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THE ROLE OF ILLICIT STIMULANT USE ON ALCOHOL AND ENERGY DRINK
CONSUMPTION

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ABSTRACT

The present study examines the non-medical medical use of prescription stimulants in college freshmen. The purpose is to determine how illicit use of prescription stimulants effect drinking behaviors and energy drink consumption. Survey data collected in spring 2010 for the EPIC study funded by National Institute on Drug Abuse was further examined in the present study. The final sample consists of male, first year students and weightlifters at the Pennsylvania State University. Only a small percentage (8.8%) reported non-medical use of prescription stimulants in the past year, of them approximately half (51%) had used prescription stimulants in the past 30 days. Independent sample t-tests indicated that students that have used prescription stimulants in the past year are more likely to consume energy drinks and mix alcohol with energy drinks and report heavier overall drinking tendencies.

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Introduction

Drugs are nothing new to the college scene; however, the dynamics of drug abuse is changing as powerful pharmaceutical drugs become more widely distributed. In particular, there has been a great increase in the distribution of prescription stimulants such as Adderall (amphetamine salts), Ritalin (methylphenidate), and Dexedrine (dextroamphetamine). Over the past 15 years there has been a 40% increase in the production of stimulant drugs in the US (White, Becker-Blease, & Grace-Bishop, 2006). The increase in availability has paralleled the increase of abuse on college campuses that has nearly doubled since 1993 (Harris, 2009). These medications are prescribed to treat attention deficit hyperactivity disorder (ADHD) as well as narcolepsy because they increase alertness and enhance focus. Unlike other drugs, prescription stimulants are rarely used for recreational purposes; students most often report using these drugs for academic reasons (DeSantis, Webb, & Noar, 2008). Over the years illicit stimulant use has become more socially acceptable among college-aged students (Harris, 2005). Adderall was found to be more socially acceptable than all other street and pharmaceutical drugs, with the exception of marijuana (Kouzoukas, Pandina, & Ogilvie, 2007).

Prescription psychostimulants are extremely powerful, addictive substances and they must be taken more seriously. Fatal drug interactions can occur between psychostimulants when mixed with drugs and alcohol. These interactions can potentially cause seizures, cardiac arrest, and a wide range of other health complications (NIH, 2009). Users that are unfamiliar with the potency and effects of prescription stimulants especially at risk of overdosing or experiencing potential consequences of adverse drug interactions.

A larger scale study (n=1811) published in the Journal of American College Health found that 34% of their college sample reported illegal use of prescription stimulants (DeSantis et al.,

2008). Access to these drugs is becoming less difficult because the use of stimulants to treat ADHD is becoming much more common. Only 1% of college users report having a *very difficult* time obtaining these drugs while the majority of college students find it *easy* or *very easy* to obtain these stimulants (DeSantis et al., 2008). While only 9% of a college sample was prescribed to a psychostimulant, 100% of these students reported distributing them to their peers (Sweeney, 2010).

Over the past decade there have been multiple attempts to determine the abuse rate of prescription stimulants across all age groups. Illicit psychostimulant use is most common among college-aged populations but still remains low within the general population (0.8%); (Wu & Schlenger, 2003). Studies have shown that non-medical use of stimulants begins in middle school students and increases during high school and college. Approximately 4-4.5% of students grades sixth through twelve have reported illicit use of Ritalin, Dexedrine and/or Adderall at least once (McCabe et al., 2004; McCabe, Teter, & Boyd, 2004). Nonetheless, 63% of stimulant users reported trying them for the first time in college (DeSantis et al., 2008). The prevalence of illicit use in the college population varies; estimates suggest the range to be between 0 and 56% (Kouzoukas, Pandina, & Ogilvie, 2007; Low & Gendaszek, 2002; Sweeney, 2010).

After entering college, the dynamics of drug use becomes complicated though some trends are evident. The majority of illicit prescription stimulant users are involved in Greek life; more than half of fraternity and sorority members reported using stimulants for non-medical reasons (DeSantis et al., 2008). Large social networks may be associated with a greater likelihood of illicit stimulant use. Students affiliated with Greek organizations report less difficulty obtaining prescription psychostimulants than non-Greek members (DeSantis et al., 2008). Other groups with notably high prescription stimulant abuse rates are white males,

students at northeastern universities, and schools with more competitive admissions standards (DeSantis et al., 2008). Moreover, schools with high (50% or more) and medium rates (50-36%) of binge drinking were found to have higher illicit stimulant use than schools with low amounts (35% or less) of binge drinking (McCabe, Knight, Teter, & Wechsler, 2005).

