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A Mental Health and Risk Behavior Analysis of American Youth Using PROC FACTOR and SURVEYLOGISTIC

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Abstract

The current study looks at recent health trends and behavior analyses of youth in America. Data used in this analysis was provided by the Center for Disease Control and Prevention and gathered using the Youth Risk Behavior Surveillance System (YRBSS). A factor analysis was performed to identify and define latent mental health and risk behavior variables. A series of logistic regression analyses were then performed using the risk behavior and demographic variables as potential contributing factors to each of the mental health variables. Mental health variables included disordered eating and depression/suicidal ideation data while the risk behavior variables included smoking, consumption of alcohol and drugs, violence, vehicle safety, and sexual behavior data. Implications derived from the results of this research are a primary focus of this study. Risks and benefits of using a factor analysis with logistic regression in social science research will also be discussed in depth. Results included reporting differences between the years of 1991 and 2011. All results are discussed in relation to current youth health trend issues. Data was analyzed using SAS® 9.3.

Introduction

The Youth Risk Behavior Surveillance System (YRBSS) was developed as a tool to help monitor priority risk behaviors that contribute substantially to death, disability, and social issues among American youth and young adults in today's society. The YRBSS has been conducted biennially since 1991 and contains survey data from national, state, and local levels. The national Youth Risk Behavior Survey (YRBS) provides the public with data representative of the United States high school students. The state and local surveys provide data representative of high school students in states and school districts who also receive funding from the CDC through specified cooperative agreements. The YRBSS serves a number of different purposes. The system was originally designed to measure the prevalence of health-risk behaviors among high school students. It was also designed to assess whether these behaviors would increase, decrease, or stay the same over time. An additional purpose for the YRBSS is to have it examine the co-occurrence of different health-risk behaviors. This particular study exams the co-occurrence of suicidal ideation as an indicator of psychological unrest with other health-risk behaviors. The purpose of this study is to serve as an exercise in correlating two different variables across multiple years with large data sets.

Methods

YRBSS provided data sets free to the public online and instructions on how to download the data sets, as well as how to apply the formatting. In order to apply the formatting, the researcher needed only to specify libraries for the data sets and formats:

```
libname mydata 'D:\SUGGF_2014';
       /* Tells SAS where the data is */
libname library 'D:\SUGGF_2014';
       /* Tells SAS where the formats are */
```

This enabled SAS® to read all the formatting as well as output the variable names, questions, and answers in a very clean manner

Concatenating Data Sets

In order for data from all of the years to be used in this analysis, concatenating the 11 data sets was necessary. There is some debate in the research world as to whether combining separately administered data sets will affect the integrity of the results as the data collected were done so at considerably different times and by different people. For the purpose of this paper, we will consider that since each of surveys were administered under CDC guidelines to a specific target population in a controlled environment and supervised by professionals, that each of the years are similar enough in their methods of data collection, questionnaire length, and distribution of questions that we can be confident that any error created by the combining of these studies will be significant enough to affect the results. The researcher for this study independently documented all of the questions used between the different surveys (a total of 168) and chose which variables would be used in the analysis based on the whether or not the questions fit either an aspect of mental health or risky behaviors. All questions asked between the years of 1991 and 2011 were included in the model and separated into categories based on risk behavior type or mental health concern. The questions used

were then given new names in order for the appropriate questions to be concatenated together. Please see Appendix A for a complete list of the variables used in this analysis and any reordering that was needed. This was necessary because even though many of the questions used were present in all or most of the surveys, the order in which the questions appeared in the survey differed between each year.

The coding to concatenate the years together is given below:

```
data YRBS_Total;
set    YRBS1991   YRBS1993   YRBS1995   YRBS1997    YRBS1999    YRBS2001
       YRBS2003   YRBS2005   YRBS2007   YRBS2009    YRBS2011;
run;
```

Descriptive Statistics

To begin the analysis, the researcher used PROC SURVEYFREQ and PROC MEANS to get an idea of the data distribution and other descriptive statistics. Frequencies for demographics, risk behaviors, and mental health variables are all provided and reviewed. When viewing the output generated by these procedures, one must consider the current debate as to the appropriateness of weighting variables included in survey analyses of this size. Some research says that weighting variables is not error proof and can contribute to excluding important factors that would otherwise have shown significant in a nonweighted analysis. This could lead to losing some insight into significant contributing factors and therefore negatively affect the integrity and robustness of the model itself. Other research suggests that weighting the variables helps exclude variables with borderline significance that could muddy the significance and generalizability of the model. The appropriateness of weighting the variables involved in the model was explored using the results. An example of the code used is provided below:

```
proc means data=YRBS_Total;
run;

proc surveyfreq data=YRBS_Total;
       strata stratum;
       weight weight;
       by  AlcoholLife1 AlcoholDay2 AlcoholDaySP3 AlcoholBinge4 AlcoholGet5
       DrugsMarLife1 DrugsMarDay2 DrugsMarDaySP3 DrugsCocaLife1 DrugsCocaDay2
       DrugsInhaLife1 DrugsInhaDay2 DrugsHeroLife1 DrugsMethLife1
       DrugsSteroLife1 DrugsInjectLife1 DrugsEcstaLife1 DrugsPrescLife1
       DrugsComboLife1 ExerHardActive1 ExerHardActive2 ExerSoftActive1
       ExerStrength4 ExerStretch5 ExerTeam6 HealthDoctor1 HealthDentist2
       MoodDep1 MoodConsiderS2 MoodPlanS3 MoodAttemptS4 MoodSeriousS5 SexForce1
       SexHist2 SexAge3 SexNumLife4 SexNumMonth4 SexSub5 SexProtect7
       SexPregnant8 SexSTD9 TobacTry1 TobacDaily2 TobacQuit3 TobacDays4
       TobacDaysSP4 TobacAmount5 TobacGet6 TobacChew7 TobacChewSP8 TobacCigar9
       VehicleHelmet1 VehicleOtherSB2 VehicleSelfSB2 VehicleSelfSB2
       VehicleOtherD3 VehicleSelfD3 ViolMultWeap1 ViolMultWeapSP1 ViolGun1
       ViolUnsafe2 ViolThreatSP2 ViolDamageSP2 ViolFight3 ViolFightSP3
       ViolInjury3 ViolSigOth4 ViolWhom4 WeightTry1 WeightThink1 WeightDietExer2
       WeightFast2 WeightSupp2 WeightPurge2;
run;
```

The frequency statistics for the demographic variables are provided below. These statistics, when compared to the general population, are skewed enough to justify the need for weighting the variables. In order to get a more accurate picture of the generalizability of our final models to the population, the weights provided by the CDC were included in the factor and logistic regression analyses used later in this study.

