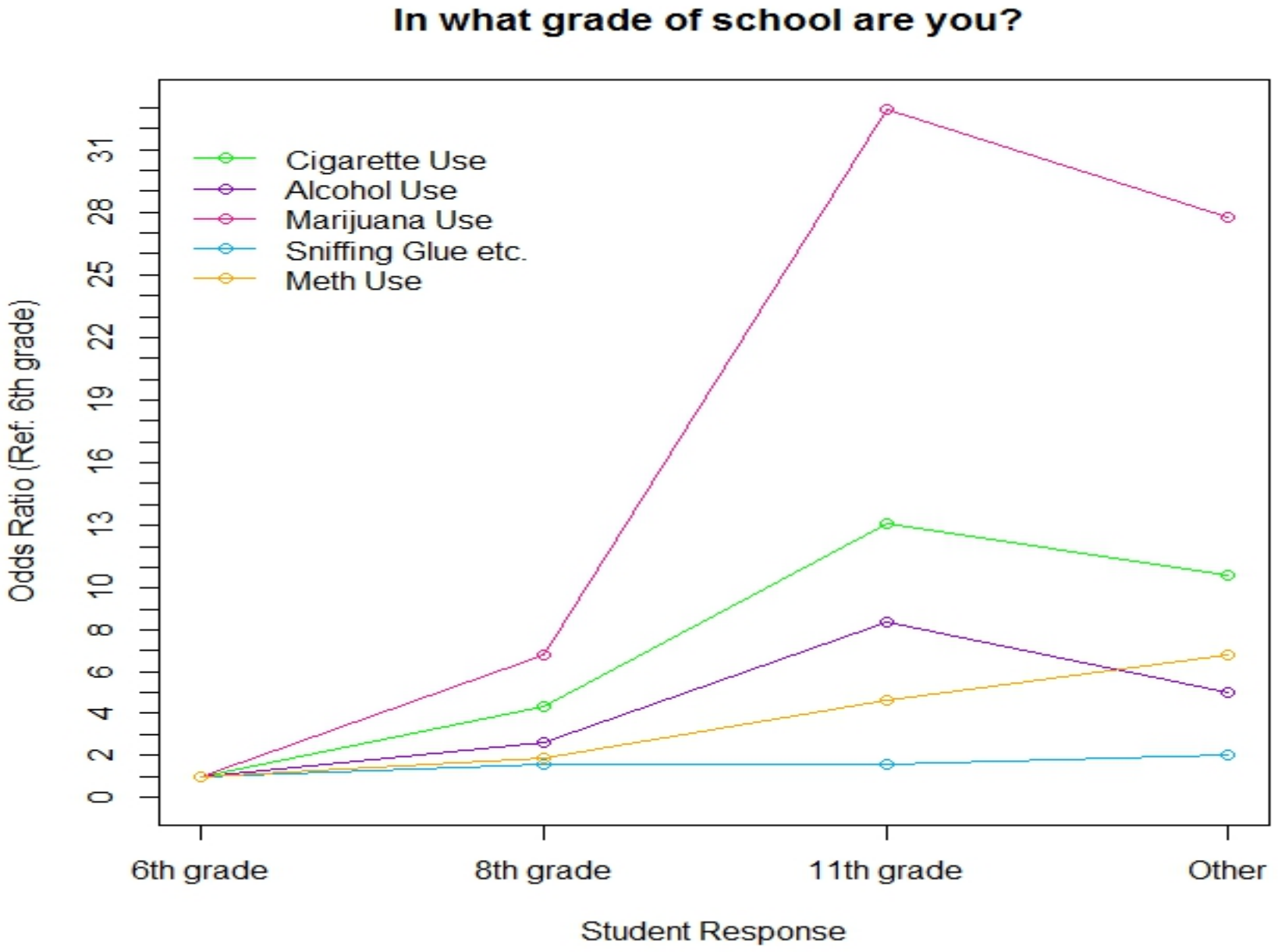


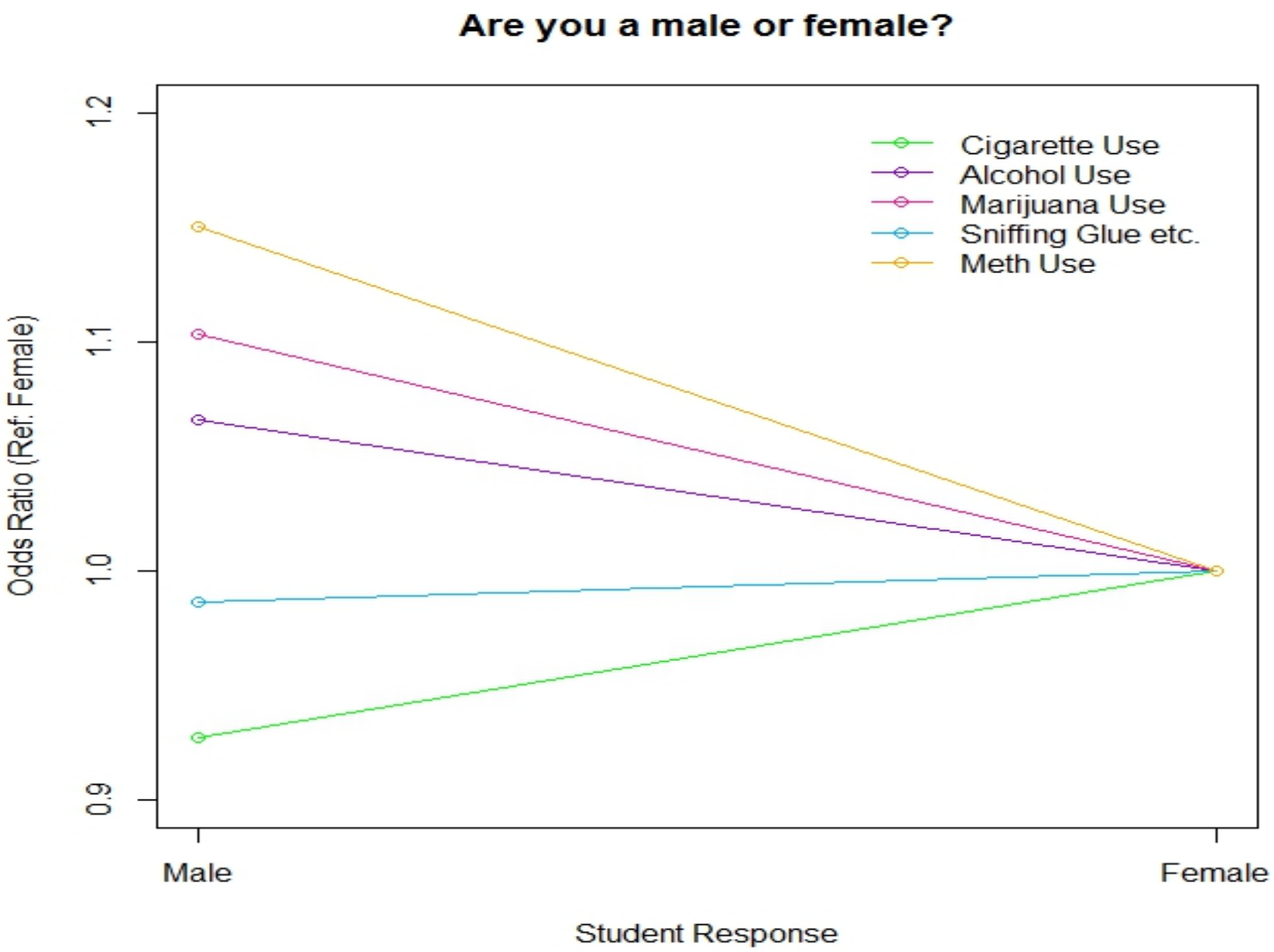
Univariable	Grade	Gender	Ethnicity	Living Situation	Paid Job	Extracurricular Activities at School	Extracurricular Activities Outside of School	Finish High School
Alcohol Use	1 (44442.31)	7 (171.75)	8 (88.59)	6 (1607.03)	2 (21485.18)	5 (2998.33)	4 (3078.26)	3 (8122.75)
Tobacco Use	1 (27544.84)	8 (-1.42)	7 (232.76)	6 (3187.53)	2 (12521.71)	5 (4290.43)	4 (5614.12)	3 (8223.05)
Marijuana Use	1 (30597.26)	8 (189.27)	7 (1223.61)	6 (3138.72)	2 (11871.19)	5 (4323.20)	4 (4795.23)	3 (6605.00)
Methamphetamine Use	3 (1916.64)	8 (118.87)	7 (656.10)	2 (2834.51)	4 (908.83)	5 (845.13)	6 (829.48)	1 (4464.38)
Glue Use	3 (1119.86)	8 (30.41)	7 (553.14)	2 (1924.26)	5 (745.86)	6 (680.92)	4 (767.99)	1 (4595.85)

