Cosmetic Neurology: Enhancement of the Mind and Attention Deficit Hyperactive Disorder Medication Abuse Among College Students

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A Senior Thesis submitted in partial fulfillment
of the requirements for graduation
in the Honors Program
Liberty University
Spring 2012

Acceptance of Senior Honors Thesis

This Senior Honors Thesis is accepted in partial fulfillment of the requirements for graduation from the Honors Program of Liberty University.

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Abstract

Cosmetic neurology is becoming increasingly popular, and it is not just sleep deprived, over worked college students who are interested. People are beginning to seek off-label prescriptions for medications that are typically used to treat disorders such as attention deficit hyperactive disorder (ADHD) or narcolepsy, while researchers are trying to create drugs used solely for mind enhancement purposes. Along with these drugs come many legal and ethical quandaries relating to the regulation of current use as well as the *what ifs* of future possibilities. A survey was conducted among college students regarding the diagnosis of ADHD, the abuse of ADHD medication, and the number of students they knew who had abused ADHD medication, with the results compared to university students all across the country. The survey revealed that 58% of the participant students at the researcher's university know other students who abuse ADHD medication, while 68% of participant students at other four- year universities know students who abuse ADHD medication.

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The pressure to get ahead and rise to the top is greater than ever as society becomes increasingly fast paced. People are constantly looking for the most efficient path to take with the least amount of work. Without considering the long-term detrimental effects, people lose their focus on what is most important in life such as their health, family, and friends. This societal trend has led towards the development of yet another short cut: cosmetic neurology (Armstrong, 2010).

This idea of creating a pill to enhance the mind of an individual has been around for centuries. Ancient philosopher René Descartes even sought the use of medication not for treatment but for enhancement. In his book *Discourse of Method*, which was written in 1637, he wrote that medicine was the answer to finding a way to increase the wisdom and capability of mankind. As technology and scientific research are increasing at an exponential rate, this far off concept is becoming a reality (Kass, 2003).

It is being called many names: cognitive enhancing, neuroenhancement, or even "nootropics", which was coined by Corneli Girugea in 1962 when the first brain enhancer was developed (Armstrong, 2010, p. 64). This is a combination of the two Greek words "noos" meaning mind and "tropein" meaning toward (Lanni et al., 2008, p. 196). However there is a name that embodies both the scientific and cultural implications of this technology, *cosmetic neurology*. This buzz-word was coined by Dr. Anjan Chatterjee, a professor of neuroscience at the University of Pennsylvania, in 2004 (Armstrong, 2010). He is a leader in the field of neurology, and he defined it as, "the practice of intervening to improve cognition and affect in

healthy individuals" (Chatterjee, 2007, p. 29). Just as people may undergo cosmetic surgery to enhance their physical features beyond therapeutic means, there is an era on the horizon in which people will be able to enhance their neurological and cognitive function through pharmacological methods as well (Chatterjee, 2006).

As researchers continue to develop new treatment methods for diseases such as dementia and attention deficit hyperactive disorder (ADHD), they are beginning to look at the implications of these drugs for the use in healthy individuals in order to improve mental capacity. Chatterjee pointed out that cognitive enhancement is targeted at improving three different categories: attention, memory, and mood (Chatterjee, 2004).

Current Medications That May Be Used As Cognitive Enhancers

There are over 500 compounds that contain properties that could enhance cognitive capabilities, which has led to the development of multiple drugs that may be used for neuro-enhancement (Armstrong, 2010). Specific drugs that are foreseen to become commonly used in daily living in healthy individuals are atomexitine (Straterra), modafinil (Provigil), methylphenidate (Ritalin) and amphetamine-dextroamphetamine mix (Adderall). The benefit to atomexitine is that it is non-addictive and has been found to increase mental awareness (Chatterjee, 2006). Adderall and Ritalin are both stimulants, and they are the most commonly used drugs for cognitive enhancement today (Greely et al., 2008).

