Academic Use of Psychostimulants in the CMU Population

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Introduction

Performance-enhancing drugs represent a sensitive and controversial issue. Popular media pervasively covers performance-enhancing drug use among professional and amateur athletes. Less covered is the use of the “academic” drugs ingested on college campuses that allow increased mental focus and stamina. We surveyed the Carnegie Mellon student population for information regarding their perception and usage of psychostimulants, such as Adderall, the most recognized brand-name in academic drug use. These drugs elicit a wide-range of opinions among students regarding the ethicality of their consumption as well as their efficacy as performance-enhancers.

Students at Carnegie Mellon University often consider the school to be a more strenuous academic environment than peer institutions. This environment could incentivize or even necessitate the use of psychostimulants in the pursuit of solid course grades. Voluntary surveys of the CMU student population’s legal and illegal consumption of psychostimulants could expose revealing information about the student body’s relationship with performance-enhancing academic drugs and the general state of the school’s academic environment. Through analysis of our survey data, we hoped to identify the specific academic conditions that particularly predict psychostimulant usage.

Popular familiarity with performance-enhancing drug use may reside primarily in athletic contexts, yet research institutions such as the National Survey on Drug Use and Health provide a broader range of studies on multiple types of drugs used for various purposes. Some of the data analyses conducted by these institutions offer helpful understanding and guidance on how drug use surveys can be conducted and addressed (United States Department of Health and Human Services).

One notable paper, “Chalk Talks- Adderall Abuse: Regulating the Academic Steroid,” addresses Adderall at the same level of concern as steroids in sports. Our interest lay in determining prevalence and frequency of campus psychostimulant usage while this talk elucidated the problematic sequelae of unprescribed Adderall use and possible avenues towards regulating use, thus providing a framework of understanding the negative elements of psychostimulant consumption (Stolz). Another paper, “When We Enhance Cognition with Adderall, Do We Sacrifice Creativity?: A Preliminary Study,” seeks to determine whether or not Adderall provides unmitigated academic enhancement, or if it negatively affects certain cognitive skills and processes (Farah, Haimm, Sankoorikal & Chatterjee). By tracking data on usage across schools and majors, as well as attempting to distil psychostimulant effects on academic performance, we hoped to expound on this paper’s scope. Two additional studies observe concerns and questions regarding Adderall use. The first analyzes Adderall abuse in Texas. The paper offers a well-founded example of surveying-over-time to find whether trends in Adderall consumption differed significantly from trends in prescription of the drug (Forrester). The second study featured a survey of individuals in
Adderall treatment centers which found that abuse existed even among those prescribed the drug (Bright).

Our work we hoped to address three major research questions, in addition to various correlational observations available from our data. 

1) **In what academic contexts do students use psychostimulants?** Does psychostimulant use correlate with field of study, class year, stress level, or other characteristics of students? Are students at CMU more inclined to use psychostimulant than students in other university? 

2) **What is the perceived and actual purpose/effect of psychostimulant use?** What is the perception of the use of prescribed and non-prescribed amphetamines among Carnegie Mellon’s students? Are these drugs primarily done for recreational, athletic, academic, or other purposes? How do academic drug users compare with recreational drug users? 

3) **How does the student body view the acceptability, prevalence, accessibility of the psychostimulant use?** How do these views correspond with actual rates of use?

**Methods**

Our survey targeted the undergraduate and graduate populations of Carnegie Mellon University students. We hoped to derive usable information respecting actual rates of drug use on CMU’s campus. In the interest of feasibility we restricted this study to the CMU student population. By doing so, we could specifically tailor survey questions to discover information that, although not generalizable to other American colleges, provided usable and recognizable conclusions for CMU students, faculty, and decision-makers. Each “unit” in this survey represented one student.

The 2012-2013 C-Book provided the survey’s sampling frame. The C-Book provides a nearly-complete roster of our target population, including email contact information. The roster lacked only recent inbound transfer students. It also included superfluous units, i.e. students who attended CMU at the time of the book’s assemblage but no longer do. This includes recent outbound transfers, students who have recently dropped out, and students who graduated at the end of Fall 2012. The C-Book also included non-students such as faculty and some organizations; only students were selected to receive the survey. The survey results could be susceptible to non-response bias; given a generally accepted stigma regarding drug use some units may have elected not to confess personal drug use. However, we are confident that we provided sufficient assurances of confidentiality and anonymity. We did not store unique identifiers for individual respondents, nor did we store participant emails. Further, we crafted survey invitations and questions to reflect a neutral and non-judgmental tone, hopefully inspiring the confidence for individual respondents to answer truthfully and unselfconsciously.

The survey was created and hosted on Qualtrics. Students received an email including a
written invitation to participate and a link to the Qualtrics survey. Generally, employing an online survey as opposed to a face-to-face format allows greater anonymity and lessens the measurement error associated with non-response bias given socially-sensitive questions. Using this logic, we elected to use an online survey and provide assurances that the email recipients were randomly selected and could expect us to discard any identifying and contact information. We risked sample error in terms of especially busy students participating less than the general population; this class of non-respondents could be categorically different from the population at large. We hoped to mitigate this potential source of error by creating a concise and user-friendly survey. Further, we expanded the completion timeframe and provided reminder emails in order to increase busier students’ opportunities and likelihood of participation.

