Running head: EFFECTS OF VYVANSE ON COGNITION AND CREATIVITY

The Effects of Vyvanse on Cognitive Ability and Creative Capacity in non-ADHD Diagnosed Individuals

Sean Cavanagh

State University of New York at Stony Brook

Abstract

In this particular experiment, the effects of a new stimulant medication, Vyvanse, will be examined. Being measured are its perceived benefits on cognitive ability and whether or not it will impede creativity. A sample of sixty college-aged individuals was used for this study, all of which were non-ADHD diagnosed and had never been prescribed stimulant medication. Over the course of two phases spaced one month apart, subjects completed five separate, yet similarly structured tasks. Cognitive ability was measured through reading comprehension, math and a short-term memory test, whereas creative capacity was measured through a pre-constructed inventory and a test of alternate uses. It is expected that for the individuals that consume the drug, they will exhibit an increase in scores in all areas between phase one and two, compared to the scores of individuals who did not consume the drug. Implications from these results will help display the positive efficacy of this drug, as well as promote it's increased implementation as a pro-drug in the pharmaceutical treatment of ADHD.

The Cognitive and Creative Effects of Vyvanse

One of the more common and widely diagnosed conditions in psychology, Attention Deficit / Hyperactivity Disorder, is a multi-faceted issue. While most diagnoses occur in children, there has recently been an increase in the prevalence of adult ADHD (Upadhyaya, Kroutil, Deas, Durell, Van Brunt & Novak, 2009). In the treatment of ADHD, various stimulant medications are often given to patients. Prescribed with the intent to increase attention and reduce impulsivity, common drugs include Adderall (mixed amphetamine salts), Ritalin (Methylphenidate) and the emerging pro-drug, Vyvanse. Studies have shown that in various college populations, non-medical use of stimulant medication is often self-justified because it is perceived as safe and beneficial (DeSantis & Hane, 2010). An important aspect of both medical and non-medical use of stimulant medication is whether or not the drug will provide the user with the desired positive effects, especially related to dependency and re-use.

As a result of the high potential for abuse in stimulant medications, there has been growing interest in the prevalence and motivation for non-medical usage of such drugs. A national lifetime prevalence survey showed that approximately 3.5 to 7 percent of current college students are likely to partake in the non-medical use of stimulant medication (Looby & Earleywine, 2009). Due to this fairly high prevalence, there has been extensive research into why non-medical usage of stimulant medication occurs. Studies have shown that most college students that abuse ADHD stimulants do it without a prescription, and for various reasons, stated as both academic and recreational (DeSantis, Webb & Noar, 2008). Surveys of college aged individuals that regularly use stimulant medication has shown a multitude of reasons for use. The majority of use was slated as a result of the

need to increase focus or complete work (academic related), whereas a small portion of frequent users have stated reasons such as getting high and staying awake (Looby & Earleywine, 2009). Due to the increasing prevalence of illegal use of stimulant medication, attention needs to be focused on ways to reduce non-medical use of such drugs.

As a possible solution to the issue of abuse, increased attention has been recently focused on an emerging pro-drug stimulant under the name Vyvanse (Lisdexamfetamine) (Howland, 2008). The pill is administered in capsule form, inside of which the active drug is comprised of extended release digestible enzymes. For this reason, if the drug were to be snorted its effects would be rendered null. In addition to this, if the drug were to be consumed in doses larger than recommended for the effect of "getting high," the therapeutic effects of the drug will not be felt and therefore not easily abused (Howland, 2008). Due to the lengthy efficacy and lowered potential for abuse, it is likely that this drug will soon emerge as a top pharmacological option in the treatment of ADHD.

Although there has been sufficient pharmacological research supporting the efficacy of the drug, there is minimal research that measures the various aspects of cognition and learning performance that are affected while on the drug. Recently, a study was conducted to attempt to measure the effects of stimulant medication on creativity. Due to the fact that creativity is a rather subjective term, it is often difficult to objectively measure. Using the drugs Adderall and Ritalin, subjects completed multiple tasks of divergent thought that strove to measure creativity. Results showed no general impairment in creative cognition, although there was a positive effect evident in a task oriented towards identifying shapes (Chaterjee, Farah, Haimm & Sankoorikal, 2009). In

order to better understand the effects of a new stimulant medication on various aspects of cognitive performance, both the findings of past research and gaps in results must be integrated into the current research design.

Considering what research in the past has shown and neglected to study, the current research design is as follows: In subjects that do not fit the diagnostic criteria for ADHD (according to the DSM-IV-TR), does the consumption of 50mg Vyvanse bear significant effects on an individual's performance on cognitive tasks measuring divergent and convergent thought. In terms of this study, divergent thought is defined as creative thinking, measured by the subjects' performance on tasks that require abstract thinking. Convergent thought on the other hand, is identified as the ability to come to a correct answer, which will be measured through brief SAT level academic tasks. This study will be conducted in two phases, in which first subjects will complete a series of tests, then return a month later to complete similar tests under the experimental condition. In this case, the independent variable is whether or not the subject will consume a 50mg Vyvanse. The dependent variable will be any variation in test scores between the first and second phases. It is expected that after having consumed the drug, subjects' performance on convergent tasks will show some significant improvements, whereas tasks that measure divergent thought will show slight impairments. Overall, it is expected that this study will show that the drug Vyvanse has the ability to produce positive effects on a user's cognitive performance without significantly restricting creativity.