Table of DemoAge1

DemoAge1	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent
1	215	159.98542	16.06412	0.1004	0.0101
2	175	166.16264	18.69376	0.1043	0.0117
3	14694	16739	194.56691	10.5054	0.1191
4	35410	38904	280.41672	24.4163	0.1661
5	40895	41623	287.38032	26.1225	0.1696
6	41463	38958	272.74984	24.4498	0.1639
7	26424	22788	218.55120	14.3014	0.1338

Table of DemoAge1					
DemoAge1	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent
Total	159276	159338	361.05816	100.000	
Frequency Missing = 415					

Table 1: This table displays frequency distributions for the age demographics. Variable values are as follows: 1 - 12 years old or younger, 2 - 13 years old, 3 - 14 years old, 4 - 15 years old, 5 - 16 years old, 6 - 17 years old, 7 - 18 years old or older

Table of DemoSex2					
DemoSex2	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent
1	80751	77374	344.89406	48.5748	0.1921
2	78439	81914	365.97221	51.4252	0.1921
Total	159190	159287	361.02033	100.000	
Frequency Missing = 501					

Table 2: This table displays frequency distributions for the gender demographics. Variable values are as follows: 1 - Female, 2 – Male

Table of DemoEth3					
DemoEth3	Frequency	Weighted Frequency	Std Dev of Wgt Freq	Percent	Std Err of Percent
1	65428	100120	363.07922	63.0682	0.1651
2	37028	22170	168.15640	13.9655	0.1055
3	40162	19666	138.79944	12.3882	0.0895
4	6228	6068	102.26670	3.8224	0.0645
5	1862	1316	46.08555	0.8293	0.0291
6	8012	9408	186.20229	5.9265	0.1136
Total	158720	158749	359.47341	100.000	
Frequency Missing = 971					

Table 3: This table displays frequency distributions for the race/ethnicity demographics. Variabe values are as follows: 1 - White, 2 - Black or African American, 3 - Hispanic or Latino, 4 - Asian or Pacific Islander, 5 - Native American or Alaskan Native, 6 - Other

The second goal of calculating these frequency statistics was to explore the distribution of response to risk behavior and mental health variables. These frequencies showed very little change in each of the responses over the years. Also, when looking at the percentages of each response, the majority of students either denied participating in any unique risky behavior or reported participating in the behavior at a lower rate than other respondents. Given these results, the researcher sought to find out if participation in a particular set of risky behaviors, being that any unique risky behavior is avoided by the majority of the population, would contribute to suicidal ideation. This idea was formulated from the general idea that most risky behaviors are viewed as poor decisions or compensatory behaviors initiated by the environment or other stimuli.

Factor Analysis

A factor analysis was performed next in order to test the correlations between the different variables and to check for underlying dimensions of related variables (Child, 1990). The variables chosen for each factor analysis were chosen based on their base similarities such as alcohol use, drug use, sexuality, health care, weight, mood, tobacco use, violence, and vehicle safety. Since this factor analysis used character data in both binary and Likert scale formats, a limitation arises. Since binary data contains only two data points and Likert scale data contains more than two points, magnitudes of correlations between these variables shrink due to the range restriction. In order to control for this a polychoric correlation matrix was needed. SAS® provides such a matrix in a macro available http://support.sas.com/kb/25/addl/fusion25010_1_polychor.sas.txt. The polychoric correlation matrix from SAS® can be implemented in two steps: (1) by first initializing the macro and computing the polychoric correlation matrix and (2) submitting the computed matrix to PROC FACTOR for factor extraction. An example of the coding is provided below:

```
data YRBS_Total_FA;
       set    YRBS1991      YRBS1993      YRBS1995      YRBS1997      YRBS1999
              YRBS2001      YRBS2003      YRBS2005      YRBS2007      YRBS2009
       YRBS2011;

run;
```

```
%polychor(data=YRBS_Total_FA, var=AlcoholLife1 AlcoholDay2 AlcoholDaySP3
AlcoholBinge4 AlcoholGet5 DrugsMarLife1 DrugsMarDay2 DrugsMarDaySP3
DrugsCocaLife1 DrugsCocaDay2 DrugsInhaLife1 DrugsInhaDay2 DrugsHeroLife1
DrugsMethLife1 DrugsSteroLife1 DrugsInjectLife1 DrugsEcstaLife1 DrugsPrescLife1
DrugsComboLife1 ExerHardActive1 ExerHardActive2 ExerSoftActive1 ExerStrength4
ExerStretch5 ExerTeam6 HealthDoctor1 HealthDentist2 MoodDep1 MoodConsiderS2
MoodPlanS3 MoodAttemptS4 MoodSeriousS5 SexForce1 SexHist2 SexAge3 SexNumLife4
SexNumMonth4 SexSub5 SexProtect7 SexPregnant8 SexSTD9 TobacTry1 TobacDaily2
TobacQuit3 TobacDays4 TobacDaysSP4 TobacAmount5 TobacGet6 TobacChew7
TobacChewSP8 TobacCigar9 VehicleHelmet1 VehicleOtherSB2 VehicleSelfSB2
VehicleSelfSB2 VehicleOtherD3 VehicleSelfD3 ViolMultWeap1 ViolMultWeapSP1
ViolGun1 ViolUnsafe2 ViolThreatSP2 ViolDamageSP2 ViolFight3 ViolFightSP3
ViolInjury3 ViolSigOth4 ViolWhom4 WeightTry1 WeightThink1 WeightDietExer2
WeightFast2 WeightSupp2 WeightPurge2,out=YRBS_Total, type=corr);

proc corr data=YRBS_Total nocorr alpha nomiss;
       var AlcoholLife1 AlcoholDay2 AlcoholDaySP3 AlcoholBinge4 AlcoholGet5;
run;

proc factor data=YRBS_Total
       method=prinit
       priors=smc
       scree
       residuals
       rotate=promax
       corr
       heywood;
       var AlcoholLife1 AlcoholDay2 AlcoholDaySP3 AlcoholBinge4 AlcoholGet5;
run;
```

As seen in this sample code, proc factor for the alcohol variable was invoked using `method=prinit`, `priors=smc`, `scree`, `residuals`, `rotate=promax`, `corr`, and `heywood`. The option `method=prinit` requests that an iterated principal factor analysis be used. The option `priors=smc` requests that squared multiple correlations between a given input variable and the other variables in the model be used to estimate the variable's prior communality. The option `scree` requests that a scree plot of the eigenvalues be displayed in the output. The option `corr` requests that both a correlation matrix and partial correlation matrix be displayed in the output. The option `residuals` requests that a residual correlation matrix and associated partial correlation matrix be displayed for the factor analysis in the output as well. The option `rotate=promax` requests that a orthogonal promax rotation be performed on the resulting factors. This was chosen based on the fact that after the initial factor extraction, orthogonal transformation, and varimax transformation, common factors were found to remain uncorrelated with each other and therefore required a promax rotation to ensure that a given variable would only have a high loading on one factor and a near zero loading on other factors. Given the diversity and complexity of the data used, this was a necessary request. Finally, the option `Heywood` requests that any communality greater than 1, be set to 1, alloying iterations to proceed.

Some minor adjustments to the factor analysis for the different variable groups were needed based on an individual basis. For factor groups Drug Use, Tobacco Use, and Violence, `priors` was set to `max` instead of `smc` based on the need for the prior communality estimate for each of the variables within these groups to be set to its maximum absolute correlation with any other variable. For the factor group Vehicle Safety, `maxiter` was set to `100` based on this variable groups need to limit the maximum number of iterations for factor extraction, as it was exceeded when using the default of 30.

Results of these factor analyses are provided below. Please see Appendix A for the explanation and distribution of the questions represented by each of the variables mentioned. Variables that fell into the categories of sleep, education, and demographics were not included in any of the factor analyses as there was either little chance that they would correlate or distribute in a meaningful manner with other variables (ex: gender and ethnicity should be evenly distributed within each other) or they were available in a very limited number of years.

Alcohol Use: For alcohol use this study looked at variables: AlcoholLife1, AlcoholDay2 AlcoholDaySP3, AlcoholBinge4, and AlcoholGet5. Three factors were indentified for these variables. When considering factor loading, the first factor contained high loading for variables AlcoholLife1, AlcoholDay2, and AlcoholDaySP3. The second factor contained high loading for variable AlcoholBinge4, and the fourth factor contained high loadings for variables AlcoholGet5. Variables chosen for inclusion in the logistic regression analysis were then reduced to recent uses of alcohol and the other two identified factors: AlcoholDay2 and AlcoholBinge4.

