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Exploring Health Trends and Risk Behavior Analysis in American Youth Using PROC SURVEYFREQ 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). This study outlines demographic differences in risk behaviors, health issues, and reported mental states. Interactions between risk behaviors and reported mental states were also analyzed. Visual representations of frequency data for the national results are also provided and discussed. A final regression model including the most significant contributing factors to suicidal ideation is provided and discussed. 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 today. 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. On the other hand, 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 'I:\RRSC_MWSUG_Analytics_2012\MWSUG_2012'; /* Tells SAS where
the data is */
libname library 'I:\RRSC_MWSUG_Analytics_2012\MWSUG_2012'; /* 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. The researcher chose which questions would be used in the analysis based on the whether or not the questions in all of the national surveys. All questions asked between the years of 1991 and 2011 were included in the model and separated into categories based on risk behavior type. This is a very simplistic way of reducing variables and the researcher acknowledges that it can create some bias. However, for the purposes of this practice, this method was used. The questions used were then given new names in order for the appropriate questions to be concatenated together. This was necessary because even though the questions used were present in all the surveys, the order in which the questions appeared in the survey differed between each year. The coding to rename each of the variables for the 1991 survey is given below:

```
data YRBS1991;
  set mydata.YRBS1991;

  alcohol1=q33;      alcohol2=q32;      alcohol3=q34;      alcohol4=q35;
```

```

demo1=q1;          demo2=q2;          demo3=q3;          demo4=q4;
diet2=q62;         diet5=q61;         diet8=q63;         diet11=q66;
diet15=q64;        diet17=q65;        diet19=q67;
drugs1=q37;        drugs2=q36;        drugs3=q38;        drugs5=q39;
drugs6=q40;        drugs7=q41;        drugs15=q44;       drugs16=q45;
drugs8=q43;        exercise2=q68;     exercise3=q69;     exercise4=q70;     exercise5=q71;
exercise7=q72;     exercise8=q73;     exercise10=q74;
exercisell=q75;
mood2=q19;         mood3=q20;         mood4=q21;         mood5=q22;
sexuality2=q48;    sexuality3=q49;    sexuality4=q50;    sexuality5=q51;
sexuality6=q52;
tobacco1=q23;      tobacco2=q25;      tobacco3=q24;      tobacco4=q27;
tobacco5=q28;      tobacco6=q29;      tobacco7=q30;
tobacco11=q26;     tobacco12=q31;
vehicle1=q9;        vehicle2=q10;      vehicle3=q6;        vehicle5=q11;
vehicle6=q12;      vehicle8=q7;        vehicle9=q8;
violence1=q14;     violence2=q15;     violence10=q16;    violence11=q17;
violence12=q18;
weight1=q57;       weight2=q58;       weight5=q59;       weight6=q60;
drop q1-q97;

```

```
run;
```

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;

```

Proc Surveyfreq

To begin the analysis, the researcher used proc surveyfreq to find the frequency of occurrence for each variable response in the data set. The researcher then displayed the frequencies as a set of bar graphs in which the data was organized by response and displayed in a manner that allowed you to see the frequencies of occurrence for each response over the years of the survey's administration. An example of the code used is provided below:

```

proc surveyfreq data=YRBS_Total;
  tables year*mood1 year*mood2 year*mood3 year*mood4 year*mood5;
run;

proc sgpanel data=YRBS_Total;
  title "Yearly Mood1";
  panelby mood1/ novarname columns=1;
  vbar year;
run;

```

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.

Proc Surveylogistic

The researcher then wanted to test to see if an interaction could be seen between 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, 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, only 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). The following SAS code was applied to the previously mentioned target question:

```
proc surveylogistic data=YRBS_Total;
  class mood1 mood2 mood3 mood4 mood5;
  cluster psu;
  strata stratum;
  model mood2 (decreasing) = mood1 mood3 mood4 mood5 / rsq;
  weight weight;
run;
```

The variable mood2 represents the question "During the past 12 months, did you make a plan about how you would attempt suicide?" This question was chosen for this study as a representation 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.

Odds Ratio Results

The results of the above SAS coding procedures are given below. The main interest of these results are the presence of significant correlations between the suicidal ideation variables and different health-risk behaviors. When viewing the Wald Chi-Square statistics and subsequent p-values, the researcher would like to note that the model parameters were set to 0 since each variable was a linear combination of other variables in the model.