We calculated our sample size according the Steve Thompson’s formula guidelines, outlined in his paper “Sample Size for Estimating Multinomial Proportions.” Thompson’s paper explained how to calculate sample sizes for questions with multinomial responses, which encompassed most of our questions. We assumed a 0.02 margin of error in order to give some leeway. Even if we failed ot achieve the .02 margin of error, a .05 margin of error would presumably be within reach. Page 43 of Thompson’s paper provides the following information. Using $\alpha=.05$ for a 95% confidence interval and $d=.02$, we find in table 1 that $d^2 n$ is 1.273. Dividing this by $0.02^2$ yields $n=3184$. Performing a finite population correction begets the following: $(12493*3184)/(12943+3184) \approx 2538$. Thus, $n=2538$ (for $0.05$ we would need 490 and $490/2538=0.19$. A 19% response rate represents a difficult but possible achievement for an online surveys.

Calculating $d^2 n$ follows this formula: max$_m z^2 * (1/m) * (1 - 1/m)$ where $k \geq m$ and $z=\Phi(1-\alpha/(2m))$. The benefit of this calculation is that for $\alpha=.05$ the max occurs at $m=3$. Therefore, this sample size will work for all multinomial responses with $k \geq 3$ and smaller sample size would work for $k=2$ so it should work for all of our questions (Thompson).

To construct and contact our Simple Random Sample, we randomly selected 2050 names and corresponding email addresses from the C-Book directory. Generating a random number $n$ in range one to five, we began with the $nth$ name in the book and selected every fifth name after that. This comprised a contact list of 2050. Ultimately we received 380 usable responses, and thus a response rate of roughly 19%.

Our survey provided multiple choice questions in order to elucidate our overarching research questions. The Qualtrics survey made use of question logic, thus exposing participants to only relevant questions. A standard variety of demographics questions included GPA, year in school and major. Crucial questions asked we about the participant’s feelings about the use of psychostimulants in school and the participant’s own usage of psychostimulants. These are some highlighted
questions, while the entire survey can be found in Appendix A.

Q33 Have you taken psychostimulants for any reason (prescribed or unprescribed)?
  o Yes (1)
  o No (2)
If Yes Is Selected, Then Skip To When have you taken psychostimulants?...If No Is Selected, Then Skip To Are you aware of any of the people yo...

Q26 When have you taken psychostimulants? Check all that apply.
  o Before attending college (2)
  o While attending another University (3)
  o During your time as a student of Carnegie Mellon University (4)
  o During this semester (at Carnegie Mellon University) (5)
  o During leave of absence from Carnegie Mellon University (6)
  o During study abroad program during time enrolled at Carnegie Mellon University (7)
  o During suspension (8)

These 2 questions are some of the more important questions in the survey as it is here that we find out whether or not the participant did psychostimulants and when. It also shows how we used question logic: the second question is skipped if they answer not to the first.

Q9 What is your primary major?

Q3 What is your additional major (if any)? Please put comma in between majors if you have 2 or more non-primary majors.

Data Analysis

Post-collection data modifications

Once we finished collecting our data it was necessary to make a few modifications before it was ready for analysis. First we re-encoded that majors so that they were all the same format. Next, we added college, a function of the student’s stated primary major. Then, we deleted all of the cases who failed to complete more than the first page of our survey. We determined that respondents who only completed the demographics section could be safely discarded as it is unlikely that this cohort shared relevant qualities that would affect the sample’s representativeness. This left us with 380 respondents. According to the Thompson paper, this gave a margin of error of: \( d^2n=1.27359 \rightarrow (1.27359/380)^{5/2} = 0.057. \) Finally we combined or eliminated redundant questions. For example, after making sure that all the blanks to the
question “did you only use psychostimulants as prescribed” were people who said no to “have you ever used psychostimulants for any reason” we got rid of the question “have you ever used psychostimulants for any reason”.

There were of course some instances of item non-response wherein participants who forgot to fill in one or two questions about demographics or their perspectives. We believed that it would be best to use an imputation strategy for these instead of deleting. We employed R to do the imputation using the MICE package. The method this package used was multiple imputation by chained equations. It assumes missing at random but we believe that because we did a simple random sample and got a fairly representative sample that Missing At Random was a valid assumption. This method first imputes all missing data using mean imputation. Then, it sets one of the imputed missing variables back to missing and regresses on the rest of the data to fill those in. It does this for every variable and then cycles a number of times. After a few cycles it gives you a filled data set and starts back over again. At the end we had 5 imputed data sets. We then checked to make sure all of the data sets had reasonable responses and how much the analysis changed. We found that the imputations failed to alter the analysis in a significant fashion because we did not have a considerable amount missing values. Therefore, we elected to use a completed data set at random.

Demographics

In order to evaluate the representativeness of the collected data, we created several bar charts to visually analyze the sampled proportions vs. the real proportions of various demographic categories. We got our information from the Carnegie Mellon Quick Facts Fall 2012.

Figure 1: Sampled vs. Real Proportions of College

Carnegie Mellon University offers students a wide variety of majors, so to simplify any analyses based upon a student’s field of study we elected to re-code answers to Question 9 (Appendix A). Question 9 asks the respondent to list their primary major. After completing the
collection of data we manually added a variable to each response: the college containing the respondent’s major. Oftentimes at Carnegie Mellon, college is used to describe a student, e.g. when asking someone what they study, one may ask “Are you in CIT?” Because of the tendency for Carnegie Mellon students to reduce their perceptions to college rather than major, we felt that it was justifiable to also make this reduction so as to provide simpler and more relevant analyses.

