Alcohol and Marijuana Use and Its Effect on GPA

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Quantitative Methods
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12-18-14
Introduction and Literature Review

Drugs and alcohol are becoming an increasingly more common thing among college students. In this statistical study, we will be looking at the effects of alcohol and marijuana on college student’s grade point average (GPA). Our indication is that the use of alcohol and marijuana does not have an effect on the grade point average of college students.

To gather this information, an eighteen question survey was passed around through social media (Appendix 1) and in-person surveys were handed out. We asked participants to state their college year, whether they were freshman, sophomore, junior, senior, or graduate students. Out of the seventy-six responses we received, no freshman or graduate students responded.

In order to efficiently find a statistical relationship between alcohol and marijuana use with GPA, the following five variables are to be used: gender, age, major, use of alcohol, and use of marijuana. We would compare measures of central tendency to observe any slight differences between variables, but ultimately would rely on correlation to depict a relationship among variables.

To test our hypothesis, we need to calculate whether or not there is a correlation between alcohol and marijuana use in relationship to cumulative GPA. In a paper released by the Centers for Disease Control and Prevention, they found just that. A study conducted in 2009 called the ‘National Youth Risk Behavior Survey’ asked high school students about their grades, alcohol use, binge drinking, marijuana use, and taking other drugs. The data that they received displayed “a negative association between alcohol and other drug use and academic achievement after controlling for sex, race/ethnicity, and grade level” (Alcohol). The study did mention one fallback to their study, stating that further research is required to see if it is low grades that lead
to drug use or if drug use results in lower grades. In our study, we are trying to determine whether or not alcohol and marijuana use leads to lower grade point averages, not the other way around.

Their statistics show that high school students who have mostly D’s and F’s (62% of those surveyed) have a higher rate of alcohol and marijuana use at all levels, meaning that they are more likely to do both very often or not often at all. Yet it still shows that approximately 32% of students who have mostly A’s use alcohol and other drugs.

A similar study conducted by Helene White et al looked at the differences in alcohol and marijuana use from the transition from high school to college. The results from this study, titled ‘Increases in Alcohol and Marijuana Use During the Transition Out of High School into Emerging Adulthood: The Effects of Leaving Home, Going to College, and High School Protective Factors’ yielded similar, yet different results. White et al discovered that alcohol consumption increased when students first went to college, such as binge drinking, and that marijuana use from high school to college remained relatively the same. This was more true in four year colleges than in two year colleges, where alcohol consumption was less often.

These two studies have helped us form our hypothesis, because we believe that alcohol and marijuana use are correlated with low grade point averages, especially at four year colleges and universities. To test our hypothesis, we are performing various correlation tests, as well as descriptive tests paired with graphs and tables to accurately portray our results and our findings.
Statistical Analysis

Our statistical analysis included the results of 76 individuals who chose to participate in a short survey. The null hypothesis states that there is not a correlation between GPA and alcohol or marijuana use. Our research hypothesis states that there will be a correlation between the two variables. In this case, the null hypothesis is our claim. To analyze our data, we summarized the grade point average for those who drink alcohol and for those who do not drink alcohol, as well as those who smoke marijuana and those who do not smoke marijuana. We also created a new column in our csv file to group those who drink and smoke, compared to those who do not participate in both. You can see the list of columns and their description in Appendix 2, along with the data we collected in Appendix 3. With this, we could see if GPA was really affected by the use of alcohol or marijuana.

By doing this individually, we could see if there were any differences in central tendency. The summary gave us data such as the minimum, mean, median, and maximum GPA. Those who do not drink alcohol had a higher mean GPA than those who did. The same pattern was exhibited in the measures of central tendency with the use of marijuana. The mean GPA for those who smoke was lower than the mean GPA of those who do not smoke. We grouped the data, separating those who smoke and drink by awarding them with a 1 and giving a 0 to those who do not partake in both. After grouping the data, we also discovered that the mean GPA was lower for those who drink and smoke, as opposed to those who participate in one or none. Table 1 below details the minimum, mean, median, and maximum grade point average for alcohol use, marijuana use, and alcohol and marijuana use combined.
Table 1: GPA in Relationship to Drug Use

<table>
<thead>
<tr>
<th></th>
<th>Alcohol and GPA</th>
<th>Marijuana and GPA</th>
<th>Both and GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>2.4</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Mean</td>
<td>3.412</td>
<td>3.397</td>
<td>3.4</td>
</tr>
<tr>
<td>Median</td>
<td>3.5</td>
<td>3.44</td>
<td>3.445</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.0</td>
<td>3.96</td>
<td>3.96</td>
</tr>
</tbody>
</table>