Suicidal Ideation and Depressive Symptoms Correlations

Significant results were found for correlations between formulating a suicidal plan (variable mood2) and other suicidal actions and depressive symptoms. All variables in this model were found to correlate significantly with suicidal planning. Variable mood1 "During the past 12 months, did you ever feel so sad and hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?" yielded a Wald Chi-Square score of 1805.5562 and a p-value of <.0001. Odds ratio scores for mood1 indicated that students who answered "Yes" to this question were 81% more likely to have answered "Yes" to mood2 than other students. Variable mood3 "During the past 12 months, did you make a plan about how you would attempt suicide?" yielded a Wald Chi-Square score of 2980.6604 with a p-value of <.0001. Odds ratio scores for mood3 indicated that students who answered "Yes" to this question were 94% more likely to have answered "Yes" to mood2 than other students. Variable mood4 "During the past 12 months, how many times did you actually attempt suicide?" yielded a Wald Chi-Square score of 92.0079 with a p-value of <.0001. Odds ratio scores for mood4 indicated that a student who answered "No" to this question was 5 times more likely to have answered "No" to suicidal thoughts. Also, as the number of attempts rose, the probability that the student answered "Yes" to mood2" increased. As for the variable mood5 "If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?" yielded a Chi-Square score of 9.6430 with a p-value of .0019. Odds ratio scores for mood5 indicated that students who answered "No" to mood2 were twice as likely to deny having made a serious attempt on their life than students who answered that any attempt that they had made had not resulted in serious medical treatment.

Alcohol Use Correlations

Significant results were found for correlations between formulating a suicidal plan (variable mood2) and alcohol use questions. Variable alcohol1 "During your life, on how many days have you had at least one drink of alcohol?" yielded a Wald Chi-Square score of 27.7431 with a p-value of 0.0001. Odds ratio scores indicated that students who answered that they have never drank alcohol were 1.75 times more likely to have answered "No" to suicidal thoughts on mood2. However, this probability that the student answered "No" to mood2 decreased as the number of lifetime drinks increased according to this model. Variable alcohol2 "How old were you when you had your first drink of alcohol other than a few sips?" yielded a Wald Chi-Square score of 5.1852 with a p-value of <.0001. Odds ratio scores for this variable yielded that students claiming to have never had a drink of alcohol other than a few sips were not significantly different from students who claimed their first drink occurred at the age of 17 or later. However, odds ratios suggested that the earlier the age of occurrence when the student drank their first drink of alcohol other than a few sips increased the probability that the student answered "Yes" to having suicidal thoughts in mood2. Variable alcohol3 "During the past 30 days, on how many days did you have at least one drink of alcohol?" yielded a Wald

Chi-Square score of 25.3532 with a p-value of 0.0003. Odds ratios for this variable indicated that students claiming to not have drunk any alcohol within the past 30 days were 37 times more likely to have denied suicidal thoughts in mood2 than students claiming to have drunk alcohol all 30 days. Odds ratios for this variable otherwise indicated no significant differences between the variable number days that student could have drunk alcohol within the last month other than abstinence. Variable alcohol4 “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?” did not yield significant Wald Chi-Square values and was deleted from the model. Variable alcohol5 “During the past 30 days, on how many days did you have at least one drink of alcohol on school property?” yielded a Wald Chi-Square value of 99.0703 with a p-value of <.0001. Odds ratio scores indicated that students who answered that they have not drunk on school property were 4 times more likely to deny suicidal thoughts in mood2 than students answering that they have drunk on school property all 30 days. The probability of having denied such thoughts decreased as the number of days a student could have indicated having drunk on school property increased. Variable alcohol6 “During the past 30 days, how did you usually get the alcohol you drank?” yielded a Wald Chi-Square value of 48.5062 with a p-value of <.0001. Odds ratios for this variable indicated that students who answered that they had not drunk alcohol within the past 30 days were 95% more likely to deny suicidal thoughts in mood2 than other students. Odds ratios also indicated that students who answered that they either bought the alcohol themselves or it was given to them were more likely to have denied suicidal thoughts in mood2 than students who gave any other answer. There were no other significant differences between the alternative answers in this variable.