Drug Use: For drug use this study looked at variables: DrugsMarLife1, DrugsMarDay2, DrugsMarDaySP3, DrugsCocaLife1, DrugsCocaDay2, DrugsInhaLife1, DrugsInhaDay2, DrugsHeroLife1, DrugsMethLife1, DrugsSteroLife1, DrugsInjectLife1, DrugsEcstaLife1, DrugsPrescLife1, and DrugsComboLife1. Twelve different factors were identified for these variables. When considering factor loading, the first factor contained high loading for variables DrugsMarLife1, DrugsMarDay2, DrugsMarDaySP3. The second factor contained high loading for variables DrugsInhaLife1, DrugsInhaDay2. The third factor contained high loading for variables DrugsCocaLife1, DrugsCocaDay2. The fourth factor contained high loading for variable DrugsSteroLife1. The fifth factor contained high loading for variablesDrugsComboLife1. The sixth factor contained high loading for variable DrugsEcstaLife1. The seventh factor contained high loading for variable DrugsMethLife1. The eighth factor contained high loading for variable DrugInjectLife1. The eleventh factor contained high loading for variable DrugsHeroLife1. The ninth, tenth, and twelfth factors contained varying loadings of the different variables mentioned. Variables chosen for inclusion in the logistic regression analysis were then reduced to recent uses of drugs and the other identified factors: DrugsMarDay2, DrugsInhaDay2, DrugsCocaDay2, DrugsSteroLife1, DrugsComboLife1, DrugsEcstaLife1, DrugsMethLife1, DrugsInjectLife1, and DrugsHeroLife1.

Exercise Participation: For exercise participation this study looked at variables: ExerHardActive1, ExerSoftActive1, ExerStrength4, ExerStretch5, ExerTeam6, and ExerInjury7. Only one factor was identified for these variables. Therefore, the variable of ExerHardActive1 was chosen to be included in the regression analysis based on being the highest loading variable for that factor.

Mental Health: For mental health variables this study looked at variables: MoodDep1, MoodConsiderS2, MoodPlanS3, MoodAttemptS4, and MoodSeriousS5. Two factors were identified for these variables. The first factor identified had high loadings for MoodDep1, MoodConsiderS2, and MoodPlanS3. The second factor identified had high loadings for MoodAttemptS4 and MoodSeriousS5. Therefore, the variables chosen to be included in the regression analysis based on their high loadings were MoodDep1, MoodConsiderS2, and MoodAttemptS4.

Sexuality: For sexuality variables this study looked at variables: SexForce1, SexHist2, SexAge3, SexNumLife4, SexNumMonth4, SexSub5, SexProtect7, SexPregnant8, and SexSTD9. Only one factor was identified for these variables. Therefore SexForce1, SexHist2, SexNumMonth4, SexPregnant8, and SexSTD9 were identified and will be included in the regression analysis based on their relevance and high factor loadings.

Tobacco Use: For tobacco use this study looked at variables: TobacTry1, TobacDaily2, TobacQuit3, TobacDays4, TobacDaysSP4, TobacAmount5, TobacGet6, TobacChew7, TobacChewSP8, and TobacCigar9. Three factors were identified for these variables. The first factor identified included variables TobacTry1, TobacDaily2, TobacQuit3, TobacDays4, TobacDaysSP4, and TobacAmount5. The second factor identified included variables TobacChewSP8, TobacChew7, and TobacCigar9. The final variable identified included TobacGet6. Based on factor loadings and considering that mental health issues were measured on a recent basis, variables TobacDays4, TobacTry1, and TobacChew7 will be included in the regression analysis.

Vehicle Safety: For vehicle safety this study looked at variables: VehicleHelmet1, VehicleOtherSB2, VehicleSelfSB2, VehicleOtherD3, and VehicleSelfD3. Two factors were identified for these variables. The first factor included high loadings for VehicleOtherD3, and VehicleSelfD3. The second variable included high factor loadings for VehicleOtherSB2. Considering the relevance of each of these identified variables, VehicleOtherD3, VehicleSelfD3, and VehicleOtherSB2 will all be included in the regression analysis.

Violence Exposure/Participation: For exposure or participation in violence this study looked at variables: ViolMulWeap1, ViolMultWeapSP1, ViolGun1; ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, ViolFight3, ViolFightSP3, ViolInjury3, ViolSigOth4, and ViolWhom4. A total of nine factors were identified for these variables. The first factor contained high loading for variables ViolMultWeap1, ViolMultWeapSP1, ViolGun1 The second factor contained high loading for variables ViolFightSP3 The fourth factor contained high loading for variables ViolUnsafe2, ViolFight3 The fifth factor contained high loading for variables ViolFight3, ViolSigOth4 The sixth factor contained high loading for variables ViolInjury3 The seventh factor contained high loading for variables ViolThreatSP2 The eighth factor contained high loading for variables ViolDamageSP2 The ninth and third factor contained varying loadings of multiple variables. No high loadings for any one variable were present in these last two factors. Considering the above, variables ViolMultWeap1, ViolFightSP3, ViolFight3, ViolUnsafe2, ViolSigOth4, ViolInjury3, ViolThreatSP2, and ViolDamageSP2 will all be included in the regression analysis.

Weight: For weight this study looked at variables: WeightThink1, WeightTry1, WeightDietExer2, WeightFast2, WeightSupp2, and WeightPurge2. Two factors were identified for these variables. The first factor contained high loadings for variables WeightFast2, WeightSupp2, and WeightPurge2. The second variable contained high loadings for variable WeightDietExer2 and WeightTry1. Variable WeightThink1 did not have high loadings in either factor. Considering these results, variables WeightDietExer2, WeightFast2, WeightSupp2, and WeightPurge2 will all be included in the regression analysis.

Please contact the author with any questions on this section. Additional information on latent factors and specific statistics are available upon request.

Logistic Regression

The researcher then wanted to test to see if an interaction could be seen between each possible mental illness and certain health-risk behaviors across the years. A logistic analysis was conducted for this purpose. The logistic analysis was written in a manner so that a multiple regression analysis could be performed, given that the particular variables used were categorical. Also, given that the variables used are in a complex survey format, PROC SURVEYLOGISTIC was a necessary procedure to employ for this analysis as it accounts for complex survey designs. The option "decreasing" was used in order to control for the fact that the variable answers were given in an ordinal format defined within the data and set in a decreasing order (least occurrence first, greatest occurrence last). Also, mainly variables that were represented in at least half of the surveys were included in these analyses, as there would not be sufficient enough data otherwise (given the size of this study and the amount of surveys given).

```
proc surveylogistic data=YRBS_Total;
      class MoodDep1 MoodConsider2 MoodPlanS3 MoodAttemptS4
            MoodSeriousS5;
      cluster psu;
      strata stratum;
      model MoodConsider2 (decreasing) = MoodPlanS3 MoodAttemptS4
      MoodSeriousS5 / rsq;
      weight weight;
run;
```

Determination of Dependent Variables

In this study, the variable MoodConsider2 represents the question "During the past 12 months, did you ever seriously contemplate suicide?" This question was chosen for this study as a representation of suicidal ideation as an indicator of poor mental health. The above model was used to test correlations between suicidal thoughts and independent effects as well as interactions between the following variables: making a plan for suicide, number of times attempted suicide, and if severity of suicidal event lead to treatment by a medical professional. Each of these variables contain the values of each answer for their particular question. The results were outputted as Wald Chi-Square values.

The other variables chosen for this study as indicators of poor mental health were MoodDep1, WeightDietExer2, WeightFast2, WeightSupp2, WeightPurge2. MoodDep1 represented the question "During the past 12 months did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?". MoodDep1, therefore, was a question related to depression related symptoms as an indicator of poor mental health. All four weight variables could be seen as measures of disordered eating as indicators of poor mental health. WeightDietExer2 ("During the past 7 days, which one of the following did you do to lose weight or to keep from gaining weight?" [none, dieted, exercised]) and WeightPurge2 ("During the past 7 days, which one of the following did you do to lose weight or to keep from gaining weight?" [none, vomit, diet pills]). In addition to these two variables we then included WeightFast2("During the past 30 days, did you go without eating for 24 hours or more [also called fasting] to lose weight or to keep from gaining weight?") and WeightSupp2 ("During the past 30 days, did you take any diet pills, powders, liquids, without a doctor's advice to lose weight or to keep from gaining weight?").