There is suggested to be a link between the use of psychostimulants and other recreational drugs such as marijuana, alcohol, cocaine, ecstasy and other prescription drugs (Teter et al., 2005). Users are more likely than non-users to have drunk alcohol in the last 30 days, 97.1% versus 72.8% respectively (Teter et al., 2005). Furthermore, illicit stimulant users are two to three times more likely than non-users to binge drink (McCabe et al., 2005; Teter, et al., 2005). This is a serious issue because alcohol in combination with prescription stimulants can potentially be fatal.

Non-illicit stimulants such as caffeine and taurine are also popular in the college party scene. In a sample of medical school students, 92% of energy drink users had consumed these beverages in combination with alcohol at least once in the last month (Oteri, Salvo, Caputi, & Calapai, 2007). Approximately a quarter of college drinkers reported simultaneously mixing alcohol and caffeinated energy drinks (O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008). Alcoholic energy drinks are appealing because it enables students to stay up later and drink longer (O'Brien et al., 2008). Caffeine slightly inhibits the side effects of intoxication even though blood alcohol content is unaffected by caffeine (Ferreira, Mello, Pompeia, & Souza-Formigoni, 2006).

Students whom report consuming alcoholic energy drinks experience twice as many alcohol-related consequences than non-users. In particular, alcoholic energy drinks are associated with increased physical harm, getting in the car with a drunk driver, being taken advantage of or

taking advantage of another person sexually, and having to seek medical treatment (O'Brien et al., 2008). The use of energy drinks and alcoholic energy drinks increases with age throughout college (Arria, Caldeira, Kaperski, O'Grady, Vincent, Griffiths, & Wish, 2010). Energy drink users consistently report heavier alcohol consumption and peak drinks (Arria et al., 2010; O'Brien et al., 2008). Finally, linking this information to the present study is that energy drink consumption is predictive of the illicit use of prescription psychostimulants in the following year (Arria et al., 2010)

This study will examine three major drug use trends in a freshman, male sample at a large northeastern public university. The first aim is to determine the illicit use of prescription stimulants, particularly focusing on Adderall, Ritalin and Dexedrine. Second, stimulant users and non-users will be compared based on their general drinking behaviors and energy drink consumption. The final analysis will compare the rate by which stimulant and non-stimulant users mix alcohol and energy drinks (AECs). The overall hypothesis of the present study is: illicit stimulant users will be heavier drinkers, be more likely to consume energy drinks and are more likely to mix alcohol with energy drinks.

Participants that report non-medical use of prescription stimulants at least once in the past year will be classified as stimulant users. Illicit users and non-users will be grouped and drinking behaviors will be evaluated based on: peak drinks, times drunk, and overall drinking tendencies. Assessing the use of energy drinks and alcoholic energy drinks will be based on yes or no questions pertaining to the general and combined use of caffeinated beverages with alcohol.

Methods

Sample and Recruitment

The original use of this data for was for the EPIC research study funded by the National Institute on Drug Abuse. The survey was designed to perform a cross-sectional analysis of drug use in a college freshmen sample. In particular investigators were originally focused on exploring the use of ten performance-enhancing drugs among freshmen males. These drugs included: Anabolic Steroids, Androstenedione, Human Growth Hormone (HGH), Dehydroepiandrosterone (DHEA), Stimulants (including Ephedrine/Ephedra), Creatine, Protein Supplements, Diuretics, Laxatives and L-carnitine.

Data was collected at two large northeastern universities. The present study only analyzes data collected at one school which made up the majority (81.2%) of the original sample. Freshmen males were randomly selected by name from the registrar and then contact information was obtained online from data warehouse. For the original study weightlifters were purposely over sampled and recruited by undergraduate research assistants at gyms on campus. Weightlifter status is considered in the demographics section and further discussed as a limitation. Gym recruits were randomly selected, all weightlifters were eligible to participate regardless of their academic standing. Recruitment took place in the spring of 2010, surveys were sent to all participants by email containing a Personal Identification Number (PIN) as well as a link to the questionnaire. Participants used their PIN to log into the survey and had 5 days to submit their responses, upon completion participants were mailed a check for 10\$.