Health History Correlations

Significant results were found between health history questions and suicidal ideation (variable mood2). Variables health1 “Has a doctor or nurse ever told you that you have Asthma?” and health2 “Do you still have Asthma?” did not yield significant results and were deleted from the model. Variable health3 “During the past 12 months, have you had an episode of Asthma or an Asthma attack?” yielded a Wald Chi-Square score of 59.0601 with a p-value of <.0001. Odds ratio scores indicated that students who claimed that they either did not have asthma or had asthma but did not suffer from any recent attacks were 1.5 times more likely to deny suicidal ideations (variable mood2) than students who stated that they were unsure if they had suffered an attack or not. Odds ratio scores also indicated that students who were able to definitely say they had suffered from a recent attack were 26% less likely to deny suicidal thoughts than students who were unsure if they had experienced a recent asthma attack. Variable health4 “Do you have any physical disabilities or long-term health problems?” yielded a Wald Chi-Square score of 82.1536 with a p-value of <.0001. Odds ratio scores for this variable indicated that students who answered that they did have a physical disability or long-term health problem were 38% less likely to deny suicidal thoughts than students who stated they were unsure if they suffered from a disability or long-term health problem. Odds ratio scores also indicated that students who denied having a disability or long-term health concern were 1.6 times more likely to deny suicidal thoughts than students who were not sure if they had either a disability or long-term health concern. Variables health5 “When was the last time you saw a doctor or nurse for a check-up or physical exam when you were not sick or injured?”, health6 “When was the last time you saw a dentist for a check-up, exam, teeth cleaning, or other dental work?”, and health7 “How do you describe your health in general?” yielded no significant results and were therefore deleted from the model.

Demographic Correlations

Major demographic variables also showed significant correlations with suicidal ideations (variable mood2). Variable demo1 “How old are you?” yielded a Wald Chi-Square score of 42.3624 with p-value of <.0001. Odds ratio scores indicated that students 12 years old and younger who participated in high school were 71% less likely to deny suicidal ideations (mood2) than students 18 years or older. However, 13-17 year old high school students did not differ significantly from 18 year old and older students on suicidal ideations. Variable demo2 “What is your sex?” yielded a Wald Chi-Square score of 1007.4353 with p-value of <.0001. Odds ratio scores for this variable indicated that females were 51% less likely to deny suicidal thoughts (mood2) than males. Variable demo3 “In what grade are you?” yielded a Wald Chi-Square of 47.8982 and p-value of <.0001. Odds ratio scores yielded that compared to students who indicated that their grade was “Ungraded or other”, the likelihood that a student denied having suicidal thoughts were 3.8 times for 9th graders, 4 times for 10th graders, 4.5 times for 11th graders, and 5.5 times for 12th graders. Variable demo4 “How do you describe yourself?” yielded a Wald Chi-Square value of 212.6445 with p-value of <.0001. Odds ratio scores indicated that compared to students who claimed a “Multiple – Non-hispanic” heritage, the likelihood that a student denied suicidal thoughts (mood2) was 1.3 times for American Indian or Alaskan Native, 2 times for Asian, 2 times for Black or African American, 1.7 times for Hispanic or Latino, 1.8 times for White, and 1.4 times for Multiple - Hispanic, with no significant difference between Multiple- Non-Hispanic and Native Hawaiian or Other Pacific Islander. Variables demo5 “Are you Hispanic or Latino?” and demo6 “What is your race?” were excluded from the model due to the model’s inability to generate results with the inclusion of those variables. Variables demo7 “How tall are you without your shoes on?”, demo8 “How much do you weigh without your shoes on?”, and demo9 “How do you describe yourself In general?” did not yield significant results and were excluded from the model.

Dietary Correlations

Of the twenty-three variables concerning student eating habits, only three showed significant results and were included in the model. Variable diet7 "During the past 7 days, how many times did you eat green salad?" yielded a Wald Chi-Square of 53.3872 and p-value of <.0001. Odds ratio scores indicated that compared to students who indicated that they ate green salad 4 or more times per day the likelihood that a student denied having suicidal thoughts was 1.9 times for students who said they did not eat green salad during the past 7 days, 2 times for students who indicated they ate green salad 1 to 3 times during the past 7 days, 2.3 times for students who indicated they ate green salad 4 to 6 times during the past 7 days, 1.8 times for students who indicated they ate green salad 1 time per day, and displayed no significant differences for students who indicated they ate green salad either 2 or 3 times per day. Variable diet 21 "During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite?" yielded a Wald Chi-Square of 41.4612 and a p-value of <.0001. Odds ratio scores indicated that compared to students who indicated that they drank pop 4 or more times per day the likelihood that a student would deny suicidal thought was 2 times greater for students who stated they did not drink pop the past 7 days, 1.7 times greater for students who indicated they drank 1 to 3 pops the past 7 days, 2 times greater for students who indicated they drank pop 4 to 6 times the past 7 days, 1.6 times greater for students who indicated they drank 1 pop per day, 1.7 times greater for students who indicated they drank 2 pops per day, and 1.8 times greater for students who indicated they drank pop 3 times per day. Variable diet 22 "During the past 7 days, how many days did you eat breakfast?" yielded a Wald Chi-Square of 105.5064 and p-value of <.0001. Odds ratio scores indicated that compared to students who indicated that they ate breakfast all 7 days of the past week the likelihood that a student denied having suicidal thoughts were 77% less likely for students who stated they did not eat breakfast the past 7 days, 74% less likely for students who stated they ate breakfast 1 day, 50% less likely for students who stated they ate breakfast 2 days, 42% less likely for students who stated they ate breakfast 3 days, 28% less likely for students who stated they ate breakfast 4 days, 39% less likely for students who stated they ate breakfast 5 days, and 21% less likely for students who stated they ate breakfast 6 days.