Demographic Results

Demographic differences in risk behaviors and mental health issues are explored below. The demographic variables explored in this analysis are biological age (regardless of grade), gender, and race/ethnicity. Demographic variables of race and ethnicity were included in this analysis but separately recoded by the researcher on account of the high variability in answer options between the survey years. Average amount of sleep per night is also explored in this section as an educational question as to the effect of sleep on mental health. Significant results from this analysis are discussed but will not be included in the final model as the final model is concerned only with the interactions between risk behaviors and mental health issues.

Depression

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of depression. Max rescaled R-square values indicated that this demographic model only contributes to about 5% of the variability in depression. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated

that for age, adolescents in high school that are twelve years or younger are twice as likely than their older peers to identify feelings of depression. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were twice as likely than males to identify feelings of depression. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, Latinos, and American Indians/Alaskan Natives were significantly more likely to identify feelings of depression than their peers while Whites and African Americans were significantly less likely to identify these same feelings.

When analyzing sleep, our model indicated that less sleep did significantly contribute to feelings of depression students who indicated getting more sleep were significantly less likely to identify these feelings. Max rescaled R-square values indicated that the model of sleep only contributed to about 5% of the variability in depression.

Suicidal Ideation

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of suicidal ideation. Max rescaled R-square values indicated that this demographic model only contributes to about 2.5% of the variability in suicidal ideation. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, adolescents in high school that are twelve years or younger are five times as likely than their older peers to identify feelings of suicidal ideation. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were almost twice as likely than males to identify feelings of suicidal ideation. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, American Indians/Alaskan Natives were significantly more likely to identify feelings of suicidal ideation than their peers while Whites and African Americans were significantly less likely to identify these same feelings.

When analyzing sleep, our model indicated that less sleep did significantly contribute to feelings of suicidal ideation while students who identified with getting more sleep were significantly less likely to identify these feelings. Max rescaled R-square values indicated that the model of sleep only contributed to about 5% of the variability in suicidal ideation.

Attempt Suicide

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of suicide attempts. Max rescaled R-square values indicated that this demographic model only contributes to about 8% of the variability in suicide attempts. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, adolescents in high school that are twelve years or younger were significantly less likely than their older peers to identify having attempted suicide. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were significantly less likely than males to identify having attempted suicide. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, Latinos, and American Indians/Alaskan Natives were significantly less likely to identify having attempted suicide than their peers while Whites and African Americans and Asian Americans/Pacific Islanders were significantly more likely to identify these same actions.

When analyzing sleep, our model indicated that less sleep did significantly contribute to actions of attempted suicide while students who indicated getting more sleep were significantly less likely to identify these actions. Max rescaled R-square values indicated that the model of sleep only contributed to about 6% of the variability in suicide attempts.

Diet and Exercise

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of Diet/Exercise. Max rescaled R-square values indicated that this demographic model only contributes to about 5% of the variability in Diet/Exercise. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, there was no significant contribution to this model. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were significantly more likely than males to identify using fasting to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, Asian Americans and Pacific Islanders were significantly more likely to diet and exercise to lose weight than their peers while African Americans were significantly less likely to diet and exercise to lose weight.

When analyzing sleep, our model indicated that sleep did significantly contribute to using fasting as a way to lose weight. Max rescaled R-square values indicated that the model of sleep only contributed to about .2% of the variability in using diet and exercise as a way to lose weight.

Fasting

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of fasting. Max rescaled R-square values indicated that this demographic model only contributes to about 4.8% of the variability in fasting. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, students who were 12 years of age or younger were 60% more likely to fast to lose weight than older peers. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were significantly more likely than males to identify using fasting to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, Asian Americans/Pacific Islanders and Native American/Alaskan Natives were significantly more likely to fast to lose weight than their peers while Whites and African Americans were significantly less likely to fast to lose weight.

When analyzing sleep, our model indicated that sleep did significantly contribute to using fasting as a way to lose weight. Students who indicated less sleep were more likely to identify having fasted than students how had more sleep. Max rescaled R-square values indicated that the model of sleep only contributed to about 4.8% of the variability in using fasting as a way to lose weight.

Diet Supplements

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of Diet Supplement usage. Max rescaled R-square values indicated that this demographic model only contributes to about 2.3% of the variability in Diet Supplement usage. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, students who were 12 years of age or younger were about 8 times more likely to use diet supplements to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were significantly more likely than males to identify using diet supplements to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, African Americans were significantly less likely to use diet supplements to lose weight than their peers

When analyzing sleep, our model indicated that sleep did significantly contribute to using diet supplements as a way to lose weight. Max rescaled R-square values indicated that the model of sleep only contributed to about 2.8% of the variability in using diet supplements as a way to lose weight.

Purging

Demographic variables of age, gender, and ethnicity all contributed significantly to the demographic model of Purging. Max rescaled R-square values indicated that this demographic model only contributes to about 4.2% of the variability in Purging. Even so, it is useful to consider demographics as biological and environmental contributing factors to this mental illness variable. The analysis of maximum likelihood estimates and odds ratio scores indicated that for age, students who were 12 years of age or younger were almost 15 times more likely than their peers to identify with purging to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for gender, females were almost three times as likely than males to identify using purging to lose weight. The analysis of maximum likelihood estimates and odds ratio scores indicated that for ethnicity/race, Native American/Alaskan Natives were significantly more likely to purge to lose weight than their peers while African Americans and Whites were significantly less likely to purge to lose weight.

When analyzing sleep, our model indicated that sleep did significantly contribute to using purging as a way to lose weight. Max rescaled R-square values indicated that the model of sleep only contributed to about 4.5% of the variability in using purging as a way to lose weight.

Final Models

The main interest of the final model results are the presence of significant correlations between the mental health variables and different health-risk behaviors. Variables that displayed high factor loadings for separate factors within an identified risk-behavior cohort are included in this model. A sample coding for these variables is provided below:

```
proc surveylogistic data=YRBS_Total;
       class MoodDep1 AlcoholDay2 DrugsInhaDay2 DrugsMethLife1 DrugsEcstaLife1
       ExerHardActive1 SexForce1 TobacTry1 TobacDays4 TobacChew7 ViolMultWeap1
       ViolUnsafe2 ViolDamageSP2 ViolFight3 ViolSigOth4 / rsq ;
       cluster psu;
       strata stratum;
```

```
        model MoodDep1 = AlcoholDay2 DrugsInhaDay2 DrugsMethLife1 DrugsEcstaLife1
        ExerHardActive1 SexForce1 TobacTry1 TobacDays4 TobacChew7 ViolMultWeap1
        ViolUnsafe2 ViolDamageSP2 ViolFight3 ViolSigOth4 / rsq;
        weight weight;
run;
```

Depression

The final model of depression supports that the following variables contribute significantly to the variability in responses to the question MoodDep1: AlcoholDay2, DrugsInhaDay2, DrugsMethLife1, DrugsEcstaLife1, ExerHardActive1, SexForce1, TobacTry1, TobacDays4, TobacChew7, ViolMultWeap1, ViolUnsafe2, ViolDamageSP2, ViolFight3, and ViolSigOth4. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of depressive symptoms. The statistics produced by SAS® are given and explained below:

-Square0.1339	Max-rescaled R-Square0.1947

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	1657.7514	60	<.0001
Score	1683.7315	60	<.0001
Wald	9738.9127	60	<.0001