The similar heights of the bars corresponding to each college are of similar heights, which indicates that the data collected is representative of the actual distribution.

Figure 2: Sampled vs. Real Proportions of Class Year

Question 4 in Appendix A asked the respondents for their class year. Possible answers were, “Freshman,” “Sophomore,” “Junior,” “Senior,” “Fifth year,” and “Post-undergraduate.” Fifth year students were a very small portion of our respondents and we elected to combine them into the senior students category. As can be seen in the figure above, post-undergraduates were seemingly under-represented. This is likely due to the ambiguous subject in the first email sent to the sampled students (Appendix C). Aside from that error, we have fairly representative data when only taking the undergraduate population into consideration.

Figure 3: Sampled vs. Real Proportions of Gender
Because we suspected that gender may have some relation to other variables we planned to collect, we decided to include a demographic question on gender (Appendix A, Question 1).

One of our preliminary hypotheses was that international students may not be as likely as non-international students to take psychostimulants without a prescription. We included Question 10 (Appendix A), which simply asks the respondent whether they are an international student or not. Although there are multiple ways to define “international student,” e.g. place of birth, place of upbringing, or cultural identity, we elected to allow the respondent to use their own judgement because we felt their perception would, on average, be more accurately descriptive than any arbitrarily imposed objective criterion.

Questions
Some of the most important questions in our survey dealt with use of psychostimulants. By combining the answers to questions 33 (have you taken psychostimulants for any reasons) and question 25 (did you only take psychostimulants as prescribed) we were able to split the respondents into three groups, i.e. those who have never used, those who used only as prescribed, and those who have at least once in their lives used not a prescribed. Because we felt that this was an important question we did some post-stratification based on the demographics above. The top left is the unweighted version and as you can see the proportions varied only slightly between this graph and all the others. The variances for the post-weighted data were calculated using a jackknife. This was additional proof that post-stratification was not necessary.
Our survey focused in part on determining the perception of psychostimulants at Carnegie Mellon. Most people who took our survey believe that psychostimulants can help students improve their academics. Also as with the previous set of graphs we post-stratified by the demographics and it failed to make a discernible impact.

Should Psychostimulants be acceptable for academic use?

This is another perspective question which we looked at in our survey. As you can see most people who took our survey believe that psychostimulants are not acceptable for academic use. Also once again there is variation in proportions between weights but the larger (in most
cases) variances of the post-weighted confidence intervals make up the difference.

Could you acquire Psychostimulants within a week?

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One final question which yielded interesting results was a question about whether or not the participant could acquire adderall within one week. The majority of participants believe that they could acquire it. Also once again the post-stratifications failed to have a significant effect.

From the demographics comparisons and post-stratification weighted question comparisons it is very clear that the data we got is fairly representative of the Carnegie Mellon community and while comparing proportions between strata may be of interest, post-weighting by stratification will not significantly affect the results that we find.

Results

Psychostimulant use

One facet of our research sought to characterize and profile the psychostimulant user at Carnegie Mellon. To do this we compared drug use across the different demographics and across the different choices for our other survey questions. We then ran chi-square tests to determine whether or not the counts of each psychostimulant user type in each response choice for the demographic or other question were significantly different from the counts we would expect based on the total number of people chose that response and the total number of people that were that user type. Listed below are the comparisons which were interesting and had significant p-values for the chi-square test (A p-value of <0.05 is considered significant). It is important to forewarn that many of these chi-square tests must be viewed with suspicion because of the low counts involved. From our understanding that makes significant findings more prominent because low counts means a higher likelihood of type II error (failing to reject the
null hypothesis when you should have). However, low counts may still represent a break in the assumptions of a chi-square test.

Chi-square p-value: 0.04967

The stated p-value indicates that this comparison was barely significant, but it does seem that some categories differed significantly from their expected results. If we were to look at the differences between actual and expected some of the more significant differences we would see would be the expected values: overestimated non-users in CFA and underestimated non-prescribed users in H&SS and Tepper. As we can see from the graph it appears that CFA, H&SS and Tepper have higher proportions of non-prescribed users. Another interesting thing to note is that the high percentage in non-prescribed usage in Tepper and CFA is mirrored by high percentage use as prescribed but in H&SS the prescribed usage proportion is rather low. This may indicate that H&SS students may be more willing to go to non-H&SS students to get psychostimulants.
The first thing to note is that as we can see from the table there are some categories of GPA which have extremely low counts. That being said when you do a chi-square test with low counts you are more susceptible to type II error which is not rejecting the null when you should have so the fact that we rejected the null implies to us that it is even more significant because it overcame the noise of low counts. It makes sense and is interesting that we see a higher proportion of non-prescribed users in lower GPA brackets. These are the people who need to try something to boost their grades or prefer doing drugs for fun to school work. Again if we looked at at tables comparing the expected counts to the actual counts we would see that some of the most significant differences are in the 2.66 to 2.99 and 3.00 to 3.32 category where the expected counts underestimated the number of non-prescribed users. It is also important to understand that this undergrads only because some post-undergrads have different grading schemes.