Drug Use Correlations

Of the seventeen variables concerning drug use, five showed significant results. Variable drug1 "During your life, how many times have you used marijuana?" yielded a Wald Chi-Square score of 55.1758 with a p-value of <.0001. Odds ratio scores indicated that compared to students who admitted using marijuana 100 or more times in their lifetime, the likelihood that a student would deny suicidal thoughts was 30% less for students who admitted to using marijuana 3 to 9 times in their lifetime and 8% less for students who admitted to using marijuana 20-39 times in their lifetime, otherwise the differences proved insignificant. Variable drug6 "During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?" yielded a Wald Chi-Square Value of 16.9254 with a p-value of .0046. Odds ratio scores indicated that compared to students who admitted to using cocaine 40 or more times in their lifetime, the likelihood that a student would deny having suicidal thoughts was 39% less for students who admitted using cocaine only 1 or 2 times in their lifetime, otherwise the differences between usage was insignificant. Variable drug9 "During your life, how many times have you taken a prescription drug (such as OxyContin, Percocet, Vicodin, Adderall, Ritalin, or Xanax) without a doctor's prescription?" yielded a Wald Chi-Square value of 74.0805 with a p-value of <.0001. Odds ratio scores indicated that compared to students who admitted using these drugs without a prescription 40 or more times in their lifetime, the likelihood that a student would deny suicidal thoughts was 1.7 times greater for students who denied ever using these drugs and insignificantly different otherwise. Variable drug10 "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?" yielded a Wald Chi-Square value of 275.4199 with a p-value of <.0001. Odds ratio scores indicated that compared to students who admitted getting high using these household items 40 or more times in a lifetime, the likelihood that a student would deny having suicidal thoughts was 4.9 times greater for students who denied ever using these items to get high, 2 times greater for students who admitted using these items only 1 or 2 times in a lifetime, 2 times greater for students admitting they've used 3-9 times in a lifetime, 1.6 times greater for students who admitted using 10-19 times in a lifetime, 1.3 times greater for students who admitted using 20-39 times in a lifetime. Variable drug16 "During your life, how many times have you used a needle to inject any illegal drug into your body?" yielded a Wald Chi-Square value of 19.3941 with a p-value of <.0001. Odds ratio scores indicated that compared to students how stated they've used a needle in this manner 2 or more times in their life, the likelihood that a student would deny suicidal thoughts was 1.9 times for students who denied ever using a needle to inject an illegal drug into their body did not differ significantly for students who stated they've used a needle in this manner only once in their lifetime.

Exercise Correlations

Of the thirteen variables measuring various aspects of student exercise habits, only 2 variables were included in the model based on significance and validity of model inclusion. Variable exercise1 "During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?" yielded a Wald Chi-Square score of 87.1597 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated that they exercised in this way all seven days, the likelihood that a student would deny having suicidal thoughts was 30% less for students who stated they did not exercise in this manner at all during the last 7 days, 29% less for students who exercised 1 day a week, 27% less for students who exercised 2 days a week, and not significantly different for students who exercised 3 or more days a week. Variable exercise5 "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?” yielded a Wald Chi-Square score of 17.8673 with a p-value of .0126. Odds ratio scores indicated that compared to students who stated that they exercised in this way all seven days, the likelihood that a student would deny having suicidal thoughts was 1.2 times greater for students who denied exercising in this manner at all during the last week, not significantly different for students who exercised between 1 and 5 days the past week in this manner, and 1.3 times greater for students who exercised 6 days a week.