In order to find a relationship between drug use and grade point average, a Pearson’s r correlation was used to determine a correlation between GPA and whether the person drinks alcohol. The p-value came out to be 0.01367, which is less than our alpha level of 0.05. The p-value is insignificant because it does not surpass the alpha level. We can reject the null hypothesis, concluding that alcohol consumption has an effect on GPA. When determining a relationship between GPA and whether the person smokes. The p-value came out to be 0.152, which is greater than our alpha level of 0.05. Because of this, we fail to reject our null hypothesis, concluding that marijuana does not have an effect on GPA. When we analyzed the grouped data, we received a p-value of 0.1653, showing that a student’s GPA is not affected by marijuana and alcohol use when combined. Below is a sample Pearson’s r correlation test on the usage of both alcohol and marijuana:

```r
> cor.test(gpa,both)
Pearson's product-moment correlation
data:  gpa and both
t = -1.4014, df = 73, p-value = 0.1653
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:     
-0.37503844    0.06759132
sample estimates: 
```
Because our p-value is above the confidence interval of 0.05, we fail to reject the null hypothesis, so there is no significant correlation between the use of both alcohol and marijuana with GPA. Although alcohol use on its own has an effect on GPA, there is no significant effect when combined with marijuana. Our results calculated a slight negative correlation between the variables, but it is too small to be considered significant.

In our studies, we also tested the frequency of drinking and smoking and how it has, if at all, affected GPA. We looked at the measures of central tendency, as well as the minimum and maximum. Table 2 displays the frequency of drinking and its effect on GPA. The average GPA for someone who doesn’t drink is higher than the GPA of someone who drinks, even if it is only a couple of times a month.

Table 2: GPA and Frequency of Drinking

<table>
<thead>
<tr>
<th>GPA &amp; Drinking</th>
<th>Minimum</th>
<th>Median</th>
<th>Mean</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not drink</td>
<td>3.400</td>
<td>3.700</td>
<td>3.718</td>
<td>3.945</td>
</tr>
<tr>
<td>A couple of times a month</td>
<td>2.500</td>
<td>3.500</td>
<td>3.431</td>
<td>4.000</td>
</tr>
<tr>
<td>Only on weekends</td>
<td>3.000</td>
<td>3.546</td>
<td>3.491</td>
<td>3.940</td>
</tr>
<tr>
<td>Once a week</td>
<td>2.500</td>
<td>3.530</td>
<td>3.367</td>
<td>3.500</td>
</tr>
<tr>
<td>Several times a week</td>
<td>2.400</td>
<td>3.250</td>
<td>3.375</td>
<td>3.890</td>
</tr>
</tbody>
</table>
Table 3 displays the frequency of smoking and its effect on GPA. The average GPA of someone who does not smoke was higher than the average GPA of someone who smokes. The lowest GPA of someone who smokes daily is greater than the minimum GPA of an individual who drinks several times a week. Reflecting our results, table 2 shows that drinking has a greater impact on GPA than marijuana does.

Table 3: GPA and Frequency of Smoking

<table>
<thead>
<tr>
<th>GPA &amp; Smoking</th>
<th>Minimum</th>
<th>Median</th>
<th>Mean</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not smoke</td>
<td>2.400</td>
<td>3.620</td>
<td>3.520</td>
<td>4.000</td>
</tr>
<tr>
<td>A couple of times a month</td>
<td>3.000</td>
<td>3.546</td>
<td>3.491</td>
<td>3.800</td>
</tr>
<tr>
<td>Once a week</td>
<td>3.200</td>
<td>3.500</td>
<td>3.440</td>
<td>3.700</td>
</tr>
<tr>
<td>Several times a week</td>
<td>2.800</td>
<td>3.390</td>
<td>3.284</td>
<td>3.527</td>
</tr>
</tbody>
</table>
Discussion and Conclusion

Initially, we surmised that the use of both alcohol and marijuana would have a negative correlation with grade point average, or that the use of both would put out lower grade point averages. Because of our correlation test and its output, this is not true. The only significant p-value was occurred in testing alcohol use and an effect on grade point average, which yielded a negative correlation of -0.283 as seen in the correlation test below:

```r
> cor.test(gpa,drinks)

Pearson's product-moment correlation
data: gpa and drinks
t = -2.5269, df = 73, p-value = 0.01367
```

alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
-0.47969699 -0.06054853
sample estimates:
cor
-0.2836129

The hypothesis testing marijuana use and grade point average went along with White’s scholarly article about the transition from high school to college, where marijuana use did not change from high school to college. White’s research went along perfectly with our significant alcohol use test, where binge drinking increased dramatically from high school to college.