<table>
<thead>
<tr>
<th>Category</th>
<th>0-2.32</th>
<th>2.33-2.65</th>
<th>2.66-2.99</th>
<th>3.00-3.32</th>
<th>3.33-3.65</th>
<th>3.66-3.99</th>
<th>4.00-4.33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people</td>
<td>6</td>
<td>9</td>
<td>32</td>
<td>53</td>
<td>67</td>
<td>78</td>
<td>20</td>
</tr>
</tbody>
</table>

Chi-square p-value: 0.001259
Once again note that some categories contain small counts. For gpa we were able to combine some columns but in this case it would not make any sense to combine 0-36 with any other columns because 0-36 represents part-time students. This graph has a very interesting and unexpected pattern. We originally thought that people who are overworked would be more likely to use psychostimulants to keep up with there work but this is clearly not the case. As you can see average number of units increased the number of non-prescribed users decreased. When looking at a comparison to see where the most high value pieces of the chi-square statistic are we see that some the most interesting are when the expected counts: underestimated the number of non-prescribed users in the 36-44 category and overestimated the number of non-prescribed users in both the 54-62 and greater than 62 categories. It is also important to keep in mind this is undergrad only because we felt that while post-undergrads may take the least units the are very different from their undergrad counterparts who take less units.
We asked a question in our survey about whether or not the participant uses any drug excluding alcohol and psychostimulants. It is interesting, and significant, to see that there is a much higher psychostimulant use among those who have used other drugs. As a follow up we asked how often they use these other drugs.
Chi-square p-value: 0.016735

This graph shows proportionally more prescribed users as other drug use becomes less frequent and the opposite is true to an extent for non-prescribed users. Proportionately more non-prescribed users use other drugs more frequently. The chi-square test statistic shows the expected counts overestimated the number of non-prescribers in the rare occasions category.

Chi-square p-value: $1.318 \times 10^{-11}$

This is an interesting, if expected, significant comparison. The graph shows that it is much more the proportion of users (prescribed and non-prescribed) is much higher when they have friends who use. This could imply that many who are using non-prescribed have friends who are prescribed and are getting the psychostimulants from them. This makes a lot of sense. The chi-square test statistic shows the expected counts underestimated the number of non-prescribed users who have friends who use.

Perceptions

Another major research question we wanted to answer with our survey analysis is the perceptions of Carnegie Mellon students towards psychostimulant use. We looked at a few of our main questions gear toward this including: what percent of Carnegie Mellon did the participant think used psychostimulants, do they think that psychostimulants improve academic performance, are psychostimulants acceptable for academic use, could you acquire psychostimulants within a week, and do you think psychostimulants should be illegal. For most of these questions we across demographics. Then we ran chi-square tests on the these comparisons. Below we have reported the interesting and significant results.
Average: 25.68%

It appears that those who used non-prescribed believed that there were more people using. On average, according to our study, people overestimated how many people use psychostimulants. Data showed a proportion of approximately 13% non-prescribed users or 20% prescribed and non-prescribed.

Chi-square p-value: 0.0031

This was an interesting and significant finding according to the chi-square test. It seems that Juniors are the most likely to believe that psychostimulants will help you improve your academics.
We could postulate that the junior is the most difficult for many students and they want to believe that a psychostimulant would make things easier. It is also interesting that Post-Undergrad students are the least likely to believe that psychostimulants are beneficial to academics. This may be due to the fact that they have been on the education scene long enough to see that it does not work as well as could be hoped.

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Chi-square p-value: $2.081 \times 10^{-6}$

As the p-value shows we reject the null of the expected counts in this case. Not only is this comparison significant in terms of the chi-square test but as the graph shows there are some interesting finding. We can see that the proportion of students who believe they could find psychostimulants increases as they move up in class year until post-undergrad where it drops to the lowest level. This makes a lot of sense because freshman are new to campus so they do not have as many connections but by the time they get to senior year they know exactly who to go to and they know more people in general. The low proportion for post-undergrads makes a lot of sense as well because they could be like freshman (new to Carnegie Mellon) but they also are not as likely to be on the main campus so even if they are here for a while they will not have meet as many people who are likely to have psychostimulants.

As was discussed above we unfortunately were not able to find any results on the final research question which was for what purpose did and how frequently did non-prescribed
psychostimulant users take psychostimulants.

There is a significant difference between the schools on what they think about the idea that psychostimulants are academic improver. It is important to note that Heinz is made up entirely of post-undergrad students so the fact that they are the least likely to think that psychostimulants are academic improvers piggybacks on the result we found earlier when we compared this question by class year. The fact that H&SS students are the most likely to believe that psychostimulants are an academic improver also makes sense because as we saw before most users believe that psychostimulants are an academic improver and H&SS had one of highest proportion of users. It is interesting that MCS also have a high proportion of people who believe it is an academic improver even though they did not have high user rates.

Chi-square p-value: 0.0051
This most interesting thing about this finding is that it confirms that those who use are the most likely to be able to find psychostimulants. As we can see, Tepper, CFA and H&SS top the charts on being able to find psychostimulants. It is interesting just how closely this mirrors the psychostimulant use type by school graph above with regards to between school proportion comparisons of Yes in this graph and non-prescribed in the other graph.

chi-square p-value: $2.08 \times 10^{-6}$
The majority of Americans believe that psychostimulants are an academic improver whereas less than 50% of International students believe that it is an academic improver. We do not have any further questions to ascertain why this may be the case but could be attributed to various cultural differences.