Sexual Activity and Health Correlations

Of the sixteen variables measuring various aspects of student sexual activity and sexual health, only 5 variables were included in the model based on significance and validity of model inclusion. Variable sexuality1 “Have you ever been physically forced to have sexual intercourse when you did not want to?” yielded a Wald Chi-Square score of 957.3236 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied ever being forced to have sexual intercourse, students who stated that they have been forced to have sexual intercourse are 70% less likely to deny having suicidal thoughts. Variable sexuality3 “How old were you when you had sexual intercourse for the first time?” yielded a Wald Chi-Square score of 60.5970 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated that the first time they had sexual intercourse was when they were 17 years or older, the likelihood that a student would deny having suicidal thoughts was 70% less for students who stated they’ve never had sexual intercourse, 44% less likely for students who stated they had sexual intercourse at age 11 or younger, 27% less likely for students who stated they had sexual intercourse at age 12, 26% less likely for students who stated 13 years of age, 28% less likely for students who stated 14 years of age, 17% less likely for students who stated 15 years of age, and there was no significant difference for students who stated they had sexual intercourse for the first time at age 16. Variable sexuality4 “During your life, how many people have you had sexual intercourse?” yielded a Wald Chi-Square score of 16.8383 with a p-value of .0048. Odds ratio scores indicated that compared to students who stated they had sexual intercourse with 6 or more partners in their life, the likelihood that a student would deny having suicidal thoughts was 2.3 times greater for students who stated they have never had sexual intercourse, not significantly different for students who stated they have had only one partner, 16% less likely for students who stated they’ve had 2 partners, 11% less likely for students who stated they’ve had 3 partners, and insignificantly different for students who stated they’ve had 4 or 5 partners. Variable sexuality5 “During the past 3 months, with how many people did you have sexual intercourse?” yielded a Wald Chi-Square value of 21.7350 with a p-value of .0014. Odds ratio scores indicated that compared to students who stated that within the last 3 months, they’ve had sexual intercourse with 6 or more individuals, the likelihood that a student would deny having suicidal thoughts was 4 times greater for students who denied having sexual intercourse ever in their life, 1.4 times greater for students who stated that they’ve had sexual intercourse but not in the last 3 months, 1.2 times greater for students who stated they’ve only had 1 partner, 1.2 times greater for students who stated they’ve only had 2 partners, 1.3 times greater for students who stated they’ve had 3 partners, and insignificantly different for students who stated they’ve had 5 partners. Variable sexuality6 “Did you drink alcohol or use drugs before you had sexual intercourse the last time?” yielded a Wald Chi-Square value of 74.3883 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated that alcohol or drugs was not involved during the last time they had sexual intercourse, the likelihood that a student would deny having suicidal thoughts was 52% less likely for students who stated they’ve never had sexual intercourse, the comparison with students who stated that drugs and/or alcohol was used the last they had sexual intercourse is not available at this time.

Tobacco Use Correlations

Of the fifteen variables measuring various aspects of tobacco use, 6 of the variables were included in the model based on significance and validity of model construction. Variable tobacco1 “Have you ever tried cigarette smoking, even one or two puffs?” yielded a Wald Chi-Square score of 38.9710 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied ever smoking a cigarette, students who answered that they have tried smoking were 1.3 times more likely to admit having suicidal thoughts. Variable tobacco2 “How old were you when you smoked a whole cigarette for the first time?” yielded a Wald Chi-Square score of 206.2873 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated they had not smoked a whole cigarette until the age of at least 17, the likelihood that a student would admit having suicidal thoughts was insignificantly different for students who answered that they have never smoked a cigarette in their lifetime, 2 times greater students who stated they smoked a cigarette for the first time at 8 years of age or younger, 1.5 times greater for students who stated 9 or 10 years old, 1.4 times greater for students who stated 11 or 12 years old, and insignificantly different for students who stated their first cigarette was smoked between the ages of 13 and 16. Variable tobacco6 “During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?” yielded a Wald Chi-Square score of 188.4219 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated that they smoked more than 20 cigarettes per day within the last 30 days, the likelihood that a student would admit having suicidal thoughts was 73% less for students who stated they did not smoke cigarettes in the last 30 days, 63% less for students who stated they smoked less than 1 cigarette per day, 61% less for students who stated they smoked 1 cigarette per day, 58% less for students who stated they smoked between 2 and 5 cigarettes per day, 63% less for students who stated they smoked between 6 and 10 cigarettes per day, and 56% less for students who stated they smoked between 11 and 20 cigarettes per day. Variable tobacco11 “Have you ever smoked cigarettes daily (regularly), that is, at least one cigarette ever day for 30 days?” yielded a Wald Chi-Square score of 76.0051 with a p-