Adderall

Adderall, which is an amphetamine-dextroamphetamine combination, is a stimulant that is currently used to treat attention deficit disorder (ADD) or attention deficit hyperactive disorder (ADHD) and can improve behavior and concentration. It is one of the most popular drugs used for cognitive enhancement, and the number of those using it for illicit purposes is growing. After

a survey was conducted on prescription stimulant use among college students, it was determined that there were three main reasons that Adderall use is so popular: easier access, fewer emotional imbalances, and overall efficacy compared to other stimulants (Teter, McCabe, LaGrange, Cranford, & Boyd, 2006). Researchers also believe that the mechanism of action plays a role in the popularity of this drug. It increases levels of dopamine in the brain as well as the levels of norepinepherine. Dopamine and norepinepherine are neurotransmitters are chemicals that are known as catecholamines. They affect mood and cognition, and cognitive enhancing drugs target these neurotransmitters (Turner & Sahakian, 2006). Amphetamines are thought to increase learning capacities as they increase neural plasticity (Chatterjee, 2006).

However, while this combination of responses may invoke an increase in cognitive capacity in one individual, it may not have the same effect on another individual due to the fact that every brain responds to neurotransmitters differently. This explains the need for various medications for the same disorder, and it also explains why students may use various medications for illicit uses of enhancement (Teter et al., 2006).

Ritalin

Another commonly used drug for cognitive enhancement is methylphenidate, most popularly known as Ritalin, which improves concentration and is typically used to treat ADHD as well. Methylphenidate was shown in many studies to improve memory and motivation, and the side effects are typically mild including headache, dry mouth, sleeping problems, nervousness, and palpitations (Repantis, Schlattmann, Laisney, & Heuser, 2010). Although researchers have not reached a conclusion on whether it is dopamine, norepinepherine, or the combination of the two that increases cognitive abilities, Ritalin is popular for the same reason that Adderall is. It is because it increases the levels of dopamine and norepinepherine (Sahakian

& Morein-Zamir, 2010). However, Ritalin has a slightly different mechanism of action as it increases these levels solely by blocking the reuptake whereas Adderall blocks reuptake along with releasing dopamine before the synapse (Teter et al., 2006). The use of methylphenidate is especially popular in student circles, but it is beginning to extend into the professional setting as well (Chatterjee, 2006).

Provigil

A newer drug, Provigil (Modafinil), has been approved for use by the FDA since 2002 and has gained a reputation as "the Cadillac of cognitive enhancers" (Armstrong, 2010, p. 58). It was developed specifically to treat patients with tiredness related to narcolepsy, sleep apnea, or shift work. Its advantages over methylphenidate and other amphetamines is that its side effects have less of a negative impact on a person's body and mood. Walter Armstrong, Senior Editor of *Pharmaceutical Executive,* stated that Provigil claims to have fewer side effects, a lower risk for addiction, and controls the body's sleep cycle better than any other drug. While this drug is growing in popularity among those who have the medical diagnoses indicated for its use, its off-label use is thought to account for 90% of the prescriptions (Armstrong, 2010).

Modafinil promotes alertness and reduces impulsive reactions, even when a person is sleep deprived. When the effects were studied in healthy people who were sleep deprived, it was found to have even more positive effects, and it improved not only attention but also wakefulness and memory (Repantis et al., 2010). Modafinil has also been shown to increase memory retention in various forms. It has a low risk of dependency, and although it was initially used to treat narcolepsy, it is now used to treat a much broader scope of diagnoses (Bostrom, 2009).

Scientists who admitted to taking Modafinil were interviewed to study its usefulness. While the level of effectiveness varied among people, there was a universal increase in the areas

of attention, working memory, word finding, improved sustained hard thinking, and mental energy (Sahakian & Morein-Zamir, 2010).

Negative side effects, not only for Modafinil but all cognitive enhancers, must be carefully taken into consideration for two reasons. The first is that this is not a necessary treatment, therefore any negative effects that can be avoided should be avoided. Secondly, the brain is much different from the rest of the body, and it is sensitive to even the slightest changes. Whether there are any long- term effects on the brain is yet to be determined due to the relatively new and higher demand for cognitive enhancers (Teter, et al., 2006). While several studies on the effectiveness of cognitive enhancing drugs have come back with positive effects, Chatterjee argued that the studies are only conducted on the effects of short-term use, and that research on long-term use has not been comprehensive enough to affirm positive effects over months of consistent use (Sahakian & Morein-Zamir, 2010).

Future Drugs Used Solely For Cosmetic Neurology

Most neuro-enhancers are designed to treat diseases, and the enhancement is an afterthought. However, there are now drugs being developed, ampakines and cyclic adenosine monophosphate response element binding protein (CREB) modulators, which are primarily for enhancement and may be used for diseases as an afterthought. Both of these enhancers work in the cells that affect the neurons associated with long-term memory (Chatterjee, 2007).