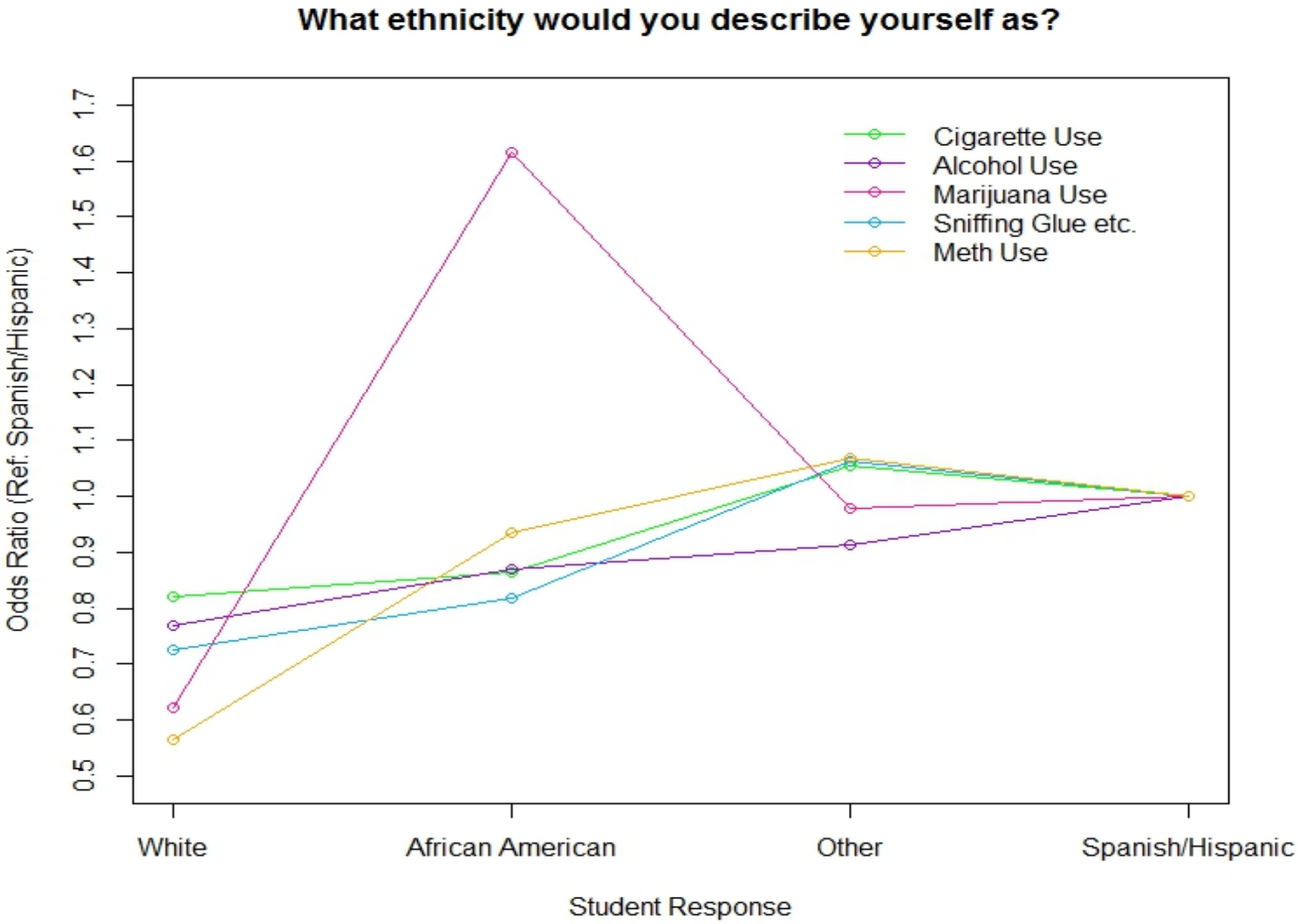
MULTIVARIABLE MODELS: BIC DIFFERENCES BETWEEN REDUCED AND FULL MODELS

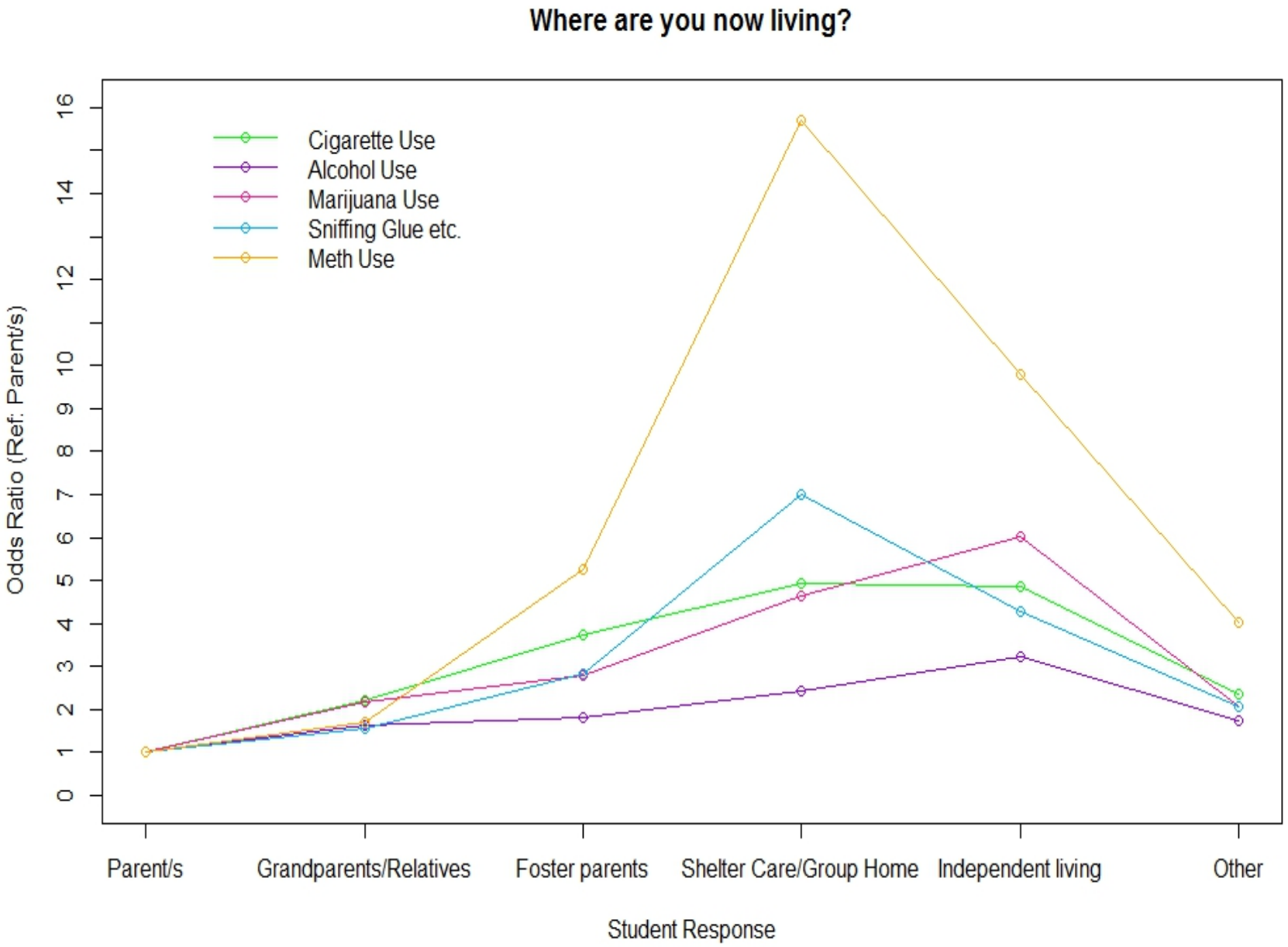


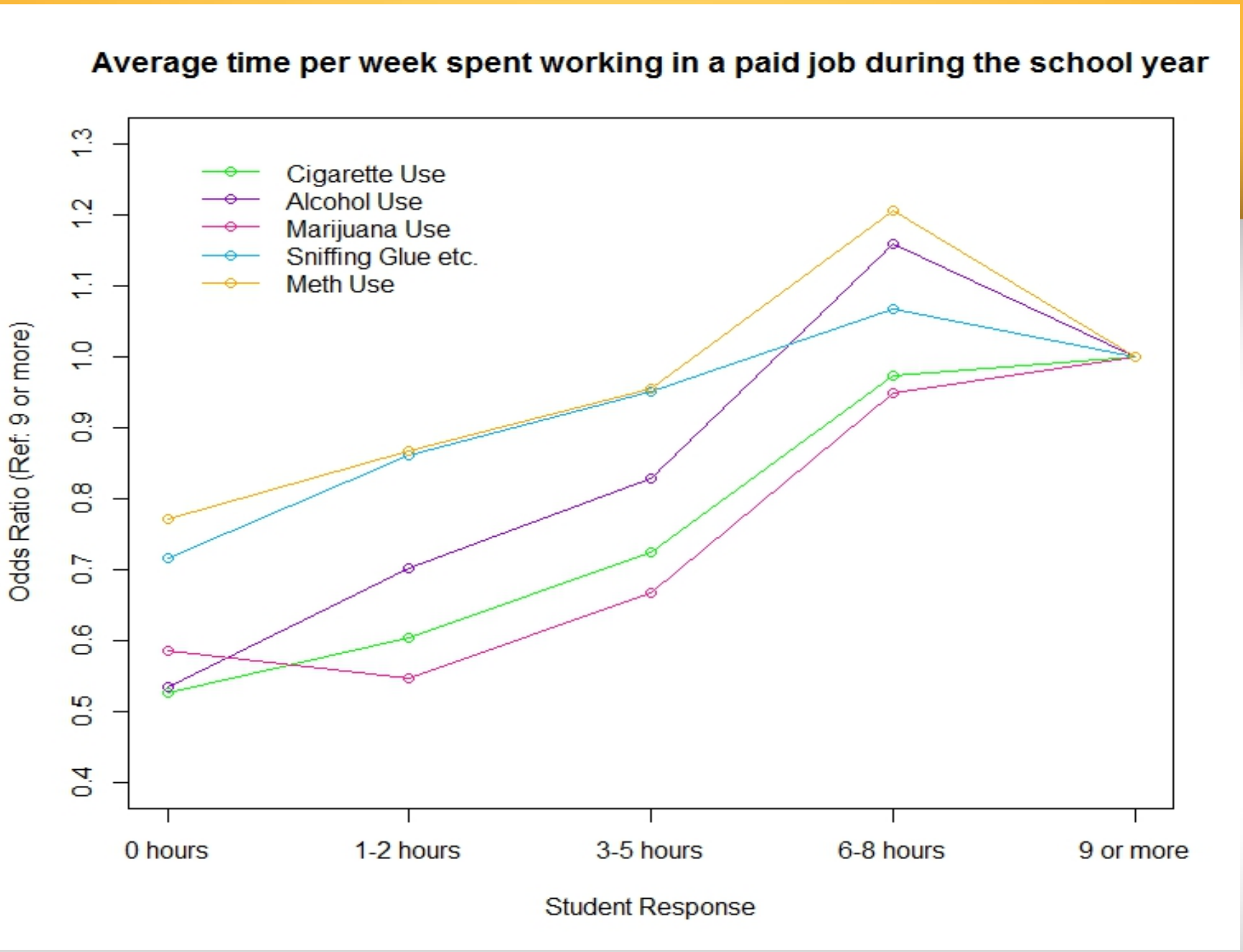
Multivariable	Grade	Gender	Ethnicity	Living Situation	Paid Job	Extracurricular Activities at School	Extracurricular Activities Outside of School	Finish High School
Alcohol Use	1 (23695.91)	8 (30.66)	7 (183.78)	4 (544.47)	3 (3209.01)	5 (348.22)	6 (267.95)	2 (4187.4)
Tobacco Use	1 (16154.71)	8 (24.1)	7 (107.24)	5 (1390.77)	4 (1527.05)	3 (1713.1)	6 (622.72)	2 (4107.47)
Marijuana Use	1 (19443.39)	8 (34.69)	4 (1117.03)	5 (1070.94)	6 (883.34)	3 (1496.85)	7 (374.88)	2 (2987.46)
Methamphetamine Use	3 (804.672)	8 (1.609)	4 (146.501)	2 (1006.168)	6 (42.972)	5 (112.843)	7 (16.23)	1 (2476.233)
Glue Use	3 (456.31)	8 (-11.71)	5 (190.48)	2 (818.58)	4 (257.75)	6 (133.8)	7 (25.06)	1 (2892.81)