value of $<.0001$. Odds ratio scores indicated that compared to students who stated that they have never regularly smoked cigarettes, students who stated that they have, at one time, smoked cigarettes were 1.5 times more likely to admit having suicidal thoughts. Variable tobacco12 “During the past 30 days, did you use chewing tobacco, such as Redman, Levi Garrett, or Beechnut, or snuff, such as Skoal, Skoal Bandits, or Copenhagen?” yielded a Wald Chi-Square score of 63.5509 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who admitted using some kind of chewing tobacco, snuff, or dip all 30 days, the likelihood that a student would admit to having suicidal thoughts was 3 times greater for students who did not use this kind of tobacco at all during the last 30 days, 2.7 times greater for students who used this kind of tobacco 1 or 2 days, 2 times greater for students who used this kind of tobacco 3 to 5 days, 2.2 times greater for students who used this kind of tobacco 6 to 9 days, 1.8 times greater for students who used this kind of tobacco 10 to 19 days, and insignificantly different for students who used this kind of tobacco 20 to 29 days. Variable tobacco13 “During the past 30 days, did you use chewing tobacco, such as Redman, Levi Garrett, or Beechnut, or snuff, such as Skoal, Skoal Bandits, or Copenhagen on school property?” yielded a Wald Chi-Square score of 23.3328 with a p-value of $.0007$. Odds ratio scores indicated that compared to students who admitted using some kind of chewing tobacco, snuff, or dip on school property all 30 days, the likelihood that a student would admit to having suicidal thoughts was 60% less likely for students who did not use this kind of tobacco at all during the last 30 days, 43% less likely for students who used this kind of tobacco 1 or 2 days, 40% less likely for students who used this kind of tobacco 3 to 5 days, 50% less likely for students who used this kind of tobacco 6 to 9 days, 46% less likely for students who used this kind of tobacco 10 to 19 days, and insignificantly different for students who used this kind of tobacco 20 to 29 days.

Vehicle Safety Correlations

Of the nine vehicle safety questions that were asked in the questionnaires, four were included in the model based on significance and validity of model construction. Variable vehicle1 “During the past 12 months, how many times did you ride a bicycle?” was not included in the model as it did not prove significant in the initial model. Variable vehicle2 “When you rode a bicycle during the past 12 months, how often did you wear a helmet?” was not included in the model as it did not prove significant in the initial model. Variable vehicle3 “How often do you wear a seat belt when riding in a car driven by someone else?” yielded a Wald Chi-Square score of 30.0640 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who stated that they always wore a seat belt when riding in a car driven by someone else, the likelihood that a student would deny having suicidal thoughts was 37% less likely for students who stated they never wore a seat belt, 31% less likely for students who said they rarely wore a seat belt, 27% less likely for students who stated they sometimes wore a seat belt, and 16% less likely for students who stated they wore a seat belt most of the time. Variable vehicle4 “How often do you wear a seat belt when driving a car?” yielded a Wald Chi-Square score of 30.1317 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who stated they wore a seat belt while they were driving all the time, the likelihood that a student would deny suicidal thoughts 17% less likely for students who said they never wore a seat belt while driving a vehicle, insignificantly different for students who stated they wore a seat belt while driving either rarely, sometimes, or most of the time. Variable vehicle5 “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” yielded a Wald Chi-Square score of 90.5970 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who stated that they have ridden in a car driven by someone under the influence of alcohol, the likelihood that a student would deny suicidal thoughts was 2 times greater for students who said have never done this, 1.4 times greater for students who stated they have done this 1 time in the past 30 days, 1.3 times greater for students who stated they have done this 2 to 3 times in the past 30 days, and insignificantly different for students who stated they have done this 4 to 5 times in the past 30 days. Variable vehicle6 “During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?” yielded a Wald Chi-Square score of 20.9525 with a p-value of $.0003$. Odds ratio scores indicated that compared to students who stated that they have ridden in a car driven by someone under the influence of alcohol, the likelihood that a student would deny suicidal thoughts was 1.9 times greater for students who said have never done this, 1.7 times greater for students who stated they have done this 1 time in the past 30 days, 1.6 times greater for students who stated they have done this 2 to 3 times in the past 30 days, and insignificantly different for students who stated they have done this 4 to 5 times in the past 30 days. Variables vehicle7 “During the past 30 days, on how many days did you text or e-mail while driving a car or other vehicle?”, vehicle8 “During the past 12 months, how many times did you ride a motorcycle?”, and vehicle9 “When you rode a motorcycle during the past 12 months, how often did you wear a helmet?” were not included in the model as they did not prove significant in the initial model.