Ampakines

Ampakines were first discovered in 1993, and are currently being studied with the intention of their primary use to be cognitive enhancement. Neuroscientist Gary Lynch co-founded the company Cortex Pharmaceuticals. The researchers of this corporation discovered ampakines and are working to develop them into drugs to put on the market (Galagan, 2012).

The science behind these drugs is that they are able to cross the blood- brain barrier and positively affect the receptors associated with long- term memory. Armstrong reported in the article, *Brave Neuro World,* that the goal of ampakines is to utilize glutamate to its fullest potential. Glutamate is a neurotransmitter that improves learning and memory by increasing plasticity of synapses in the brain (Armstrong, 2010). There are three main effects that ampakines have in the brain, all of which may boost cognitive enhancement. The first is that they enhance transmission. They also increase the long-term potentiation at the synapses in the cortex of the brain, which affects memory and increases learning. Thirdly, they increase excitatory transmission, which regulates brain-derived neurotropic factor (BDNF). BDNF affects synaptic plasticity, which is the creation of new neuronal pathways in the brain as learning occurs (Lynch & Gall, 2006).

Researchers question the efficacy of ampakines as a mode of enhancement because, although ampakines have been shown to improve the brain in these three areas, the brain of a healthy individual is already fully functioning. Even Mark Varney, the current CEO of Cortex Pharmaceuticals said in an interview that he personally questions the reality of improving cognition in healthy adults (Armstrong, 2006). However, studies in both animals and humans have shown improvement in the retention of information related to difficult activities. Lower concentrations of ampakines in humans still led to improved scores while learning a complex maze, although the results were less varied from normal brain function than in animals (Lynch & Gall, 2006).

Learning and memory occur through a continuous process of synaptic plasticity and as neurons communicate with one another by transmitting signals between various connections. This causes both physical and chemical changes in the brain as an individual encounters new

experiences. Memory is not one process, but it is a three-step process that involves many different types of neurons in the brain. The three phases of memory formation are acquisition, formation, and recall. The various processes also lead to various types of memories such as short-term, long-term, implicit, and explicit (Lanni et al., 2008).

CREB Modulators

CREB is crucial to the conversion of short-term memory to long-term memory. CREB affects molecules in the brain, which lead to synaptic changes. Various levels of CREB may positively or negatively affect long-term memory. However, it does not affect short-term memory (Lanni et al., 2008).

Substances which would allow people to study less and remember more, decrease their hours of sleep and increase their hours of work, and spend less time worrying about fatigue while enjoying feelings of attentiveness may sound quite appealing. However, there are obviously problems that must arise from this. Researchers are now looking at both short-term and long-term side effects as well as the many ethical dilemmas that proceed from such innovative biotechnology. While it is not shocking that there is a push to stretch the human body to reach higher functioning capacities, there are many factors that must be examined before this may be put into practice legally. There is believed to be widespread use among the public, however education or open discussion about the topic is rare. In order to reduce the amount of illegal use of these substances, some regulation as well as informed public education is needed (Forlini & Racine, 2009).

Regulation

Although cognitive enhancement is still in the research phase, the regulatory committees that are already in place need to begin producing guidelines as to the use of cognitive enhancers.

Requiring a prescription for off-label use is not stopping people from obtaining these drugs through illegal means, and if the government wants control of this issue, they must begin allowing the use of these drugs through means that they can regulate more closely. Several researchers have addressed the reality that many people are already using cognitive enhancing drugs. Allowing these drugs to become more readily available will also encourage researchers to push deeper into making these drugs more effective and perfecting the desired outcomes (Farah et al., 2004).

Those who have been studying cognitive enhancement are no longer questioning the necessity for governing policies, but they are now questioning the type and severity of policies that need to be put into place. This could begin with educating the public as to their options and possible moral implications, or it could lead to legislatures creating agencies specifically responsible for the regulation of cognitive enhancers. How long is long enough for research and the consideration of every possibility? Many believe that it is time to end the thinking and discussion and begin acting and creating laws (Farah et al., 2004).