This interesting finding echoes our comparison of responses to this question by class year.
The freshman and the post-undergrads were the least likely to be able to find psychostimulants and we postulated that perhaps younger students have the smallest circles of contact in the drug community. This could also be a possible reasoning behind this finding. We lack data to expound on this, but we assume that international students may be less socially connected to the drug community than domestic students.

Discussion

This research project was designed to make inferences toward the use of psychostimulants for numerous reasons on the Carnegie Mellon University campus. The survey was designed to not only examine people’s personal use, but also their perception and knowledge of others’ use. Our final goal is to be able to be able to analyze psychostimulant use in three distinct ways. First, we want to look at the profile of a psychostimulant user by analysing trends in school, class year, and academic workload. Second, we aim to see if there is a distinct trend in reasons for using psychostimulants, whether it be for academic use, recreational use, or possibly even athletic. Lastly, it is important to take a look at the preferences and opinions of Carnegie Mellon students on the use of psychostimulants. Along with these, it is important to see if there are key differences between estimations of usage and the actual usage found in the survey.

The use of psychostimulants may have been at the center of our survey, but all of the questions had a secondary goal of creating a profile of those who use psychostimulants outside of medical diagnosis. There are a number of trends in the data that have lead to this profile, including the factor of peer use. When students have friends they are aware use psychostimulants, they had a higher percent chance of using. When they did not have a friend who used psychostimulants, they had a percent that used themselves was slightly under 3%, while closer to 40% when they did have a friend who used psychostimulants. This may seem intuitive, since your friends likely share interests and also improves accessibility. Students who use psychostimulants also have a higher percentage of other drug usage, but it varies by amount of other use. Those who use other drugs daily is lower than weekly and monthly, etc. This may also seem intuitive that people who use drugs are more open to trying other forms of drugs, whether through experimentation or in extreme cases addiction. It also seems logical that those who use it more likely use it less often than daily since psychostimulants and other drugs are expensive habits to have, which is not easy to sustain on a college budget.

Another major characteristic is that they have a higher chance of being in Tepper, the College of Fine Arts, or the Dietrich College of Humanities and Social Sciences. These three schools had the highest percentage of psychostimulant use, each with over 20% using psychostimulants. The next closest was under 12%, which was interdisciplinary majors. This fact was actually contrary to our original expectations. We had thought that the schools associated with more difficult course would have had
higher usage rates than those associated with lighter course loads. Oddly enough, we observed almost the exact opposite of our expectations. There are some other characteristics associated with a psychostimulant user that do not have as much data supporting, but are important to mention. In some cases, post stratification seemed like it showed a distinct trend, but after examining the number of people in each strata, it was noted that there are very unequal numbers making it difficult to make a supported conclusion from. Despite this, it is important to note these trends. The trend when usage was compared to GPA was that those with lower GPA’s were more likely to use psychostimulants than those with better GPA’s near 4.0. This went along well with our expectation that those struggling with academics more would resort to psychostimulants as study aids to help boost their abilities. Also with this, it seemed that the lower number of units enrolled in also correlated in the same manner with lower unit totals having a higher likelihood of usage. This showed that possibly those who are struggling may take fewer units but still feel the pressure of psychostimulants. We had expected those with higher unit totals may also use these drugs, but it turned out to not be the case. Overall, the user profile we created involved 5 important characteristics. A student would likely be in Tepper, CFA, or H&SS, have used other drugs in the past, have friends who also use psychostimulants, and have a lower GPA and unit count than the average student.

Another reason for collecting this data is to try and figure out why students take psychostimulants at Carnegie Mellon. One of our assumptions is the academic difficulty would lead to a more stressful environment, which could pressure students into using academic study drugs. First we wanted to gauge the difficulty of the school by asking a question to those who had been at another university previously. The overall trend fit our assumption well with the majority saying that Carnegie Mellon is more difficult than schools they attended before. Unfortunately, this was nearly the only conclusion we could draw from this. Other data collected had problems with it, including accidentally using a select one method for one question where we meant to do a select all that apply. It also was a problem that overlap was common with prescribed use and academic use. This made it very difficult to analyze and also what was seen was insignificant. We also observed that the data we collected for gauging when people take the drugs was essentially unanimous in that nearly everyone selected the option for having taken the drug in the current semester. Graphing this seemed almost useless, but it is worth noting the recency of use. The overall reasons for taking psychostimulants however remain somewhat unfounded, but we assume that stress and academic difficulty for those who are struggling to keep a high GPA even with low unit counts has an effect on peoples usage.

Lastly, we wanted to look at peoples’ perceptions of psychostimulant usage overall. We first wanted to see how much people assumed others used the drug on the Carnegie Mellon Campus. By
asking people what percent of Carnegie Mellon students they think use the drugs, we were able to see if the actual usage pattern matched their inferences. As it turned out, we learned that people primarily over-estimated the usage at Carnegie Mellon by 5% if you include prescribed users and over 10% if only non-prescribed use is counted. This was somewhat surprising, but it shows that people think that those around them need psychostimulants to perform at this school. This result was also analyzed along with their response to whether or not they took the drugs at all, took for non-prescribed reasons, and prescribed use. From this we were able to see that those who have taken the drugs estimated the rate to be higher than those who have never taken it. This shows that those who take the drug have a feeling that more people around them also take them. This could pair with the results we found before that if you take psychostimulants, it is far more likely you know others who take them. We also wanted to test the accessibility of the drug to students at our school. To do this, we asked the respondents if they could get psychostimulants within a week of completing the survey. The results were considered by school, and showed a very similar relationship to the usage rate in those schools. The three highest values again were by Tepper, CFA, and H&SS, and the remaining schools all were in the same order as when we analyzed usage rates. This could be expected since there is more access if more people take them in the schools already. Last, we analyzed whether or not people think that psychostimulants are in fact academic aids. In doing so, we found it was pretty much a well-established perception that they do help improve academic performance. There were only 2 groups that defied this trend. Heinz had a 50% split and international students did not think it was an academic improver. These were slight surprises, but it shows that there are distinct differences between schools. The perceptions people had further profile a psychostimulant user, and show the perceived effects of these drugs at Carnegie Mellon.