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
AlcoholDay2	6	33.7364	<.0001
DrugsInhaDay2	5	44.2964	<.0001
DrugsMethLife1	5	13.6903	0.0177
DrugsEcstaLife1	5	23.6901	0.0002
ExerHardActive1	7	40.2238	<.0001
SexForce1	1	50.4077	<.0001
TobacTry1	1	19.3990	<.0001
TobacDays4	6	15.4489	0.0170
TobacChew7	1	15.7040	<.0001
ViolMultWeap1	4	18.9681	0.0008
ViolUnsafe2	4	99.2497	<.0001
ViolDamageSP2	7	87.7285	<.0001
ViolFight3	7	75.0762	<.0001
ViolSigOth4	1	42.4344	<.0001

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 20% of the variability in depression identification. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsInhaDay2, DrugsMethLife1, DrugsEcstaLife1, TobacDays4, ViolMultWeap1, ViolUnsafe2, ViolDamageSP2, and ViolFight3 were significantly less likely to identify feelings of depression than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying these feelings while students who indicated greater participation were more likely to identify these feelings regardless of number of times of usage/participation. On the other hand, students who identified less participation in challenging physical activities were significantly more likely to identify feelings of depression than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. ViolSigOth4 indicated that students who indicated having experienced violence from a significant other were almost 2 times more likely to identify feelings of depression than peers who denied this variable. For TobacChew7, students who identified participation chewing tobacco were significantly more likely to also identify feelings of depression than their peers who denied participation in this variable. Variable TobacTry1 indicated that students who tried cigarettes were 1.5 times more likely to identify depression symptoms while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were 2.6 times more likely to identify these same feelings. This model suggests that when

looking at depression as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Suicidal Ideation

The final model of suicidal ideation supports that the following variables contribute significantly to the variability in responses to the question MoodConsiderS2: AlcoholDay2, DrugsInhaDay2, DrugsMethLife1, DrugsSteroLife1, ExerHardActive1, SexForce1, TobacDays4, TobacChew7, VehicleSelfD3, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, and ViolSigOth4. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of suicidal ideation. The statistics produced by SAS® are given and explained below:

R-Square0.1014	Max-rescaled R-Square0.1762

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	1184.4516	59	<.0001
Score	1458.4023	59	<.0001
Wald	65940.1966	59	<.0001

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
AlcoholDay2	6	36.2926	<.0001
DrugsInhaDay2	5	65.9721	<.0001
DrugsMethLife1	5	53.6327	<.0001
DrugsSteroLife1	5	28.9721	<.0001
ExerHardActive1	7	25.6334	0.0006
SexForce1	1	87.5406	<.0001
TobacDays4	6	38.9449	<.0001
TobacChew7	1	9.1733	0.0025
VehicleSelfD3	4	10.9159	0.0275
ViolUnsafe2	4	21.7489	0.0002
ViolThreatSP2	7	17.1693	0.0163
ViolDamageSP2	7	21.8359	0.0027
ViolSigOth4	1	17.9589	<.0001

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 17.6% of the variability in suicidal ideation identification. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsInhaDay2, DrugsMethLife1, DrugsSteroLife1, TobacDays4, VehicleSelfD3, ViolUnsafe2, ViolThreatSP2, and ViolDamageSP2 were significantly less likely to identify thoughts of suicide than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying these thoughts while students who indicated greater participation were more likely to identify these thoughts regardless of number of times of usage/participation. On the other hand, students who identified less participation in challenging physical activities were significantly more likely to identify suicidal thoughts than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. ViolSigOth4 indicated that students who indicated having experienced violence from a significant other were almost 64% more likely to identify suicidal thoughts than peers who denied this variable. For TobacChew7, students who identified participation chewing tobacco were significantly more likely to also identify suicidal thoughts than their peers who denied participation in this variable while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were 2.5 times more likely to identify these same thoughts. As with depression, this model suggests that when looking at suicidal ideation as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Attempt Suicide

The final model of suicide attempts supports that the following variables contribute significantly to the variability in responses to the question MoodAttemptS2: AlcoholDay2, DrugsInhaDay2, DrugsHeroLife1, DrugsMethLife1, DrugsSteroLife1, ExerHardActive1, SexForce1, TobacTry1, TobacChew7, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, ViolFightSP3, and ViolSigOth4. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of recent suicide attempts. The statistics produced by SAS® are given and explained below:

R-Square	0.1327	Max-rescaled R-Square	0.2600

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	1414.9014	66	<.0001
Score	2130.0006	66	<.0001
Wald	.	65	.

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
AlcoholDay2	6	19.3398	0.0036
DrugsInhaDay2	5	79.4713	<.0001
DrugsHeroLife1	5	23.3462	0.0003
DrugsMethLife1	5	36.3919	<.0001
DrugsSteroLife1	5	21.5946	0.0006
ExerHardActive1	7	38.0853	<.0001
SexForce1	1	113.8444	<.0001
TobacTry1	1	6.6820	0.0097
TobacChew7	1	20.3622	<.0001
ViolUnsafe2	4	46.9804	<.0001
ViolThreatSP2	7	34.1676	<.0001
ViolDamageSP2	7	65.3249	<.0001
ViolFightSP3	7	177.5436	<.0001
ViolSigOth4	1	10.5652	0.0012

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 26% of the variability in identification of recent suicide attempts. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsInhaDay2, DrugsHeroLife1, DrugsMethLife1, DrugsSteroLife1, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, and ViolFightSP3 were significantly more likely to deny recent suicide attempts than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying having ever attempted suicide while students who indicated greater participation were more likely to identify these attempts regardless of number of times of usage/participation. On the other hand, students who identified less participation in challenging physical activities were significantly more likely to identify recent suicide attempts than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. ViolSigOth4 indicated that students who indicated having experienced violence from a significant other were significantly more likely to identify having attempted suicide than peers who denied this variable. For TobacChew7, students who identified participation chewing tobacco were significantly more likely to also identify having attempted suicide than their peers who denied participation in this variable while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were also significantly more likely to identify having attempted suicide recently. As with depression and suicidal ideation, this model suggests that when looking at suicide attempts as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Diet and Exercise

The final model of weight loss by diet/exercise supports that the following variables contribute significantly to the variability in responses to the question WeightDietExer2: AlcoholDay2, DrugsMarDay2, DrugsMethLife1,

DrugsSteroLife1, DrugsComboLife1, ExerHardActive1, SexForce1, SexNumMonth4, TobacChew7, VehicleSelfD3, ViolMultWeap1, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, ViolInjury3, and ViolSigOth4. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of using diet and exercise to lose weight. The statistics produced by SAS® are given and explained below:

R-Square	0.0596	Max-rescaled R-Square	0.0844

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	647.8961	73	<.0001
Score	633.6052	73	<.0001
Wald	4786840.92	73	<.0001

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
AlcoholDay2	6	39.7751	<.0001
DrugsMarDay2	5	11.3923	0.0441
DrugsMethLife1	5	16.0261	0.0068
DrugsSteroLife1	5	10.9916	0.0515
DrugsComboLife1	5	49.6549	<.0001
ExerHardActive1	7	188.7903	<.0001
SexForce1	1	39.4401	<.0001
SexNumMonth4	7	30.3844	<.0001
TobacChew7	1	9.3435	0.0022
VehicleSelfD3	4	12.9705	0.0114
ViolMultWeap1	4	19.8341	0.0005
ViolUnsafe2	4	9.5603	0.0485
ViolThreatSP2	7	477.1294	<.0001
ViolDamageSP2	7	26.4335	0.0004
ViolInjury3	4	274.6227	<.0001
ViolSigOth4	1	5.3254	0.0210

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 8% of the variability in identification of using diet and exercise to lose weight. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsMarDay2, DrugsMethLife1, DrugsSteroLife1, DrugsComboLife1, SexNumMonth4, VehicleSelfD3, ViolMultWeap1, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, and ViolInjury3 were significantly more likely to identify using diet and exercise to lose weight than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of identifying that they used diet and exercise to lose weight while students who indicated greater participation were less likely to identify this type of weight loss regardless of number of times of usage/participation. On the other hand, students who identified less participation in challenging physical activities were significantly less likely to identify using diet and exercise for weight loss than peers who identified greater participation in these activities. Similar results were found for binary variables. ViolSigOth4 indicated that students who indicated having experienced violence from a significant other were significantly more likely to identify using diet and exercise to lose weight than peers who denied this variable. For TobacChew7, students who identified participation in chewing tobacco were significantly less likely to also identify using diet and exercise to lose weight than their peers who denied participation in this variable while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were 2 times more likely to identify using diet and exercise to lose weight. The differing results between this mental health variable and the previous three could be summed up to the fact that diet and exercise are generally considered a healthy way to lose weight. It can be used in unhealthy ways and an unhealthy use of diet and exercise should be watched closely by clinicians and researchers. However, this model supports that diet and exercise seem to be the go to method of weight loss for individuals who have less or no engagement in other risky behaviors.