Regulation is hindered because a topic as controversial as cosmetic neurology raises many ethical debates. Many believe that this issue of cognitive enhancement entangles so many areas of society that proper regulation is going to require a holistic approach (Pasquale, 2010). In 2006, Chatterjee said that the focus of the ethical debate lies on three matters, "character, coercion, and justice" (Chatterjee, 2006, p. 111). As science and technology are rapidly advancing, the question is shifting from can it happen to should it happen? In 2006, the Neuroethics Society was formed in order to address these dilemmas early (De Vries, 2007).

As various aspects of society became increasingly interested in research on the brain and how it affects behavior, the United Nations Educational, Scientific, and Cultural Organization

(UNESCO) took it upon themselves to create the International Brain Research Organization (IBRO) (Illes & Bird, 2006). While UNESCO is an international organization, an influential American organization is The Human Brain Project. It was created in 1993 and is funded by the United States government. It has been created to integrate all of the information and knowledge of neuroscientific research. They have come up with a new focus of study known as neuroinformatics. Although it has not created the interest that those who are involved had hoped for, they are still hoping that this American organization will be useful in the furthering of the global neuroscience field (Lanni et al., 2008).

John Harris, the Sir David Alliance Professor of Bioethics at the University of Manchester and the co-editor of the *Journal of Medical Ethics,* held a strong opinion toward the research in the field of cognitive enhancement. He said that many people focus on the danger of furthering such technology, and they try to find a resolution by weighing the risk versus the benefit. However, most people do not take into account that there are dangers to avoiding research simply because of opposition. Many unjustified objections are given more respect than they merit (Harris, 2011).

While Harris favored cognitive enhancement, other people are vehemently against it. He referred to people who fear the danger associated with technology, and Ingmar Persson and Julian Savulescu (2008) fit into this category. The most basic consequence of cognitive enhancement is the increase of the speed at which humans acquire knowledge. Perrson and Savulescu worried that with the knowledge of the means to create weapons of mass destruction, cognitive enhancement would exponentially increase the number of people who had this knowledge and would allow them the opportunity to expand upon it. Even if a small percentage of evil people use the knowledge acquired through cognitive enhancers to obliterate mass

amounts of people, its use would become too great of a risk (Perrson & Savulescu, 2008). The expansion of knowledge and technology should not be avoided due to the possibility of misuse, but researchers must be aware of the possibility and use prudence to prevent it (Illes & Bird, 2006).

Perrson and Savulescu insisted that the only way to reduce malevolence is to develop a moral enhancement to deliver along with the cognitive enhancement. They compared cognitive enhancement to martial arts. Practicing martial arts allows people to fight in a greater capacity compared to those who do not know martial arts, but along with the instruction on the technical aspects there is an emphasis to educate those being trained in martial arts about morality. Due to the fact that martial arts and cognitive enhancement may both be used for good or evil, moral teaching should accompany both of these as well (Perrson & Savulescu, 2008).

Bill McKibben used the issue of nuclear weaponry to show how regulation has controlled the use of weapons of mass destruction despite the fact that the technology has been developed since World War II. The mere fact that nuclear bombs have only been dropped twice (Hiroshima and Nagasaki) shows how successful control of these weapons has been. This same control can be exemplified in guiding the measures to control cognitive enhancing measures as well (McKibben, 2004).

The people who would abuse such enhancements for the purpose of developing weapons of mass destruction already have an innate nature to cause harm. If researchers are going to halt the progression of cognitive enhancement, should they also stop researching better nutrition practices because that information could further the lifespan of a terrorist? It is important that researchers keep morality in the forefront of their minds while pioneering these avenues of biotechnology. However, the argument that research on cognitive enhancement should only

continue under the condition that research on moral enhancement is coupled with it is extreme (Persson & Savulescu, 2008).

Therapy Versus Enhancement

At the beginning of almost every discussion regarding cosmetic neurology, people argue the importance of distinguishing between therapy and enhancement. In order to differentiate between the two, one must first establish the definitions of *normal* and *health.* The matter of distinguishing therapy versus enhancement is contingent upon the definition of *normal*. Even in America, there are so many different cultures and socioeconomic classes that the definition of normal is varied. Perhaps a definition of health provides a more objective foundation for this discussion. The World Health Organization defined health as, "a state of complete physical, mental, and social well-being" (Kass, 2003, p. 15). Could the use of cognitive enhancers be classified as therapeutic then if an individual feels mentally incomplete if he or she is not performing to the full capabilities that could be reached with cognitive enhancing drugs (CEDs)? If cognitive enhancers were considered therapeutic, would it put the controversy to rest and become ethically acceptable solely on the grounds of classification? Leon Kass (2003), Chairman of the President's Council on Bioethics, suggested that distinguishing between therapy and enhancement is not enough to make an ethical decision because the distinction will not always be clear.