Our output and results did not follow the survey conducted by the Centers for Disease Control, where they found that high school students that used alcohol along with other drugs had mostly D’s and F’s as their grades, compared to straight A students.

If we were to test our hypothesis again, along with our three components, we would take out any outliers and gather more responses that would include a wider age group and a more equal gender response. We received 53 female responses, 21 male responses, and 2 people who
defined themselves as other. Because of this heavy skew, we were unable to test this variable with drug use and grade point average. In the future, we would be more diligent about getting a more even response pertaining to this variable. The same situation occurred with age, since we only received responses from sophomores, juniors, and seniors they were all in the same age group, meaning no pattern or relationship could be found with the age variable. What we really wanted to test is if there were any particular majors that had lower grade point average and who had a higher frequency of alcohol and marijuana use. Unfortunately, with our responses there were so many different majors and minors that no pattern or no one major stuck out to use. If we were to test this variable in the future, it would be best to get a certain number of responses from each major on campus in order to find a correlation.

With a regression, it is easy to find outliers in a data set. After we conducted our correlation tests, we ran a regression to locate any outliers as seen in Figure 1 and 2 below:

In the regression tests above that compare students that just use marijuana and students that just use alcohol, Responder #12 kept popping up as an outlier. Looking at our data set, we
saw that 12 had an abnormally low grade point average of 2.4. We also saw other outliers in our marijuana usage but because of the format of the output, we were unable to identify those points. We thought that these outliers would not affect our correlation tests, but in the future we would take these out to see if it does in fact affect our outputs.

As stated in our hypothesis, we were looking for a negative correlation between students who use just alcohol, just marijuana, and the use of both alcohol and marijuana. Due to our correlation test outputs, only the use of just marijuana had a negative correlation in relationship to grade point average. Or in other words, if you drink alcohol during the school semester, the more probable it is that your grade point average will be lower than those who do not drink alcohol.

Appendix 1

Survey

**What do you identify as?**
A. Male  
B. Female  
C. Other

**What is your school year?**
A. Freshman  
B. Sophomore  
C. Junior  
D. Senior  
E. Graduate student

**What is your age?**
A. Under 18  
If chosen, please specify: 
B. 18  
C. 19  
D. 20  
E. 21  
F. 22  
G. Over 22  
If chosen, please specify:

**What is your GPA (cumulative)?**

**What is your major?** Please include any and all that apply.

**What is your minor?** Please include any and all that apply.

**Do you drink alcohol?**
A. Yes
B. No

*If yes, please continue. If no, please leave section blank.*

At what age did you first start drinking?

How often do you drink alcohol during the school year?

A. A couple of times a month
B. Once a week
C. Several times a week
D. Only on weekends
E. Daily

How many drinks will you consume on an average night of drinking?

Have you ever let drinking interfere with attending class?

Have you ever let drinking interfere with doing homework?

Have you ever smoked marijuana?

A. Yes
B. No

*If yes, please continue. If no, please leave section blank.*

At what age did you first start smoking marijuana?

How often do you smoke marijuana during the school year?

A. A couple of times a month
B. Once a week
C. Several times a week
D. Only on weekends
E. Daily

Have you ever let marijuana interfere with attending class?

Have you ever let marijuana interfere with doing homework?
Appendix 2

"age": How old are you?

“both”: 1 indicates that they smoke and drink, 0 indicates either or none

"drink": Do you drink alcohol?

"drink1": Have you ever let drinking affect homework?

"drink2": Have you ever let alcohol interfere with going to class?

"drinkage": How old were you when you first started drinking?

"drinks": 1 indicates that they drink, 0 indicates that they do not

"drinksavg": How many drinks will you consume on an average night?

"frequency1": How often do you drink alcohol?

"frequency2": How often do you smoke marijuana?

"gpa": What is your cumulative GPA?

"major": What is your major?

"minor": What is your minor?

"school": What is your school year?

"sex": What do you identify as?

"smoke": Have you ever smoke marijuana?

"smoke1": Have you ever let marijuana use affect homework?

"smoke2": Have you ever let marijuana use interfere with going to class?

"smokeage": At what age did you first start smoking?
"smokes": 1 indicates that they smoke, 0 indicates that they do not