The survey itself has its own successes and weakness that go along with what some would consider a sensitive subject. While the data received was large, as the survey was sent to nearly one fifth of the student population, it also may have a problem of large non-response rates due to the sensitive nature. In some cases, the survey is asking about illegal practices, though we assure total anonymity. The discussion of drugs likely limited the response rate to slightly below the expected 20% rate usually associated with online surveys, but our reminder system was successful in getting us as close as we did. Another more glaring problem that hurt the survey’s representativeness was an error in the original survey email. The name of the survey included the word “undergraduate” to show that the course that the survey project is for is an undergraduate level course. Unfortunately, this was not as clear as we hoped and we, and our instructors, received numerous complaints that people who received the survey were graduate students and should not be receiving the email. We are examining graduate students, however, so this error may be the reason our graduate population was significantly under what we would call representative. This was fixed for the reminder email, but
it was not enough to bring in the desired number of responses from graduate students.

Overall, this project was successful in creating a profile of the Carnegie Mellon psychostimulant user and peoples perception of them. Hopefully these can help explain to a point the reasons for usage at our school, but the overarching reasons seem to require further analysis. The survey was a successful mode to compile the data for the Carnegie Mellon community and was essential to making the inferences we came to find. The success of this project, can only be gauged by its usefulness, and to that we believe it could successfully be used to address the pressures at Carnegie Mellon that facilitate the use of psychostimulants without prescription. To fully change the school however, the data for reasons for usage must be better examine to see what changes will result in the most progress.
Works Cited


Appendices

Appendix A: The Survey

Consent to Participate in Survey
You will be participating in a survey for a student project in the Statistics and Society (36-303) class under Statistics Department at Carnegie Mellon University. If you agree to participate in this research study, you will be asked to complete an online survey about your use of psychostimulants, as well as your awareness of others’ use. This survey is expected to take 10 to 15 minutes.

Purpose
This survey study is designed to look at the use of Adderall, Ritalin, and other psychostimulants in the Carnegie Mellon University community. The purpose is not only finding out the usage of such substances, but also students’ opinions on these drugs’ intended uses. We have selected you using a random sample from the Carnegie Mellon University C-Book.

Risks & Benefits
There are no direct benefits for completing this survey, though the results may yield information useful for the Carnegie Mellon university community as a whole. It is possible that you may find the content of the questionnaires or activities uncomfortable. You may also at any time choose to fully stop your participation in the study.

Confidentiality
Any information that is obtained in connection with this study will be completely confidential and anonymous. The site we are using does not collect any information about your computer, and we will not request any identifying information from you. The information you provide will only be associated with a random code number.

Compensation
There is no form of compensation for this research.

Contact Information
If you have any questions or concerns about this study, you are welcome to contact the primary researchers at the following email address:

psychostimulant36333@cmu.edu

Voluntary participation
Your participation is VOLUNTARY. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. If you want to discontinue participation in the experiment, just scroll to the bottom of the survey and hit complete. If you do choose to participate, you may change your decision and stop at any time. You may also participate, but leave any answer blank and continue with the remainder of the survey. At any point you no longer wish to participate in the survey, please exit the browser without submitting your responses.

I understand the details explained in the Informed Consent above and would like to participate in this survey.

☐ Yes
☐ No
Q1
What is your gender?
- Male
- Female

Q2
What is your age?
0 10 20 30 40 50 60 70 80 90 100
Your age

Q4
What is your current class-year at CMU?
- Freshman
- Sophomore
- Junior
- Senior
- Fifth year
- Post-undergraduate

Q9
What is your primary major?

Q3
What is your additional major (if any)? Please put comma in between majors if you have 2 or more non-primary majors.

<table>
<thead>
<tr>
<th>Q10</th>
<th>Are you an international student?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q7</th>
<th>Are you a member of a varsity or club sports team at Carnegie Mellon University?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q6</th>
<th>What is your current overall cumulative GPA?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 to 1.99</td>
</tr>
<tr>
<td></td>
<td>2.00 to 2.32</td>
</tr>
<tr>
<td></td>
<td>2.33 to 2.65</td>
</tr>
<tr>
<td></td>
<td>2.66 to 2.99</td>
</tr>
<tr>
<td></td>
<td>3.00 to 3.32</td>
</tr>
<tr>
<td></td>
<td>3.33 to 3.65</td>
</tr>
<tr>
<td></td>
<td>3.66 to 3.99</td>
</tr>
<tr>
<td></td>
<td>4.00 to 4.33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q11</th>
<th>What is your average number of units taken per semester at CMU?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - 36</td>
</tr>
<tr>
<td></td>
<td>36 - 44</td>
</tr>
<tr>
<td></td>
<td>45 - 53</td>
</tr>
<tr>
<td></td>
<td>54 - 62</td>
</tr>
<tr>
<td></td>
<td>Greater than 62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q12</th>
<th>Were you previously a full time student of any college or university other than Carnegie Mellon?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>
Q13
Do you perceive Carnegie Mellon to be more academically demanding than your previously attended colleges and universities?
- Yes
- No
- About the same