The difference between therapy and enhancement is that therapy is aimed at treating a disease whereas enhancement is aimed at improving normal, healthy people. Chatterjee argued that although there is a distinction, these two interventions constantly overlap. He posed the question: if researchers are focused on treatment, is it wrong for them to consider enhancement as well? He also explained how the increase in life expectancy, which has led to an increase in

America's elderly population, has stimulated research in neuroscience (Chatterjee, 2004). The research being done to find treatment for disorders such as dementia, or age related memory loss has ignited research for enhancement (Chan & Harris, 2006).

Nick Bostrom, philosophy professor at University of Oxford, described cognitive enhancement as magnifying the ability of the mind by impacting the process of synthesizing information. He observed that it is an improvement that is not targeted toward an illness. The demand for cognitive enhancement is not to produce *super-humans* as many of those in opposition purport. He gave the example that an individual with poor memory recall, although having no diagnosed illness, may take a cognitive enhancer and still have a worse memory than a person with Alzheimer's who has retained a good portion of his or her memory. While he agreed that most studies have not shown conclusive data regarding improvement in order to show the efficacy, it has become such a broad study with so many methods that it is much more unlikely that all cognitive enhancement methods are ineffective (Bostrom, 2009).

Demand on the Market for Cognitive Enhancing Drugs

Physicians

People's perspectives on the role of medicine will affect their demand for cognitive enhancement. Barbara Sahakian and Sharon Morein-Zamir(2010), associates at the Behavioural and Clinical Neuroscience Institute at University of Cambridge, observed that people who believe the function of medicine is for the betterment of the patient will be more likely to put the pressure on doctors and ultimately the entire market for these drugs. Many have found a way to attain these medications easily if they desire the effects regardless of the incomplete data on effectiveness and long-term side effects. Currently the only legal way to obtain these medications may be with a prescription, and many doctors will prescribe them for off-label use.

That is also completely legal due to the limited regulations on that practice (Sahakian & Morein-Zamir, 2010). Who should decide that cognitive enhancement is morally good for society as a whole when each doctor is faced with making his or her own decision whether or not an unnecessary prescription is providentially good for a person? This is the reason that physicians have become known as the gatekeepers regarding the distribution of cognitive enhancers (Kass, 2003).

Researchers

Researchers and pharmaceutical companies have so much pressure to pursue the development of cognitive enhancing drugs because there is a market and high demand. It was reported that supplements to enhance memory now make up a billion dollar market annually solely in America (Lanni et al., 2008). However, cognitive enhancement of various forms, including illicit cognitive enhancing drug use, is not an issue that is specific to the United States. This is why some of the most advanced research in neuroenhnacement is being conducted in Moscow, Russia where it has been going on since Joseph Stalin's dictatorship (Armstrong, 2010). A world-wide study found that people in the United Kingdom were more likely to obtain cognitive enhancing drugs over the internet than those in the United States (Sahakian & Morein-Zamir, 2010). Sahakian and Morein- Zamir (2010) also reported that the majority of university students got their cognitive enhancing prescription drugs from friends or peers.

Ethical Implications

Many researchers have addressed the ethical dilemmas associated with cosmetic neurology, and most of them have come to the conclusion that it is no longer a matter of if but when. Some researchers came to the conclusion that regardless of the ethically correct answer,

the only question to be answered is if researchers have gained enough knowledge to prevent brain doping (Lanni et al., 2008).

Sahakian and Morein-Zamir (2010) defined neuroethics as, "the study of the ethical, legal, and social questions that arise when scientific findings about the brain are carried into practice" (p. 200). It does not just combine the two fields of ethics and health care, but it takes into account issues of economic, political, philosophical, religious, and a moral nature. Neuroethics is a specific type of bioethics that cognitive enhancement falls under, which is one of the primary reasons the Neuroethics Society was established.