Method

Participants

For this particular study, subjects have been acquired from the subject pool at Stony Brook University, a large research institute. Desired subjects were drawn from the subject pool and then pre-screened for ADHD diagnostic criteria, as well as the usage of stimulant medication. From those that did not meet the diagnoses for ADHD or regularly take such medicine, sixty subjects were obtained. Subject's ages ranged from twenty to twenty-four, and for the purpose of this study, factors such as gender, race and socioeconomic status have been rendered irrelevant (yet are ideally balanced). Since we are dealing with a college population, level of educational attainment is about the same across subjects. As briefly mentioned before, this experiment will operate in two separate, yet similarly constructed phases; in the first phase, all subjects will complete the same tasks in an allotted time. During the second phase, subjects will be split into two groups unbeknownst to them; half (n=30) will function as a placebo group, and the other half (n=30) will act as an experimental group.

Measures

The two measures of thought that we are striving to measure in this experiment are divergent and convergent thought. Divergent thinking will be measured by a set of cognitively oriented tasks, such as an SAT level reading comprehension, free-response math portion, and a brief short-term memory task. For aspects of divergent thought, they will be measured through a form of Guilford's Alternative Uses Task and the Torrence Test of Creative thinking, which have their own scoring matrixes. In this particular experiment, these tasks will measure the creative capacity of an individual. After subjects have completed these tasks during phase one, a basis for comparison has been established, against which phase two scores will be measured; either under the placebo or

experimental condition (consumed 50mg Vyvanse). Any variance in scores between phase one and two will represent any effects, positive or negative, that consumption of stimulant medication had on the subjects' cognitive ability and creative capacity.

Procedures

The experiment will be conducted as follows. During phase one, subjects will complete all of the above tasks over the course of two to three hours, at separate times, in a room in the Psychology A building that remains the same. Tests of convergent thought will be distributed first, over the course of an hour, with five-minute breaks in between each specific task. The same will follow for tests of divergent thought; subjects may take a break up to 15 minutes long in between tasks, but not during them. Following phase one, subjects will arrive for phase two about one month later, unaware of their new conditions. Thirty subjects will consume a glucose pill an hour before phase two, whereas the other thirty will consume a 50mg Vyvanse. Both groups of subjects will then complete similar versions of the same kinds of tasks from phase one. Comparing the results of phase one and phase two, separating the experimental group from the placebo, a significant variation in scores will either support a positive or negative effect on different aspects of cognition while either on or off stimulant medication.

Results

In this particular experiment, a number of things are trying to be found. Mainly though, the hypothesis states that there will be a significant effect on the results of test scores of subjects that are under the experimental condition, compared to those in the control group. More specifically, it is expected subjects that have consumed the drug will

show the strongest improvements on scores of tests oriented towards convergent thinking, whereas tests of divergent thought will show only slight differences.

The statistical procedure used to analyze the results gathered during this experiment will involve t-tests for independent groups. This test will show the differences in scores between the two different phases for each group; these results will depict any positive or negative effect that consumption of the drug has on cognitive and creative performance. The degrees of freedom for this experiment will be df = 59. Descriptive statistics for the experimental and control groups can be seen in Table 1, through a comparison of means and standard deviations. In Tables 2, 3, 4, 5 and 6, the difference of scores between phase one and two for each group can be seen, each table representing a different test. For table 2, 3 and 4, test representing cognitive tasks are shown, and for tables 5 and 6, the test that measure creativity can be seen.

With a significance level of $p < .05$, a significant effect was found for the experimental group, $t(29) = x.xx$; the results of test scores under the experimental condition improved significantly between phase one and two. This shows that after having consumed the drug, test scores improved to a noticeable degree, not due to chance. Scores of subjects under the control condition (n=30) remained consistent, thus eliminating the change being due to chance. Analyzing between-group changes in test scores, as well as relative standard deviations, it becomes clearer how truly the scores are varying in relation to the mean scores of subjects.

Discussion

As expected, significant results were obtained from the experiment. The present study was designed to see if there would be any difference in the test scores of

individuals after consuming the drug Vyvanse, compared to when to taking the tests normally. Out of five tests, three were oriented towards cognitive and memory tasks, whereas the other two aimed to measure creativity. After data was compiled, the results bolstered the idea that the drug will have some impact on a user's cognitive ability and creative capacity. On all but one of the tests, subjects under the experimental condition displayed relatively significant improvements in their scores, whereas for the control group and the creativity inventory (Torrence Test of Creativity), scores remained unaffected across the board.