Violence Correlations

Of the fourteen violence variables included in the initial model, only four variables were proven to be significantly correlated with suicidal ideation. Variable violence1 “During the past 30 days, on how many days did you carry a weapon such as a gun, knife or club?” yielded a Wald Chi-Square score of 25.3060 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who stated that they carried a weapon 6 or more days, the likelihood that a student would deny suicidal thoughts was 1.2 times greater for students who stated they did not carry a weapon, and insignificantly different for students who stated they carried a weapon 1 to 5 days. Variable violence5 “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?” yielded a Wald Chi-Square score of 187.2663 with a p-value of $<.0001$. Odds ratio scores indicated that compared to students who stated that they missed school 4 or 5 days due to unsafe conditions,

the likelihood that a student would deny suicidal thoughts was 2.3 times greater for students who stated they did not miss any school for this reason, and insignificantly different for students who stated they missed 1 to 3 days of school. Variable violence10 "During the past 12 months, how many times were you in a physical fight?" yielded a Wald Chi-Square score of 410.3212 with a p-value of <.0001. Odds ratio scores indicated that compared to students who stated that they were in 12 or more fights the past year, the likelihood that a student would deny suicidal thoughts was 2.8 times greater for students who stated they did not get into any fights, 1.7 times greater for students who stated they were in 1 fight, 1.6 times greater for students who stated they were in 2 to 3 fights, 1.4 times greater for students who stated they were in 4 to 5 fights, 1.3 times greater for students who stated they were in 6 to 7 fights, and insignificantly different for students who stated they were in 8 to 11 fights. Variable violence14 "During the past 12 months, did your boyfriend or girlfriend ever hit, slap, or physically hurt you on purpose?" yielded a Wald Chi-Square score of 552.0690 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied having a boyfriend or girlfriend who physically hurt them on purpose, students who admitted being in this type of situation were 64% less likely to deny suicidal thoughts.

Weight Control Correlations

Of the ten questions contributing to the weight control variables, five of them resulted in significant correlations with suicidal ideations. Variable weight3 "During the past 30 days, did you exercise to lose weight or to keep from gaining weight?" yielded a Wald Chi-Square value of 23.3113 with a p-value of .0688. Odds ratio scores indicate that compared to students who denied having used exercise to lose weight, students who participated in exercise to lose weight had a 1.1 times greater likelihood of denying suicidal thoughts. Variable weight7 "During the past 30 days, did you eat less food, fewer calories, or foods low in fat to lose weight or to keep from gaining weight?" yielded a Wald Chi-Square value of 63.5714 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied eating less food, fewer calories, or foods lower in fat to adjust weight, students who admitted to doing this were 23% less likely to deny suicidal thoughts. Variable weight8 "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?" yielded a Wald Chi-Square score of 668.0480 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied "fasting", students who admitted to doing it were 64% less likely to deny suicidal thoughts. Variable weight9 "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?" yielded a Wald Chi-Square value of 72.3727 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied taking diet supplements without a doctor's advice, students who admitted doing this were 37% less likely to deny suicidal thoughts. Variable weight10 "During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?" yielded a Wald Chi-Square score of 224.2224 with a p-value of <.0001. Odds ratio scores indicated that compared to students who denied ever vomiting or taking laxatives to lose weight, students who admitted to doing it were 56% less likely to deny suicidal thoughts.

Multicollinearity

Given the above scores, a more compact model for each predictive category was needed. Multicollinearity was then explored by taking the log value of each variable test the interaction of its original value and log. An example of the code is given below:

```
proc surveylogistic data=YRBS_Total;
  class mood1 mood2 mood3 mood4 mood5;
  cluster psu;
  strata stratum;
  model mood2 (order=data) = mood1 mood3 mood4 mood5
                           mood1*lnmood1 mood3*lnmood3
                           mood4*lnmood4 mood5*lnmood5 / rsq;
  weight weight;
run;
```

Variables contributing to multicollinearity were thus deleted from the model. Also, other variables that violated the assumption of linearity of the logit were also excluded from the model. This narrowed each model down to less than 6 variables each. The final results for each predictive model are given below

Odds Ratio Results

The results of the above SAS coding procedures are given below. The main interest of these results are the presence of significant correlations between the suicidal ideation variables and different health-risk behaviors. When viewing the Wald Chi-Square statistics and subsequent p-values, the researcher would like to note that the model parameters were set to 0 since each variable was a linear combination of other variables in the model.

Suicidal Ideation and Depressive Symptoms Correlations

Aside from suicidal ideation itself, there were no other suicidal factors or depressive symptoms that contributed to suicidal ideation left in this model.