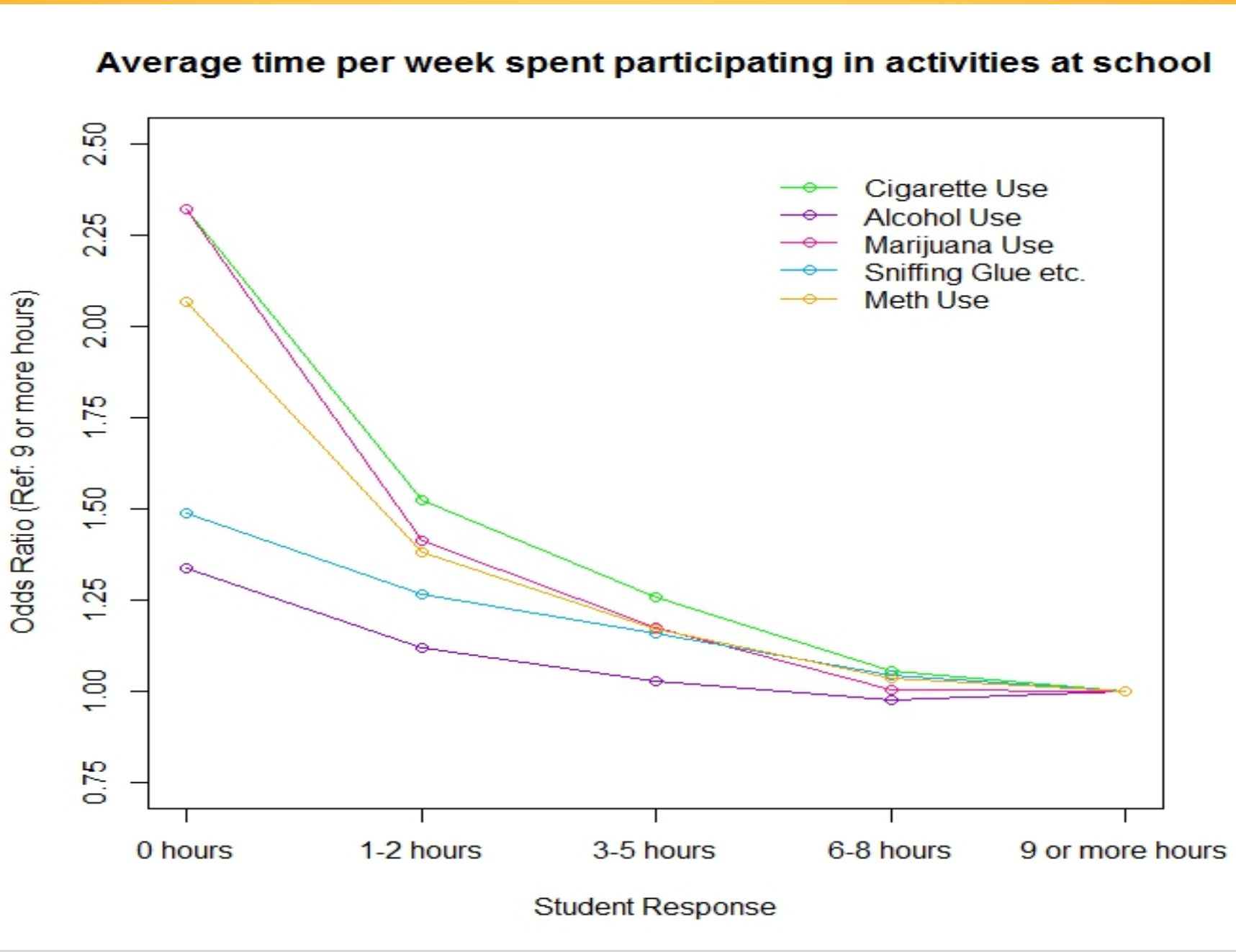

In what grade of school are you?
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
Odds Ratio (Ref: 6th grade)
0
2
4
6
8
10
13
16
19
22
25
28
31
6th grade
8th grade
11th grade
Other
Student Response