Q14
Psychostimulants are drugs that have antidepressant or mood-elevating properties to improve concentration (Adderall, Dextroine, Ritalin, etc.). In this survey, caffeine is not considered as a psychostimulant. On a scale of 0 to 100, what percentage of students at CMU do you think use psychostimulants?

<table>
<thead>
<tr>
<th>Percentage of CMU students on psychostimulants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Q15
Do you think the consumption of psychostimulants can improve one's academic performance?
- Yes
- No

Q16
Do you believe it is acceptable for a student to use psychostimulants without a prescription to improve his or her academic performance?
- Yes
- No
- No opinion / Unsure

Q17
Do you think it should be illegal to use psychostimulants (for any purpose) without a prescription?
- Yes
- No
- No opinion / Unsure
<table>
<thead>
<tr>
<th>Q18</th>
<th>Are you confident that you could acquire psychostimulants within a week of today?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q20</th>
<th>How would you describe your academic life at Carnegie Mellon University?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very manageable</td>
</tr>
<tr>
<td></td>
<td>Somewhat manageable</td>
</tr>
<tr>
<td></td>
<td>Somewhat stressful</td>
</tr>
<tr>
<td></td>
<td>Very stressful</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q21</th>
<th>Will you consider taking psychostimulants in the future for academic reasons?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Unsure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q22</th>
<th>Should baseball players who were found to have taken performance enhancing drugs be excluded from induction into the National Baseball Hall of Fame?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>No opinion/Unsure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q19</th>
<th>Do you often consume caffeine products for academic purposes?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q32</th>
<th>Recent college studies show that a considerable number of people use drugs for recreational use. Do you recreationally use any drugs, excluding alcohol and psychostimulants, which you are not prescribed (marijuana, nicotine, cocaine, amphetamines, etc.)?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>
For the previously mentioned drugs, how regular is your use?

- Daily
- Weekly
- Monthly
- Only on rare occasions

Have you taken psychostimulants for any reason (prescribed or unprescribed)?

- Yes
- No

When have you taken psychostimulants? Check all that apply.

- Before attending college
- While attending another University
- During your time as a student at Carnegie Mellon University
- During this semester (at Carnegie Mellon University)
- During leave of absence from Carnegie Mellon University
- During study abroad program during time enrolled at Carnegie Mellon University
- During suspension
Q25  

**Display This Question:**
If Have you taken psychostimulants for any reason (prescribe...) Yes is Selected Edit

Have you taken psychostimulants only when they were prescribed to you as they were prescribed?

- Yes
- No

Q28  

**Display This Question:**
If Have you taken psychostimulants only when they were prescribed... No is Selected Edit

When have you taken psychostimulants not as prescribed to you?

- Before attending college
- While attending another University
- During your time as a student of Carnegie Mellon University
- During this semester (at Carnegie Mellon University)
- During leave of absence from Carnegie Mellon University
- During study abroad program during time enrolled at Carnegie Mellon University
- During suspension
Q27

How frequent was/is your use of psychostimulants at Carnegie Mellon University?

- Daily
- Several times per week
- Once a week
- Several times per month less than once a week
- Once a month
- Several times per semester less than once a month
- Once per semester
- Very infrequent
- Exactly once

Q30

People take psychostimulants for various reasons. Why have you taken psychostimulants? Check all that apply.

- For a medically diagnosed condition
- For academic improvement
- For recreational use
- For athletic improvement
- Other (specify)
Q31

For which academic situations have you taken psychostimulants? Check all that apply.

- [ ] Midterms
- [ ] Finals
- [ ] Assignments
- [ ] Presentations
- [ ] Focusing in class

Q29

Are you aware of any of the people you know personally regularly taking psychostimulants (at least once per semester)?

- [ ] Yes
- [ ] No

Q32

Thank you for participating in this survey! We really appreciate your effort and time.
Appendix B: The Informed Consent Form

Consent to Participate in Survey

You will be participating in a survey for a student project in the Survey, Statistics, and Society (36-303) class under Statistics Department at Carnegie Mellon University. If you agree to participate in this research study, you will be asked to complete an online survey about your use of psychostimulants, as well as your awareness of others’ use. This survey is expected to take 10 to 15 minutes.

Purpose

This survey study is designed to look at the use of Adderall, Ritalin, and other psychostimulants in the Carnegie Mellon University community. The purpose is not only finding out the usage of such substances, but also students’ opinions on theses drugs’ intended uses. We have selected you using a random sample from the Carnegie Mellon University C-Book.

Risks & Benefits

There are no direct benefits for completing this survey, though the results may yield information useful for the Carnegie Mellon university community as a whole. It is possible that you may find the content of the questionnaires or activities uncomfortable. You may also at any time choose to fully stop your participation in the study.