Alcohol Use Correlations

Some significant results were found for correlations between formulating a suicidal plan (variable mood2) and alcohol use questions. Variable alcohol1 "During your life, on how many days have you had at least one drink of alcohol?" yielded a Wald Chi-Square score of 228.6328 with a p-value of 0.0001. Variable alcohol4 "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?" did not yield significant Wald Chi-Square values and was deleted from the model. Variable alcohol5 "During the past 30 days, on how many days did you have at least one drink of alcohol on school property?" yielded a Wald Chi-Square value of 59.55 with a p-value of <.0001. Variable alcohol6 "During the past 30 days, how did you usually get the alcohol you drank?" yielded a Wald Chi-Square value of 183.29 with a p-value of <.0001. There were no other significant differences between the alternative answers in this variable. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Health History Correlations

There were no significant correlations between health history variables and suicidal ideation left in this model.

Demographic Correlations

There were no significant correlations between demographic variables and suicidal ideation left in this model.

Dietary Correlations

Of the twenty-three variables concerning student eating habits, only two ended up showing significant results and were included in the model. Variable diet 21 "During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite?" yielded a Wald Chi-Square of 15.2844 and a p-value of .0182. Variable diet 22 "During the past 7 days, how many days did you eat breakfast?" yielded a Wald Chi-Square of 82.011 and p-value of <.0001. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Drug Use Correlations

Of the seventeen variables concerning drug use, only four showed significant results. Variable drug1 "During your life, how many times have you used marijuana?" yielded a Wald Chi-Square score of 86.5003 with a p-value of <.0001. Variable drug6 "During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?" yielded a Wald Chi-Square Value of 45.89 with a p-value of <.0001. Variable drug10 "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?" yielded a Wald Chi-Square value of 35.2372 with a p-value of <.0001. Variable drug16 "During your life, how many times have you used a needle to inject any illegal drug into your body?" yielded a Wald Chi-Square value of 10.86 with a p-value of .0044. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Exercise Correlations

There were no significant correlation between exercise variables and suicidal ideation left in this model.

Sexual Activity and Health Correlations

Of the sixteen variables measuring various aspects of student sexual activity and sexual health, only one variable were included in the model based on significance and validity of model inclusion. Variable sexuality3 "How old were you when you had sexual intercourse for the first time?" yielded a Wald Chi-Square score of 15.4837 with a p-value of .0303. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Tobacco Use Correlations

Of the fifteen variables measuring various aspects of tobacco use, two of the variables were included in the model based on significance and validity of model construction. Variable tobacco6 "During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?" yielded a Wald Chi-Square score of 149.4580 with a p-value of <.0001. Variable tobacco12 "During the past 30 days, did you use chewing tobacco, such as Redman, Levi Garrett, or Beechnut, or snuff, such as Skoal, Skoal Bandits, or Copenhagen?" yielded a Wald Chi-Square score of 25.1237 with a p-value of .0003. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Vehicle Safety Correlations

Of the nine vehicle safety questions that were asked in the questionnaires, three were included in the model based on significance and validity of model construction. Variable vehicle4 "How often do you wear a seat belt when driving a car?" yielded a Wald Chi-Square score of 29.1857 with a p-value of <.0001. Variable vehicle5 "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" yielded a Wald Chi-Square score of 16.4323 with a p-value of .0025. Variable vehicle6 "During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?" yielded a Wald Chi-Square score of 17.4058 with a p-value of .0016. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Violence Correlations

Of the fourteen violence variables included in the initial model, only three variables were proven to be significantly correlated with suicidal ideation. Variable violence1 "During the past 30 days, on how many days did you carry a weapon such as a gun, knife or club?" yielded a Wald Chi-Square score of 17.5561 with a p-value of .0015. Variable violence5 "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?" yielded a Wald Chi-Square score of 79.6531 with a p-value of <.0001. Variable violence10 "During the past 12 months, how many times were you in a physical fight?" yielded a Wald Chi-Square score of 16.8035 with a p-value of .0187. This model alone still did not account for even 10% of the variance in suicidal ideation and requires the addition of variables from other predictors.

Weight Control Correlations

There were no significant correlations between weight control variables and suicidal ideation left in this model.

Conclusion

Given the above results from the first and second models correlating suicidal ideation and health-risk behaviors, we can see that several different predictors contribute to whether or not an adolescent may have suicidal thoughts. Multiple combinations of these predictors were looked at with little insight as to a single model that best explained the variation in suicidal ideation. The development of such a model is thus beyond the scope of this paper. However, the development of such a model, at least one that could shed light on the contributions of each group of predictor variables to suicidal thoughts, could still be explored.

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