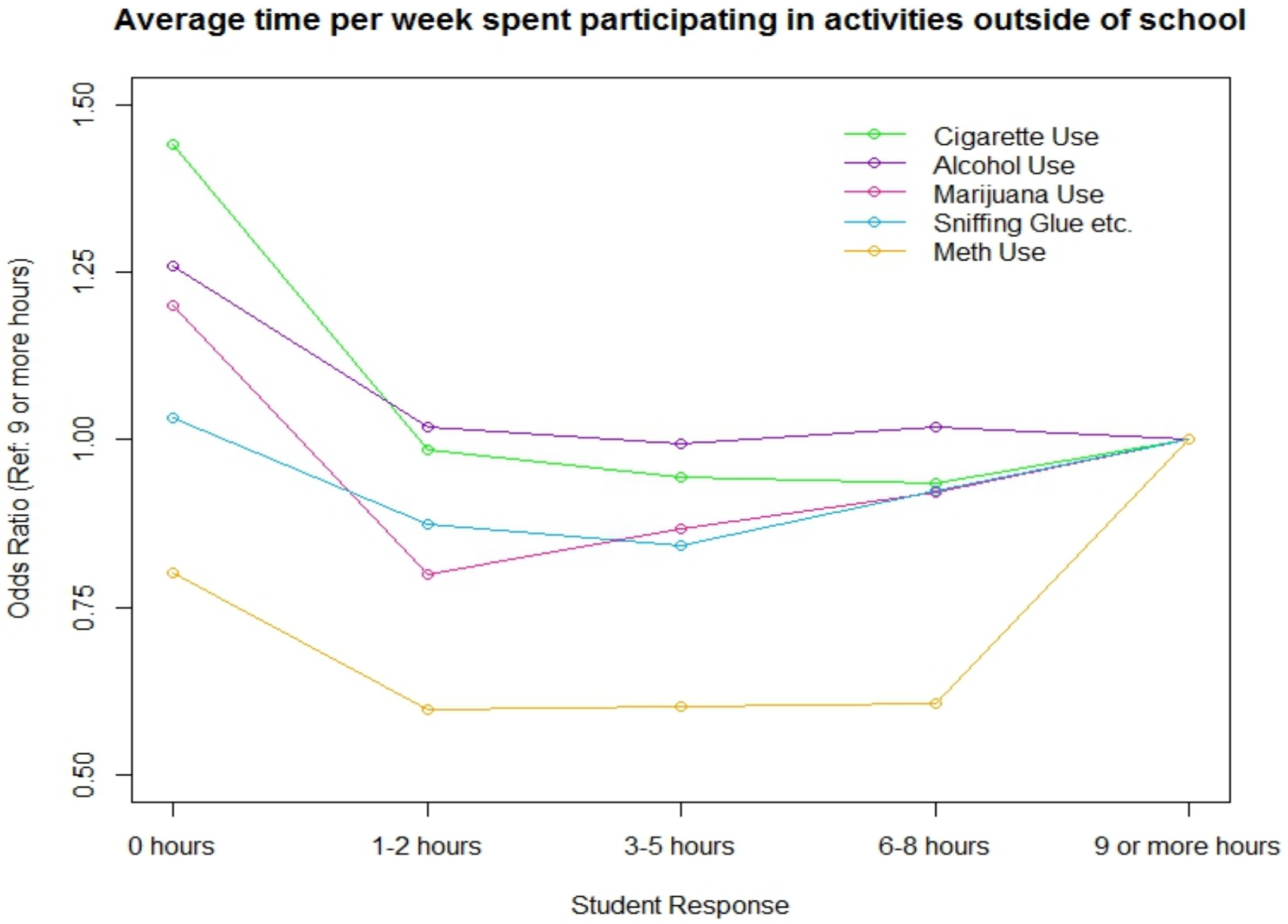

Are you a male or female?
Odds Ratio (Ref: Female)
1.2
1.1
1.0
0.9
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
Male
Female
Student Response