Measures

Prescription stimulant use

The present study focuses on the non-medical use of Prescription Stimulants (PS): Adderall, Ritalin and Dexedrine. Medical-use of prescription stimulants was not examined in the present study, and participants were only asked to report their use of PS without a prescription. PS use was measured based on illicit use of Adderall, Ritalin and/or Dexedrine in the last year and with in the past 30 days. Frequency of PS use was measured with seven response options pertaining to frequency of use (*never, 1-2 occasions, 3-5 occasions, 6-9 occasions, 10-19 occasions, 20-39 occasions, 40 or more occasions*). This scale was then recoded by combining the six PS using groups into one group, *PS users*, while keeping those who *never* used stimulants in a separate *non-using* group.

Alcohol consumption

Alcohol use was measured on three scales: Drunkenness, peak drinks and type of drinker. First participants were asked to report the type of drinker they consider themselves to be based on six options (*I have never have tried alcohol, I have tried alcohol but currently I don't drink, I am a light social non-problem drinker, I am a moderate social non-problem drinker, I am a heavy non-problem drinker or I am a heavy, problem drinker*). Based on the participant responses, all non-drinkers (*I have never have tried alcohol, I have tried alcohol but currently I don't drink*) were combined into one group (*non-drinkers*) prior to analysis. Similarly, heavy drinkers (*I am a heavy non-problem drinker or I am a heavy problem drinker*) were combined into one (*heavy drinker*) group. The final four categories used to classify drinker type were: *non-drinkers, light drinker, moderate drinkers and heavy drinkers*.

Current drinkers were then evaluated for drunkenness when asking them to indicate:

“Over the last 30 days on how many occasions have you been drunk of very high from alcohol”. Similarly they were asked to indicate the “peak number of drinks consumed on one occasion with in the last 6 weeks”. Peak drinks and drunkenness evaluation was done using an open ended numeric response (0-99).

Energy drink consumption and mixing alcohol with energy drinks

Energy drink consumption was evaluated based on a *yes* or *no* response to the question “Do you consume energy drinks?”. Consumption of alcohol-energy drink mixtures was evaluated in a similar manor indicating a *yes* or *no* response to the question “Do you mix alcohol with energy drinks”.

Analysis

Drinker-type

To assess the relationship between *PS users* and *drinker-type* two chi-squared analyses were done based on PS use. The first analysis considered average *drinker-type* of those whom used PS in the past 12 months (PS-12m) in comparison to non-PS users, the second chi-square analysis compared those who have used PS with in the last 30 days (PS-30d) with non-users.

Drunkenness

Outliners reporting greater than 30 drunken occasions in the last 30 days were removed from analysis. Due to a skewed distribution, a log transformation was done to normalize measures of drunkenness. An independent sample-t test was ran to compare drunkenness of non-users with those in the PS-12m group and again to compare non-users with those in the PS-30d group. A third independent sample t-test was done comparing drunkenness of the two stimulant using groups (PS-12m and PS-30d).

Peak drinks

Due to a skewed distribution, a log transformation was done to normalize measures of peak drinks. Two independent sample-t tests were run and separately compared groups based on stimulant use. The first compared non-users and the PS-12m group and the second compared the PS-12m and PS-30d groups.

Energy drink consumption/ mixing alcohol-energy drinks

A chi-squared analysis was used to determine differences among groups with respect to the overall consumption of energy drinks. Two chi-squared analyses were done to compare energy drink consumption of the different groups. The first chi-square analysis compared energy drink consumption of non- users with the PS-12m group. The second chi-square analysis compared energy drink consumption of PS-12m and PS-30d groups. The consumption of alcohol-energy drinks was measured in the same manor as energy drink consumption.

Results

Demographics

Of the final sample ($N=1449$), only those whom completed the entire survey were considered for analysis (88%). Thus, the final sample was slightly smaller than the original ($N=1,273$) but still sufficiently large enough to address the main research question. The sample consisted of males between the age of 17.5 and 22.5 years ($M=18.55$, $SD=.964$). A majority of the sample consisted of freshmen (86.5%). There was no significant age difference between stimulant users and non-users.