Previous research has shown that stimulant medication used in the treatment of ADHD can provide a positive effect on attention and cognition, but only some focus has been placed on it's potential to impede creativity (Chaterjee, Farah, Haimm & Sankoorikal, 2009). Similar to the previous study, yet using a new drug, this experiment examined the effects that such medicine can have on divergent thought. The slightly positive and barely changed scores on the creativity spectrum indicate that the drug does not necessarily enhance creativity, nor does it quite pose any harm to it. In addition, some negative aspects of stimulant medications are their relatively high abuse rate and accessibility (Looby & Earleywine, 2009). They are commonly used by college students and are often insufflated recreationally (DeSantis, Webb & Noar, 2008). Recent research has proven the efficacy of an emerging pro-drug, Vyvanse, which is comprised of digestible enzymes, bearing less potential for abuse (Howland, 2008). The findings in this study continue to support the potential benefits of this drug in the treatment of ADHD, as well as reports of positive experiences from most subjects that consumed the drug.

The significant results produced by this study were influenced mainly by multiple strengths within. Having used a sample that was never prescribed stimulant medication helped to ensure that first time users experienced the effects. Additionally, the strong positive effect on the short-term memory and other cognitive tasks supports the efficacy of a drug that has not been researched often. As well as striving to measure learning oriented tasks, this study also contributed to a thin column of research by striving to record the highly subjective term, creativity. Since it is not commonly researched, this addition to the field of psychopharmacology is significant. Another strength of this study was the consideration of a control and experimental group, creating a sound mean of comparison, as opposed to simply following the trends of one larger experimental group.

Aside from the numerous strengths of the study, there were also a number of minor limitations that existed in the experiment. Relative to the participants of the study, the sample size was fairly small and comprised of college students, who although educationally equal, likely have different levels of intelligence. Additionally, the fact that they were non-ADHD diagnosed can be limiting in that the positive effects they received, may not always be experienced by patients with ADHD, especially severe cases in children. Although two separate measures were used to determine creativity, the term remains subjective; in this case findings may only apply to a narrow definition of what is widely considered creative ability.

As a whole, the results obtained from this study bear numerous implications in the field of psychology and pharmacology. Mainly, the positive effects of Vyvanse indicate its efficacy in the treatment of ADHD symptoms. These findings can assist in the implementation of a drug with a lowered potential for abuse into the pharmaceutical

market. Additionally, more has been revealed regarding the effects that impulse-reducing medications can have on test performance, as well as creativity. In terms of future research, findings from this study could provide a foundation for further experimentation in observing the role of stimulant medication in cognitive performance and individual creative capacity. Overall, these findings should assist in the integration of Vyvanse in more research, as well as the treatment of ADHD.

References

DeSantis, A., Webb, E., & Noar, S. (2008). Illicit use of prescription adhd medications on a college campus: A multimethodological approach. *Journal of American College Health*, *57*(3), 315-323.

DeSantis, A., & Hane, A. (2010). "Adderall is definitely not a drug": Justifications for the illegal use of adhd stimulants. *Substance Use & Misuse*, *45*, 31-46.

Farah, M., Haimm, C., Sankoorikal, G., & Chatterjee, A. (2009). When we enhance cognition with adderall, do we sacrifice creativity? a preliminary study. *Psychopharmacology*, *202*, 541-547.

Howland, R. (2008). Lisdexamfetamine: A prodrug stimulant for adhd. *Journal of Pyschosocial Nursing*, *46*(8), 19-22.

Looby, A., & Earleywine, M. (2009). Prescription stimulant expectancies in recreational and medical users: Results from a preliminary expectancy questionnaire. *Substance Use & Misuse*, *44*, 1578-1591.

Upadhyaya, H., Kroutil, L., Deas, D., Durell, T., Van Brunt, D., & Novak, S. (2009). Stimulant formulation and motivation for nonmedical use of prescription attention-deficit/hyperactivity disorder medications in a college-aged population. *The American Journal on Addictions*, *19*, 569-577.

Table 1

Descriptive Statistics of Control and Experimental Group scores in Phase One and Two

Test Type	Experimental, Phase 1 M (SD)	Experimental, Phase 2 M (SD)	Control, P1 M (SD)	Control, P2 M (SD)
Reading Comp.	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)
Math FR	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)
Memory Task	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)
TTOC	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)
Alternate Uses	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)	xx.xx (x.xx)

n=60, 30 in experimental, 30 in control
Test scores graded on 0-100 composite scale

Table 2

Variation in Scores Between Phase One and Two: Reading Comprehension Test

	Experimental	Control
Difference in Scores	xx.xx	xx.xx

n=60, 30 in experimental, 30 in control

Table 3

Variation in Scores Between Phase One and Two: Free Response Math

	Experimental	Control
Difference in Scores	xx.xx	xx.xx

n=60, 30 in experimental, 30 in control

Table 4

Variation in Scores Between Phase One and Two: Memory Task

	Experimental	Control
Difference in Scores	xx.xx	xx.xx

n=60, 30 in experimental, 30 in control

Table 5

Variation in Scores Between Phase One and Two: Torrence Test of Creativity

	Experimental	Control
Difference in Scores	xx.xx	xx.xx

n=60, 30 in experimental, 30 in control

Table 6

Variation in Scores Between Phase One and Two: Alternate Uses Task

	Experimental	Control
Difference in Scores	xx.xx	xx.xx

n=60, 30 in experimental, 30 in control