Confidentiality

Any information that is obtained in connection with this study will be completely confidential and anonymous. The site we are using does not collect any information about your computer, and we will not request any identifying information from you. The information you provide will only be associated with a random code number.

Compensation

There is no form of compensation for this research.

Contact Information

If you have any questions or concerns about this study, you are welcome to contact the primary researchers at the following email addresses.
Voluntary participation

Your participation is VOLUNTARY. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. If you want to discontinue participation in the experiment, just scroll to the bottom of the survey and hit complete. If you do choose to participate, you may change your decision and stop at any time. You may also participate, but leave any answer blank and continue with the remainder of the survey. If at any point you no longer wish to participate in the survey, please exit the browser without submitting your responses.

Appendix C: Survey Emails

Send Date: April 2, 2013 @ 8:00 PM
Survey Link Type: Individual Link
From Name: Psychostimulant group
Reply-To Email: psychostimulant36303@cmu.edu
Subject: CMU Psychostimulant Survey

Please ignore this message if you have already participated in our survey. We have no way of knowing who has completed our survey. This is a reminder email to the previous survey we asked you to participate.

Dear CMU Undergrad or Post-Undergrad Student,

You have been randomly selected from a directory of all CMU students to receive this survey. Please be assured that all responses will be kept completely anonymous. It will take between 5 and 10 minutes to complete.

The study seeks to determine present use and perceptions of psychostimulants (Adderall, Ritalin, etc.) among CMU students. For your responses to count, please submit by Wednesday April 10th, 2013 at 5 PM.

This study is run by students in 36-303: Sampling, Surveys, and Society and will be monitored by faculty. Please follow the attached link to complete the survey.

Send Date: March 24, 2013 @ 7:09 PM
Survey Link Type: Individual Link
From Name: Psychostimulant group
Reply-To Email: psychostimulant36303@cmu.edu
Subject: Undergraduate Psychostimulant Survey

Dear CMU Student,

You have been randomly selected from a directory of all CMU students to receive this survey. Please be assured that all responses will be kept completely anonymous. It will take between 5 and 10 minutes to complete.

The study seeks to determine present use and perceptions of psychostimulants (Adderall, Ritalin, etc.) among CMU students. For your responses to count, please submit by Wednesday April 10th, 2013 at 5 PM.

This study is run by students in 36-303: Sampling, Surveys, and Society and will be monitored by faculty. Please follow the attached link to complete the survey.

Follow this link to the Survey:
${l://SurveyLink?d=Take the Survey}

Or copy and paste the URL below into your internet browser:
${l://SurveyURL}

Follow the link to opt out of future emails:
${l://OptOutLink?d=Click here to unsubscribe}

Best regards,
Project Group B, 36-303

Appendix D: Miscellaneous Graphs and R Code
Imputing and Jackknife Code

```r
# imputing
d = read.csv("impute test.csv")
colnames(d)
d2 = d[-c(1,5,6,12+2,26+2,27+2,30+2,31+2,32+2,33+2,34+2,35+2,36+2,37+2,38+2,39+2)]
library(mice); d3 = mice(d2)
d[c(2:4,7:13,15:24,26,27,42)] = complete(d3, 1); d.check1 = d
write.table(d, "C:/Users/Peter/Documents/36-303/imputed 1.txt", sep="\t")
#...similar code for d.check2 through 4
d[c(2:4,7:13,15:24,26,27,42)] = complete(d3, 5)
d.check5 = d
```
write.table(d, "C:/Users/Peter/Documents/36-303/imputed 5.txt", sep="\t")
#d.check3 is choice!
#jackknife weighting
#########
#class wt
#########
j=data.frame(d.check3)
colnames(d)
jack=j[,c(4,27,16,17,19)]
jack=data.frame(class.year=jack[,1],adderall=jack[,2],improver=jack[,3],acceptable=jack[,4],
aquire=jack[,5])
jacker=function(s,k){
  trials=c()
  for(i in 1:nrow(jack)){
    ja=jack[-i,]
    ja$wieghts=ifelse(
      ja[,1]=="Freshman",((5830/4)/12019)/(nrow(ja[ja[,1]=="Freshman",])/nrow(ja)),ifelse(ja[,1]=="Sophomore",((5830/4)/12019)/(nrow(ja[ja[,1]=="Sophomore",])/nrow(ja)),ifelse(ja[,1]=="Junior",((5830/4)/12019)/(nrow(ja[ja[,1]=="Junior",])/nrow(ja)),ifelse(ja[,1]=="Senior",((5830/4)/12019)/(nrow(ja[ja[,1]=="Senior",])/nrow(ja)),(6189/12019)/(nrow(ja[ja[,1]=="Post-undergraduate",])/nrow(ja))))))
    trials=c(trials,(sum(ifelse(ja[,k]==s,1,0)*ja$wieghts)/sum(ja$wieghts)))
  }
  mean=(sum(ifelse(ja[,k]==s,1,0)*ja$wieghts)/sum(ja$wieghts))
  variance=((nrow(jack)-1)/nrow(jack))*sum((trials-mean)^2)
  return(c(mean=mean,variance=variance))
}
jacker("no use",2);jacker("non-prescribed use",2);jacker("only prescribed use",2);
jacker("No",3);jacker("Yes",3);jacker("No",4);jacker("No opinion / Unsure",4);jacker("Yes",4)
jacker("No",5);jacker("Unsure",5);jacker("Yes",5)
#similar code for all other weights
11111111