Respondents were predominately white (83%), followed by Asian (9%), other (4%), African American (3%) and American Indian or Middle Eastern (2%). Of the over all sample, 55% reported lifting weights regularly.

Stimulant use

Of the entire sample, 8.8% of participants reported using Adderall, Ritalin or Dexedrine at least once in the past 12 months ($N=112$). Approximately half (51%) of PS-users reported using psychostimulants in the last 30 days.

Drinker-type

PS-12m users were significantly heavier drinkers than non-users, $\chi^2(3, N=1250) = 113.933$, $p < 0.001$. When examining drinker-types PS users were more likely to report being a “moderate social drinker” or “heavy drinker”, while non-users were more likely to report being a “non-drinker” or “light drinker”.

Peak drinks

Examination of the difference between the mean peak drinks of the PS-12m group (2.57 , $SD = .577$) and non-PS users (2.04 , $SD = .576$) was non-significant. Further, there was no

difference in the peak number of drinks among PS-30d and PS-12m groups.

Drunkennes

Examination of the difference between the number of times drunk with in the last 30 days for the PS-12m group ($M=1.89$, $SD=.774$) and non-PS users ($M=1.29$, $SD=.794$) was non-significant. Further, there was no significant difference in the number of times drunk in the last 30 days among PS-30d and PS-12m groups.

Energy drink consumption

A chi-square analysis was used to determine differences between the number of group members whom reported consuming energy drinks as well as those who mix alcohol with energy drinks. Participants in the PS-12m group were significantly more likely to consume energy drinks than those in the non PS using group, $\chi^2(1, N=1247) = 48.95, p<.001$. Further, members of the PS-30d group were more likely to consume energy drinks than those in the PS-12m group, $\chi^2(4.36, N=112) = 4.35, p=.037$.

Mixing alcohol and energy drinks

In the present study, 15.5% of students reported drinking an alcoholic energy drink at least once. A chi-square analysis revealed that those in the PS-12m group were significantly more likely to mix alcohol energy drinks than those in the non-PS using group, $\chi^2(1, N=1248) = 110.57, p<.001$. The likelihood of alcoholic energy drink consumption was also significantly greater for the PS-30d group than the PS-12m group, $\chi^2(1, N=112) = 10.29, p=.001$.

Summary

The present study had four main findings. The over all frequency of past year PS use was 8.8%. PS users were more likely than non-users to consume energy drinks and mix alcohol with energy drinks. Of the stimulant-using group, the PS-30d group was more likely to consume

energy drinks and mix alcohol with energy drinks than the PS-12m group. Lastly, PS-users were more likely to report being a “moderate social drinker” or “heavy drinker”, and non-users were more likely to report being a “non-drinker” or “light drinker”. Nonetheless, there was no significant difference between groups for peak drinks or drunkenness.

Discussion

The present study provides a deeper understanding about the drinking habits of college and prescription stimulant use of college freshmen males. It is consistent throughout the literature that illicit prescription stimulant users have a higher likelihood of drinking alcohol and doing other drugs (McCabe et al., 2005; Teter et al., 2005). The present study suggests that this trend also applies to the consumption of alcoholic energy drinks. The mixture of alcohol, caffeine and prescription stimulants can be fatal and needs to be further explored.

Stimulant use

An aim of the present study was to determine the amount of illicit prescription stimulant use among freshmen. In addition, it was predicted that stimulant users would have a higher rate of alcohol consumption along with a greater likelihood of consuming caffeinated alcoholic cocktails. According to the present study 8.8% of college freshmen males reported illicitly using Adderall, Dexedrine and/or Ritalin in the past year. This was nearly double the prevalence of PS use among younger students, past year PS use among middle and high school samples ranged from 4-4.5% (McCabe, Teter, & Boyd, 2004; McCabe, Teter, Boyd, & Guthrie, 2004). Previous studies found that the prevalence of PS use is only slightly higher among college students, ranging from 4.1-5.9% (McCabe, Knight, Teter, & Wechsler, 2005; Teter, McCabe, LaGrange, Cranford, & Boyd, 2006). College samples have a much greater prevalence of PS abuse than the general population. A nationwide sample found that on average only 0.7-0.9% of the general population were illicit PS users (Wu & Schlenger, 2003). This suggests that college students are at a much greater risk of abusing prescription stimulants than other populations. When lifetime PS use was examined among university samples, rates as high as 11.9%, 35.5%, and 56% were found (Kouzoukas, Pandina, & Ogilvie, 2007; Low & Gendaszek, 2002; Sweeney, 2010).