Fasting

The final model of using fasting for weight loss supports that the following variables contribute significantly to the variability in responses to the question WeightFast2: AlcoholDay2, DrugsInhaDay2, DrugsHeroLife1, DrugsMethLife1, DrugsComboLife1, ExerHardActive1, SexForce1, ViolDamageSP2, ViolFightSP3, and ViolSigOth4. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of using fasting for weight loss. The statistics produced by SAS® are given and explained below:

R-Square0.0587	Max-rescaled R-Square0.1154

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	697.0867	49	<.0001
Score	885.6637	49	<.0001
Wald	72157138.0	49	<.0001

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
AlcoholDay2	6	29.2804	<.0001
DrugsInhaDay2	5	39.5685	<.0001
DrugsHeroLife1	5	15.1950	0.0096
DrugsMethLife1	5	35.4304	<.0001
DrugsComboLife1	5	24.5951	0.0002
ExerHardActive1	7	29.4870	0.0001
SexForce1	1	34.5465	<.0001
ViolDamageSP2	7	27.7930	0.0002
ViolFightSP3	7	126.4956	<.0001
ViolSigOth4	1	7.8441	0.0051

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 11.5% of the variability in identification of using fasting for weight loss. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsInhaDay2, DrugsHeroLife1, DrugsMethLife1, DrugsComboLife1, and ViolDamageSP2 were significantly more likely to use fasting to lose weight than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying having ever attempted suicide while students who indicated greater participation were more likely to identify using fasting for weight loss regardless of number of times of usage/participation. On the other hand, students who identified less participation in challenging physical activities (ExerHardActive1) or fights (ViolFight3) were significantly more likely to identify using fasting for weight loss than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. ViolSigOth4 indicated that students who indicated having experienced violence from a significant other were1.5 times more likely to identify having used fasting for weight loss than peers who denied this variable while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were also 2.6 times more likely to identify having recently used fasting for weight loss. As with some of the previous mental health variables, this model suggests that when looking at fasting (defined as an unhealthy method of weight loss) as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Diet Supplements

The final model of using diet supplements without a doctors order to lose weight supports that the following variables contribute significantly to the variability in responses to the question WeightSupp2: AlcoholDay2, DrugsMethLife1, DrugsSteroLife1, SexForce1, SexHist2, SexNumMonth4, TobacTry1, TobacDays4, VehicleOtherSB2, VehicleSelfD3, ViolThreatSP2, and ViolDamageSP2. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of diet supplement use. The statistics produced by SAS® are given and explained below:

R-Square0.0665	Max-rescaled R-Square0.1656

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	735.4220	54	<.0001
Score	969.4442	54	<.0001
Wald	1.27534E13	54	<.0001

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
AlcoholDay2	6	55.6641	<.0001
DrugsMethLife1	5	50.4493	<.0001
DrugsSteroLife1	5	26.5424	<.0001
SexForce1	1	18.0237	<.0001
SexHist2	1	7.5174	0.0061
SexNumMonth4	6	14.0816	0.0287
TobacTry1	1	10.4908	0.0012
TobacDays4	6	26.0576	0.0002
VehicleOtherSB2	5	13.7608	0.0172
VehicleSelfD3	4	21.4363	0.0003
ViolThreatSP2	7	16.6676	0.0197
ViolDamageSP2	7	40.0729	<.0001

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 16.6% of the variability in identification of recent diet supplement use. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in AlcoholDay2, DrugsMethLife1, DrugsSteroLife1, SexNumMonth4, TobacDays4, and VehicleSelfD3, were significantly more likely to deny recent diet supplement use than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying having ever used diet supplements while students who indicated greater participation were more likely to identify these attempts regardless of number of times of usage/participation. On the other hand, students who identified less participation in VehicleOtherSB2, ViolThreatSP2, and ViolDamageSP2 were significantly more likely to identify recent diet supplement use than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. SexHist2 supported that students who denied having sex in the past were significantly less likely to identify having used diet supplements to lose weight than peers who admitted to this variable while SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were almost 2 times more likely to identify having used diet supplements recently. For TobacTry7 however, students who identified having never tried smoking cigarettes in the past were almost 2 times more likely to use diet supplements than other peers. As with most other mental health variables in this study, this model suggests that when looking at unprescribed diet supplement use as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Purging

The final model of purging to lose weight supports that the following variables contribute significantly to the variability in responses to the question WeightPurge2: DrugsCocaDay2, DrugsInhaDay2, DrugsMethLife1, SexForce1, TobacDays4, VehicleOtherD3, VehicleSelfD3, ViolUnsafe2, ViolThreatSP2, ViolDamageSP2, ViolFightSP3, and ViolInjury3. More specifically, this model suggests that unhealthy participation in these activities correlate significantly with identification of recent purging. The statistics produced by SAS® are given and explained below:

R-Square0.0426	Max-rescaled R-Square0.1443

Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	524.7684	63	<.0001
Score	890.3928	63	<.0001
Wald	3728397759	63	<.0001

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
DrugsCocaDay2	5	12.2072	0.0321
DrugsInhaDay2	5	18.6123	0.0023
DrugsMethLife1	5	25.2941	0.0001
SexForce1	1	61.3827	<.0001
TobacDays4	6	34.7640	<.0001
VehicleOtherD3	4	13.4986	0.0091
VehicleSelfD3	4	8.5285	0.0740
ViolMultWeap1	4	19.3492	0.0007
ViolUnsafe2	4	11.4630	0.0218
ViolThreatSP2	7	64.7639	<.0001
ViolDamageSP2	7	19.3353	0.0072
ViolFightSP3	7	25.2556	0.0007
ViolInjury3	4	16.9803	0.0020

The maximum re-scaled R-square value for this model suggests that the risky behaviors identified above contribute to only 14.4% of the variability in identification of recent purging. Analysis of Maximum Likelihood Estimates and Odds ratio scores indicate that students who indicated less participation in DrugsCocaDay2, DrugsInhaDay2, DrugsMethLife1, VehicleOtherD3, VehicleSelfD3, ViolThreatSP2, ViolDamageSP2, ViolInjury3and ViolFightSP3 were significantly more likely to deny recent purging than students who identified greater participation in these variables. More specifically, students who denied participation in these activities had the greatest likelihood of denying having ever used purging to lose weight while students who indicated greater participation were more likely to identify these attempts regardless of number of times of usage/participation. On the other hand, students who identified less participation in ViolDamageSP2 and ViolFightSP3 were significantly more likely to identify recent purging than peers who identified greater participation in these activities. Similar results to the former were found for binary variables. SexForce1 indicated that students who had been forced to have sexual intercourse when they did not want to were also 3 times more likely to identify having used purging to lose weight recently. As with depression and suicidal ideation, this model suggests that when looking at purging to lose weight as a dependent variable, researchers and clinicians must also consider unsafe risky behaviors and environments that could put these students at risk for this mental health issue.