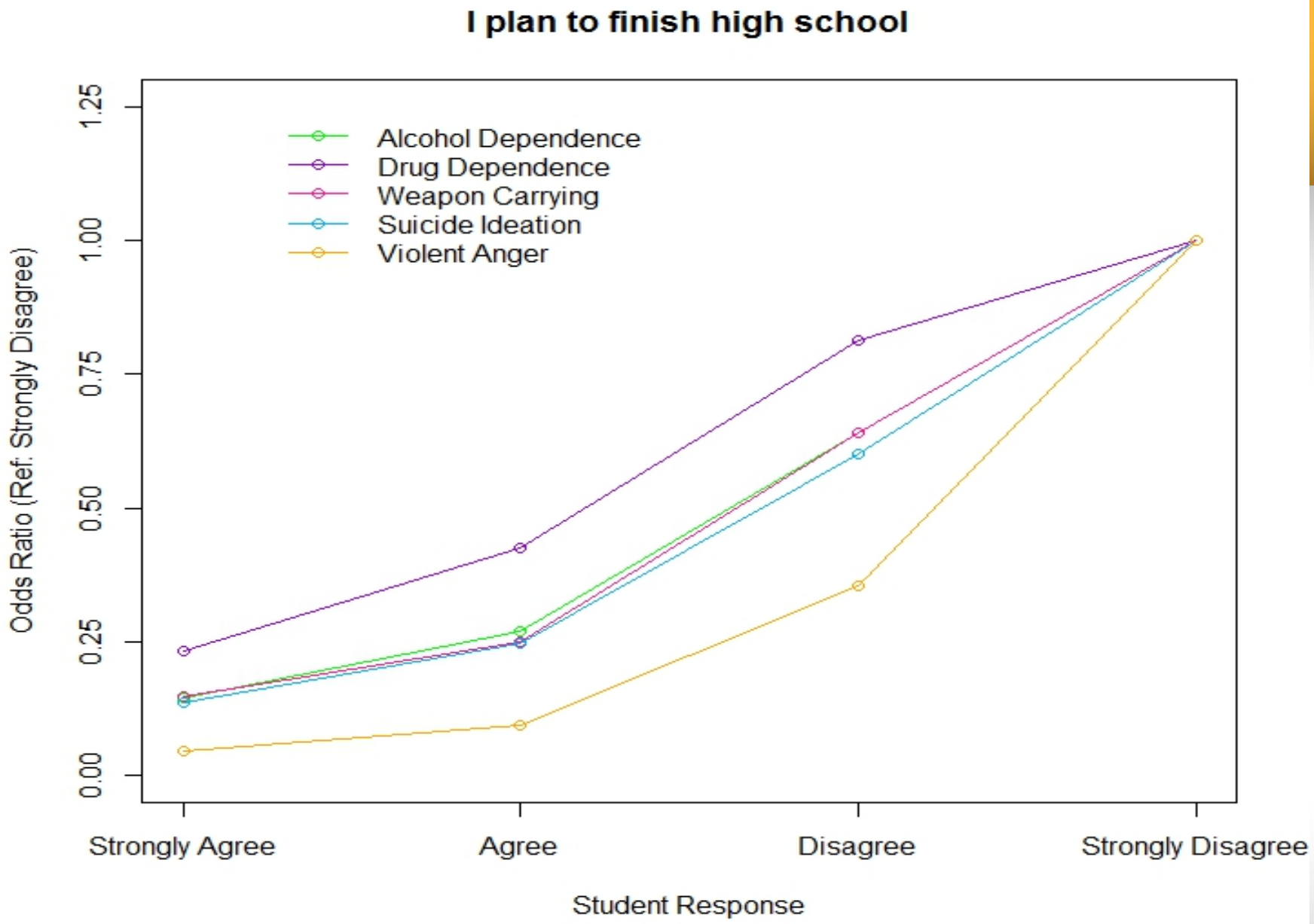

What ethnicity would you describe yourself as?
Odds Ratio (Ref: Spanish/Hispanic)
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
White
African American
Other
Spanish/Hispanic
Student Response


Where are you now living?
Odds Ratio (Ref: Parent/s)
0
1
2
3
4
5
6
7
8
9
10
12
14
16
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
Parent/s
Grandparents/Relatives
Foster parents
Shelter Care/Group Home
Independent living
Other
Student Response


Average time per week spent working in a paid job during the school year
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
Odds Ratio (Ref: 9 or more)
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
0 hours
1-2 hours
3-5 hours
6-8 hours
9 or more
Student Response


Average time per week spent participating in activities at school
Odds Ratio (Ref: 9 or more hours)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
0 hours
1-2 hours
3-5 hours
6-8 hours
9 or more hours
Student Response


Average time per week spent participating in activities outside of school
Odds Ratio (Ref: 9 or more hours)
0.50
0.75
1.00
1.25
1.50
Cigarette Use
Alcohol Use
Marijuana Use
Sniffing Glue etc.
Meth Use
0 hours
1-2 hours
3-5 hours
6-8 hours
9 or more hours
Student Response


I plan to finish high school
Alcohol Dependence
Drug Dependence
Weapon Carrying
Suicide Ideation
Violent Anger
Odds Ratio (Ref: Strongly Disagree)
0.00
0.25
0.50
0.75
1.00
1.25
Strongly Agree
Agree
Disagree
Strongly Disagree
Student Response

MAX/MIN PROBABILITIES FOR HIGHEST/LOWEST RISK TEENS

- We wish to characterize the probabilities of use for the highest and lowest risk adolescents
- We used the Maximum Likelihood Estimates Table, provided by SAS, to identify the largest and smallest parameter estimates for each explanatory variable
- We added these values, along with the intercept, to compute the inverse logit transform

MAX/MIN PROBABILITIES FOR HIGHEST/LOWEST RISK TEENS

	Maximum	Minimum
Alcohol Use	99.0 %	7.08 %
Smoking Cigarettes	97.7 %	0.84 %
Tried Marijuana	99.8 %	0.29 %
Sniffing Glue	90.6 %	2.24 %
Methamphetamines	97.0 %	0.13 %

CONCLUSIONS

- For the univariable models as well as the multivariable models, there is a consistently strong relationship between the outcome variables and those indicators regarding grade and finishing high school.
- Living situation can greatly affect a student's predisposition to abusing various substances.
- As hours spent working a paid job increases, the odds of a student abusing substances also increases.
- There is a strong, positive, relationship between grade level and substance abuse.

ACKNOWLEDGEMENTS

Thank You!

BAYESIAN INFORMATION CRITERION (BIC)

- BIC is a measure for comparing models fit using maximum likelihood.
- BIC is defined as

$$BIC = -2 \times \ln(\text{likelihood}) + \ln(N) \times k$$

where
k = number of parameters estimated
N = number of observations

- BIC combines fit and complexity. Fit is measured negatively by $-2 \times \ln(\text{likelihood})$; the larger the value, the worse the fit. Complexity is measured positively, $\ln(N) \times k$. Given two models fit using the same data, the model with the smaller value of the information criterion is considered to be better.

MAX/MIN PROBABILITIES FOR HIGHEST/LOWEST RISK TEENS

- To analyze the maximum and minimum probabilities ,we begin by looking at the Analysis of Maximum Likelihood Estimates table computed from SAS when the effect of the explanatory variables is applied to the desired response variable.
- Then we take each explanatory's sub-category variable value and add them. Afterwards, by multiplying by (-1) we find the missing value that adds up to 0.
- Next step would be to select the biggest value for the maximum probability or the smallest value for the minimum probability. These steps are repeated for all the response values and each result ,in addition to the computed intercept, is summed and assigned to another variable (e.g. L).
- Finally, we plug the obtained result in the following formula which will yield either the maximum or the minimum probability depending on which one is desired :

$$MP(or\ mP) = \frac{e^L}{1 + e^L}$$