The present study found past year PS use to be greater than previously determined in five other university samples. Previous research has found that males as well as student attending northeastern universities typically have higher rate of PS use than students in other areas of the country. Other factors suggest that the true prevalence of PS use at this university could possibly be even higher than we determined. This was partially due to the fact that the present sample consisted of mostly freshmen. Due to the fact they were only at the university for 6 months prior to data collection it is likely that they were not yet fully involved in social networks. It has been shown that PS use is more prevalent among members of Greek life and possibly linked to the size of students social network (McCabe et al., 2005). Data collection was done around the time of fraternal initiation; therefore if participants were involved with Greek life they would have only been a part of it for a few weeks. With this in mind it is possible that the prevalence of illicit PS use is greater than determined in the present study.

Prescription Stimulant Use and Alcohol consumption

Stimulant users were more likely than non-users to classify themselves as being a heavy drinker and non-users were more likely than PS-users to classify themselves as non-drinkers. In the present study 30.9% of all participants reported themselves as non-drinkers, though campus wide data collected in 2009, found that only 18.3% of students were non-drinkers (Harper, 2010). The elevated number of non-drinkers in the present study may be due to the addition of weight lifters to our sample. Previously it has been found that approximately one fourth (25%) of students regularly work out and our sample had over double this amount (55%) of weightlifters. This suggests that the sample used in the present study was slightly more health conscious than the average college student population.

PS users significantly more likely to be drinkers than non-users (92.8% versus 66.9%), this finding parallels results from previous studies that have also found PS users to be heavier drinkers (Teter et al., 2005). Although a large percentage of PS users (92.8%) of PS users were drinkers, a previous study found that 100% of stimulant users had consumed alcohol at least once in the last 30 days (Teter et al., 2005). This slight decrease in alcohol use among PS users may also be due to the adding of a small amount of weightlifters in our sample. Since prescription stimulants are most often used for academic purpose (DeSantis, Webb, & Noar, 2008) some may view them as less of a health concern than alcohol.

Prescription Stimulant Use and Energy Drink Consumption

The present study revealed that PS users are more likely more likely to consume energy drinks however, previous studies found energy drink use overall was more common than in our sample. In 2007, 51% of students attending a Central Atlantic University reported using energy drinks at least one energy drink in the last month compared to the 31.4% of energy drink consumers in the present study (Malinauskas, Aeby, Overon, Carpenter-Aeby, & Barber-Heidal, 2007). College females are more likely to consume energy drinks than their male counterparts (Malinauskas et al., 2007) the all male sample used in the present study may be why a fewer portion of respondents were energy drink consumers.

The number one reason for using energy drinks is to compensate for a lack of sleep (Malinauskas et al., 2007). Underlying characteristics such as sleep deprivation may explain why PS users have a greater likelihood to consume energy drinks than non-users. There also may be underlying personality traits that incline PS users to consume energy drinks for their stimulating effect. Some research suggests that extraversion is a personality trait more common among caffeine users than non-users (Landrum, 1993) it would be interesting to see if this was also true

when comparing PS users and non-users.

Over the past several years the use of energy drinks and non-medical PS have been growing epidemics on college campuses. Illicit prescription stimulant users are more likely to use other power stimulants (such as cocaine), this supports the increased likelihood of PS users to consume to also energy drinks (McCabe et al., 2004; McCabe et al., 2005; Teter et al., 2005). Recently it has been found that energy drink consumption early in college was predictive of future PS use (Arria, Caldeira, Kasperski, O'Grady, Vincent, Griffiths, & Wish, 2010). It is still unknown why PS users consume caffeine more often than non-users. Further research is needed to determine the psychosocial conditions that mediate the use of these drugs.