Conclusion

This study was intended as an exercise on the use of factor analysis with logistic regression in a large survey sample of social science data, however, the significant results of the study warrant some discussion. In conclusion, this study supports the idea that youth participation in risky behaviors is correlated significantly with various possible mental illness indicators. These indicators were also identified as strong representations of the proposed risky behaviors through factor analysis. This study also found that overall, students who were female and in high school during their late tweens and early teens were at a greater risk for displaying mental illness characteristics than other students. The results of this study should encourage further research into the contributing factors of mental illness and youth participation in risky behaviors. If we can further strengthen our understanding of the connection between these two entities, proper preventative programs and therapies can be developed to assist students with various mental and physical health problems as they arise.

The limitations of this study stem from the fact that it is a secondary analysis based on a nationally distributed sample. The researcher could not be sure how the data was randomized and therefore, weights recalculated by the Center for Disease Control and Prevention were used in the analysis.

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Appendix A

Below is the complete list of variables considered for the analysis. Please contact author for information on the number of data points, reordering and distribution of data points, logic behind exclusion/inclusion of particular variables, and any other questions concerning this table.

Question	1991	1993	1995	1997	1999	2001	2003	2005	2007	2009	2011	Variable Name
During your life, on how many days have you had at least one drink of alcohol?	Q33	Q39	Q37	Q37	Q39	Q40	Q39	Q39	Q39	Q39	Q40	Alcohol Life1
During the past 30 days, on how many days did you have at least one drink of alcohol?	Q34	Q40	Q38	Q38	Q41	Q42	Q41	Q41	Q41	Q41	Q42	Alcohol Day2
During the past 30 days, on how many days did you have at least one drink of alcohol on school property?		Q42	Q40	Q40	Q43	Q44	Q43	Q43	Q44	Q44	Q45	Alcohol DaySP3
During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?	Q35	Q41	Q39	Q39	Q42	Q43	Q42	Q42	Q42	Q42	Q43	Alcohol Binge4
During the past 30 days, how did you usually get the alcohol you drank?									Q43	Q43	Q44	Alcohol Get5
How old are you?	Q01	Q01	Q01	Q01	Q01	Q01	Q01	Q01	Q01	Q01	Q01	DemoAge1
What is your sex?	Q02	Q02	Q02	Q02	Q02	Q02	Q02	Q02	Q02	Q02	Q02	DemoSex2
How do you describe yourself?	Q04	Q04	Q04	Q04	Q04	Q04	Q04	Q04	Q04/ Q05	Q04/ Q05	Q04/ Q05	DemoEth3
During your life, how many times have you used marijuana?	Q37	Q44	Q42	Q42	Q44	Q45	Q44	Q44	Q45	Q45	Q46	DrugsMarLife1
During the past 30 days, how many times did you use marijuana?	Q38	Q45	Q43	Q43	Q46	Q47	Q46	Q46	Q47	Q47	Q48	DrugsMarDay2
During the past 30 days, how many times did you use marijuana on school property?		Q46	Q44	Q44	Q47	Q48	Q47	Q47	Q48	Q48	Q49	DrugsMarDaySP3
During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?	Q40	Q48	Q46	Q46	Q48	Q49	Q48	Q48	Q49	Q49	Q50	DrugsCocaLife1
During the past 30 days, how many times have you used any form of cocaine, including powder, crack, or freebase?	Q41	Q49	Q47	Q47	Q49	Q50	Q49	Q49	Q50	Q50	Q51	DrugsCocaDay2
During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?			Q49	Q49	Q50	Q51	Q50	Q50	Q51	Q51	Q52	DrugsInhaLife1

During the past 30 days, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?					Q51	Q52	Q51					DrugsInhaDay2
During your life, how many times have you used heroin (also called smack, junk, or China White)?					Q52	Q53	Q52	Q51	Q52	Q52	Q53	DrugsHeroLife1
During your life, how many times have you used methamphetamines (also called speed, crystal, crank, or ice)?					Q53	Q54	Q53	Q52	Q53	Q53	Q54	DrugsMethLife1
During your life, how many times have you taken steroid pills or shots without a doctor's prescription?	Q44	Q52	Q50	Q50	Q54	Q55	Q55	Q54	Q55	Q55	Q56	DrugsSteroLife1
During your life, have you used a needle to inject any illegal drug into your body?	Q45	Q53	Q52	Q52	Q55	Q56	Q56	Q55	Q56	Q56	Q58	DrugsInjectLife1
During your life, how many times have you used ecstacy (also called MDMA)?						Q90	Q54	Q53	Q54	Q54	Q55	DrugsEcstaLife1
During your life how many times have you taken a prescription drug (such as OcyContin, Percocet, Vicodin, Adderall, Ritalin, or Xanax) without a doctor's prescription?										Q90	Q57	DrugsPrescLife1
During your life, how many times have you used any other type of illegal drug (hallucinogenic drugs), such as LSD, PCP, acid, angel dust, mescaline, ecstacy, mushrooms, speed, ice, heroin?	Q43	Q51	Q51	Q51		Q91	Q91	Q90	Q89	Q89	Q89	DrugsComboLife1
During the past 12 months, how would you describe your grades in school?						Q07	Q07			Q98		EduGrades1
Compared to other students in your class, what kind of student would you say you are?	Q05	Q05										EduRank2
During the past 30 days, on how many days did you miss classes or school without permission?								Q97				EduMiss3
How far in school (how much education) did your mother go?		Q86	Q87	Q88								EduMom4
How far in school (how much		Q87	Q88	Q89								EduDad5

education) did your father go?												
On how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, jogging, swimming laps, tennis, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?	Q68	Q77	Q77	Q77	Q79	Q80	Q80	Q78	Q90	Q91		ExerHardActive1
During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day (Add up all the time you spend in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time)?								Q80	Q80	Q80	Q79	ExerHardActive2
On how many of the past 7 days did you participate in physical activity for at least 30 minutes that did not make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors?			Q80	Q80	Q80	Q81	Q81	Q79	Q91	Q92		ExerSoftActive1
On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?	Q70	Q79	Q79	Q79	Q81	Q82	Q82				Q92	ExerStrength4
On how many of the past 7 days did you do stretching exercises, such as toe touching, knee bending, or leg stretching?	Q69	Q78	Q78	Q78								ExerStretch5
During the past 12 months, on how many sports teams did you play?	Q74/ Q75	Q83/ Q84	Q83/ Q84	Q83/ Q84	Q85	Q86	Q86	Q84	Q84	Q84	Q83	ExerTeam6
During the past 30 days/12 months, did you see a doctor or nurse for an injury that happened while exercising or playing sports?					Q86	Q92	Q93	Q92	Q93			ExerInjury7
On an averge school night, how many hours of sleep do you get?									Q97	Q97	Q96	Sleep1
When was the last					Q89	Q93						HealthD