Prescription Stimulant Use and Mixing Alcohol with Energy Drinks

Mixing energy drinks with alcohol is a growing trend on college campuses. Pre-mixed alcoholic energy drinks are cheap and heavily marketed to college students. Sales were high until the dangerous effects of these drinks got the attention of lawmakers and certain pre-mixed energy cocktails were banned in some states. Nonetheless these laws are not keeping students from mixing the ingredients themselves. On average students consume approximately three times more energy drinks while partying than in any other situation (Malinauskas et al., 2007).

Previous studies found that 25% of student drinkers had mixed alcohol with a caffeinated beverage in the last 30 days (O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008); this is a greater percentage than found in our sample (15.5%). This may indicate that the likelihood of mixing alcohol with energy drinks increases throughout college but further studies are needed to validate this trend.

McCabe and colleagues (2005) found that stimulant users are more likely to have used other drugs in the past year such as marijuana, cocaine and ecstasy (McCabe et al., 2005). With

this in mind it is no surprise that PS users are more likely to mix alcohol with energy drinks than non-users.

Limitations

There are many limitations that make it difficult to generalize these findings to the overall college population. The sample was only male freshmen. This is problematic because non-medical use of prescription stimulants in college students is consistently higher among males than females (McCabe et al., 2005). Previous research suggests that smaller social networks are associated with less access to prescription stimulants, therefore by only considering freshmen, our results may be underestimating the use of these drugs.

A second limitation with regards to the sample may be the oversampling of weightlifters for the original study. According to the American College Health Association (2004) approximately 42.5% of college students lift weights regularly compared to the 55% of our sample whom reported regularly lifting weights. The additional health consciousness of this sample is perhaps a valid explanation for why the drinking behaviors of this sample were less problematic than previous studies done on freshmen at Penn State.

There were inconsistent differences between stimulant users and non-users with regards to their alcohol consumption. Peak number of drinks and times drunk were similar between each group but general drinking behaviors were significantly different between groups. Also, there were only two questions measuring illicit prescription stimulant use and lifetime use was not considered. In addition there were no questions pertaining to the use of PS with a prescription.

The legal consequences of having Adderall, Ritalin or Dexedrine without a prescription are extremely harsh. Even though confidentiality is highly protected, some students, especially freshmen, may be hesitant to disclose information about their use of certain drugs. It is a felony

to possess these stimulants without having a prescription. In the present study students had to provide their first and last names as well as contact information and mailing address. Having to disclose this identifiable information could have potentially influenced the responses of some participants.

Future directions

It is well stated throughout the literature that PS use is linked with both licit and illicit drug use. Further research is needed to determine the common personality trait and factors influencing students decision to consume prescription stimulants. In addition, protective and risk factors associated with greater levels recreational drug use among PS users. Drinking and drug consuming behaviors of illicit PS users need to be researched in comparisons to prescribed PS users.

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ACADEMIC VITA: Brittney M. Barbieri

EDUCATION

Pennsylvania State University – Expected Graduation: Spring 2011

- Schreyer Honors College
- Major: Bachelor of Science in Biobehavioral Health
- Relevant Coursework: Cognitive Psychology, Abnormal Psychology, Epidemiology, Research Ethics, Research Strategies for Studying Biobehavioral Health, Biology, Genetics, Organic Chemistry, Pharmacological influences of Health, Statistics

Niskayuna High School – June 2007

WORK & RESEARCH EXPERIENCE

Penn State Alcohol and Skin Cancer Prevention Research Lab (Jan 2009 to Present)

- Involved in multiple projects concerning alcohol-related interventions
- Responsible for performing literature searches, recruit participants, data collection and entry, analysis, aiding in proofing and publications

Student Health Center (Jan 2010 to Present)

- Edited and delivered one hour interventions to students about sexual health and available resources

Child Study Center (Dec 2010 to Present)

- Working with kindergarteners diagnosed with ADHD to teach them to recognize their emotions and practice positive social interactions

Pacific Institute for Research Evaluation (April 2010 to Nov 2010)

- Questioning drivers about their knowledge of drinking and driving laws and administering preliminary breathalyzer tests

Personality Psychopathology and Psychotherapy Research Laboratory (Jan 2010 to Aug 2010)

- Coding psychologist notes and participant behavior
- Literature reviews

State College Chiropractic and Massage Center (Dec 2009 to Sept 2010)

- Worked on soft-tissue prior to chiropractic adjustments and instructed patients during manual therapy