time you saw a doctor or nurse for a check-up or physical exam when you were not sick or injured?												octor1
When was the last time you saw a dentist for a check-up, exam, teeth cleaning, or other dental work?					Q91	Q94	Q94					HealthDentist2
How do you describe your health in general?								Q07	Q98			HealthGeneral3
During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?					Q22	Q23	Q23	Q23	Q23	Q23	Q24	MoodDep1
During the past 12 months, did you ever seriously consider attempting suicide?	Q19	Q24	Q22	Q22	Q23	Q24	Q24	Q24	Q24	Q24	Q25	MoodConsiderS2
During the past 12 months, did you make a plan about how you would attempt suicide?	Q20	Q25	Q23	Q23	Q24	Q25	Q25	Q25	Q25	Q25	Q26	MoodPlanS3
During the past 12 months, how many times did you actually attempt suicide?	Q21	Q26	Q24	Q24	Q25	Q26	Q26	Q26	Q26	Q26	Q27	MoodAttemptS4
If you attempted suicide during the past 12 months, did any attempt result in an injury, poinsoning, or overdose that had to be treated by a doctor or nurse?	Q22	Q27	Q25	Q25	Q26	Q27	Q27	Q27	Q27	Q27	Q28	MoodSeriousS5
Have you ever been physically forced to have sexual intercourse when you did not want to?					Q21	Q22	Q22	Q22	Q22	Q21	Q21	SexForce1
Have you ever had sexual intercourse?	Q48	Q57	Q56	Q56	Q57	Q58	Q58	Q57	Q58	Q58	Q60	SexHist2
How old were you when you had sexual intercourse for the first time?	Q49	Q58	Q57	Q57	Q58	Q59	Q59	Q58	Q59	Q59	Q61	SexAge3
During your life, how many people have you had sexual intercourse?	Q50	Q59	Q58	Q58	Q59	Q60	Q60	Q59	Q60	Q60	Q62	SexNumLife4
During the past 3 months, with how many people did you have sexual intercourse?	Q51	Q60	Q59	Q59	Q60	Q61	Q61	Q60	Q61	Q61	Q63	SexNumMonth4
Did you drink alcohol or use drugs before you had sexual intercourse the last time?	Q52	Q61	Q60	Q60	Q61	Q62	Q62	Q61	Q62	Q62	Q64	SexSub5
The last time you had sexual intercourse, did you or your partner use	Q54	Q63	Q62	Q62	Q63	Q64	Q64	Q63	Q64	Q64	Q66	SexProtect7

protection? ?												
How many times have you been pregnant or gotten someone pregnant?	Q55	Q64	Q63	Q63	Q64	Q65	Q65					SexPregnant8
Have you ever been told by a doctor or nurse that you had a sexually transmitted disease such as genital herpes, genital warts, chlamydia, syphilis, gonorrhea, AIDS, or HIV infection?	Q56	Q65										SexSTD9
Have you ever tried cigarette smoking, even one or two puffs?	Q23	Q28	Q26	Q26	Q27	Q28	Q28	Q28	Q28	Q28	Q29	TobacTry1
Have you ever smoked cigarettes daily (regularly), that is, at least one cigarette every day for 30 days?	Q26	Q30	Q85	Q85	Q34	Q35	Q34	Q34	Q34	Q34	Q35	TobacDaily2
Have you ever tried to quit smoking cigarettes?	Q30	Q35	Q33	Q33	Q35	Q36	Q35	Q35	Q35	Q35	Q36	TobacQuit3
During the past 30 days, on how many days did you smoke cigarettes?	Q28	Q32	Q28	Q28	Q29	Q30	Q30	Q30	Q30	Q30	Q31	TobacDays4
During the past 30 days, on how many days did you smoke cigarettes on school property?		Q34	Q32	Q32	Q33	Q34	Q33	Q33	Q33	Q33	Q34	TobacDaysSP4
During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?	Q29	Q33	Q29	Q29	Q30	Q31	Q31	Q31	Q31	Q31	Q32	TobacAmount5
During the past 30 days, how did you usually get your own cigarettes?			Q30	Q30	Q31	Q32	Q32	Q32	Q32	Q32	Q33	TobacGet6
During the past 30 days, did you use chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Copenhagen?	Q31	Q36	Q34	Q34	Q36	Q37	Q36	Q36	Q36	Q36	Q37	TobacChew7
During the past 30 days, on how many days did you use chewing tobacco or snuff on school property?		Q37	Q35	Q35	Q37	Q38	Q37	Q37	Q37	Q37	Q38	TobacChewSP8
During the past 30 days, did you smoke cigars, cigarillos, or little cigars?				Q86	Q38	Q39	Q38	Q38	Q38	Q38	Q39	TobacCigar9
When you rode a motorcycle during the past 12 months, how often did you wear a helmet?	Q08	Q08	Q07	Q07	Q07	Q08		Q88	Q88	Q88		VehicleHelmet1
How often do you wear a seat belt when driving a car?						Q88	Q88					VehicleOtherSB2

How often do you wear a seat belt when riding in a car driven by someone else?	Q06	Q06	Q05	Q05	Q09	Q10	Q09	Q09	Q09	Q09	Q09	VehicleSelfSB2
During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?	Q11	Q11	Q10	Q10	Q10	Q11	Q10	Q10	Q10	Q10	Q10	VehicleOtherD3
During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?	Q12	Q12	Q11	Q11	Q11	Q12	Q11	Q11	Q11	Q11	Q11	VehicleSelfD3
During the past 30 days, on how many days did you carry a weapon such as a gun, knife or club?	Q14	Q13	Q12	Q12	Q12	Q13	Q12	Q12	Q12	Q12	Q12	ViolMultWeap1
During the past 30 days, on how many days did you carry a weapon such as a gun, knife, or club on school property?		Q15	Q14	Q14	Q14	Q15	Q14	Q14	Q14	Q14	Q14	ViolMultWeapSP1
During the past 30 days, on how many days did you carry a gun?		Q14	Q13	Q13	Q13	Q14	Q13	Q13	Q13	Q13	Q13	ViolGun1
During the past 30 days, on how many days did you not go to school because you felt you would be unsafe at school or on your way to or from school?		Q16	Q15	Q15	Q15	Q16	Q15	Q15	Q15	Q15	Q15	ViolUnsafe2
During the past 12 months, how many times has someone threatened or injured you with a weapon such as a gun, knife, or club on school property?		Q17	Q16	Q16	Q16	Q17	Q16	Q16	Q16	Q16	Q16	ViolThreatSP2
During the past 12 months, how many times has someone stolen or deliberately damaged your property such as your car, clothing, or books on school property?		Q18	Q17	Q17			Q17	Q17	Q17		Q88	ViolDamageSP2
During the past 12 months, how many times were you in a physical fight?	Q16	Q19	Q18	Q18	Q17	Q18	Q18	Q18	Q18	Q17	Q17	ViolFight3
During the past 12 months, how many times were you in a physical fight on school property?		Q22	Q20	Q20	Q19	Q20	Q20	Q20	Q20	Q19	Q19	ViolFightSP3
During the past 12 months, how many times were you in a physical fight in which you were injured and had to be	Q18	Q21	Q19	Q19	Q18	Q19	Q19	Q19	Q19	Q18	Q18	ViolInjury3

treated by a doctor or nurse?												
During the past 12 months, did your boyfriend or girlfriend ever hit, slap, or physically hurt you on purpose?					Q20	Q21	Q21	Q21	Q21	Q20	Q20	ViolSigOth4
The last time you were in a physical fight, with whom did you fight?	Q17	Q20	Q21									ViolWhom4
During the past 12 months, have you ever been bullied on school property?										Q22	Q22	ViolBullySP5
During the past 12 months, have you ever been electronically bullied?											Q23	ViolBullyElec5
How do you describe your weight? How do you think of yourself?	Q57	Q66	Q64	Q64	Q65	Q66	Q66	Q64	Q65	Q65	Q67	WeightThink1
Which of the following are you trying to do about your weight?	Q58	Q67	Q65	Q65	Q66	Q67	Q67	Q65	Q66	Q66	Q68	WeightTry1
During the past 30 days, did you diet or exercise to lose weight or to keep from gaining weight?	Q59	Q68	Q67/ Q66	Q67/ Q66	Q67/ Q68	Q68/ Q69	Q68/ Q69	Q66/ Q67	Q67/ Q68	Q67/ Q68		WeightDietExer2
During the past 30 days, did you go without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight?					Q69	Q70	Q70	Q68	Q69	Q69	Q69	WeightFast2
During the past 30 days, did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight (Do not include meal replacement products such as Slim Fast)?			Q69	Q69	Q70	Q71	Q71	Q69	Q70	Q70	Q70	WeightSupp2
During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?	Q60	Q69	Q68	Q68	Q71	Q72	Q72	Q70	Q71	Q71	Q71	WeightPurge2