Some scientists believe that the ethics related to the implications that cognitive enhancement could have on society should be taught to students along with general neuroscience education. Researchers such as Sahakian and Morein-Zamir believe that the various ethical implications are important to consider. However, instead of focusing on the morality of the issue, they place an emphasis on educating future health care workers as well as the general public of the various issues and then allow individuals to make their own decisions. This shifts the pressure from legislators trying to regulate its use to the autonomous adult making an informed decision (Sahakian & Morein-Zamir, 2010).

The concept behind ethics is determining what is good. Persson and Savulescu further distinguished ethics as they differentiated between what is providentially good versus what is morally good. Providentially good actions are specific to the individual, whereas actions that are morally good are beneficial to society as a whole. They asserted that while cognitive enhancement may be providentially good for one individual, that makes it providentially bad for another individual as one person has the upper hand on the other. Persson and Savulescu (2008) argued that this makes it morally wrong because it is does not reach an end that is good for the

whole. Subsequently, the second individual's cognitive enhancement would be providentially bad for the first individual because it would lessen the disparity that the enhancement gave the first individual. They agree that cognitive enhancement may be a positive scientific advance if the majority of society was morally good, but that even then, there would be reasons not to pursue it (Persson & Savulescu, 2008).

Safety

Of all the concerns with the use of cognitive enhancers, the primary concern for all people, whether their motives are political, economical, or philosophical, should be for safety. Safety is the primary concern with cosmetic neurology. While it is often compared to cosmetic surgery, due to the fact that they are both elective, cosmetic neurology is more concerning because the mind is so much more complex, and researchers have a much more difficult time estimating the response. However, as with any other drug, researchers could never know the extensive possibilities of every potential long-term or short-term side effect (Farah et al., 2004).

While many people in American culture accept the ideas of technological advancement, they often struggle with accepting the implementation of scientific breakthroughs, primarily due to safety concerns. The use of cognitive enhancers has been compared to heart transplants and to in vitro fertilization. There were many discussions about the physical and moral concerns as they were introduced, but many of these concerns have been discredited. This is in part because people have become more comfortable with the idea, and also because the technology and process have been refined. As they have become safer, they have become more familiar. While researchers are still unsure if a perfect cognitive enhancer will ever be produced, the end goal for cognitive enhancement, or any form of medicine, is to reach maximal benefit with minimal harm (Turner & Sahakian, 2006).

Sahakian and Morein-Zamir addressed the dangers concerning the alteration of personhood by enhancement. The solution to this problem may be remedied by the use of pharmacogenomics. This process distinguishes the way genes are affected by drugs. Those who are more likely to experience more severe side effects would then not be allowed to receive a prescription for that drug. This would minimize the probability of harmful effects (Sahakian & Morein-Zamir, 2010).

Character

The question of character immediately becomes a concern when a person considers the fact that, at this present time, using cognitive enhancing drugs for non-pharmacological use, or without a prescription, is illegal. After a survey investigated college students' perceptions of those who used cognitive enhancing drugs, it revealed that many college students view their peers who use cognitive enhancers negatively as cheaters (Sahakian & Morein-Zamir, 2010). However, perceptions change when an individual sets his thinking to a day when the law allows cognitive enhancers. Then the answer to whether or not cognitive enhancement is cheating is found in the difference between the questions of whether an individual is pursuing excellence in a process or excellence in an outcome. Most commonly, especially in areas of academia, the outcome benefits a greater number of people than the process, which may only benefit the individual. Scientists that use CEDs while conducting cancer research are more focused on reaching the outcome, which will benefit mass numbers of people, than they are on the personal lessons that may be learned through a lengthy research process. The question of morality then changes from *is it ethical for researchers to use CEDs* to *is it ethical for legislatures to inhibit the use of CEDs*? This will impede the quest for a cure to cancer allowing the deaths of millions of people due to a prolonged process (Goodman, 2010).

It is also believed that with the wide spread use of cognitive enhancers, people will lose the sense of self worth that comes along with hard work. Rob Goodman stated that enhancers change improvement from active to passive as it no longer requires discipline and hard work, but it merely occurs (Goodman, 2010). According to this belief, there would be no motivation to challenge oneself because there would be a pill that could be taken instead (Sahakian & Morein-Zamir, 2011). However, cognitive enhancement will not eliminate motivation. It will instead raise the standard and motivate people to do more and work harder. In his book, *Enough,* McKibben (2004) addressed issues with bioethics, and questioned whether or not there is an end state that will ever be enough.

Many advocate that there may be exemptions for certain groups of people, such as surgeons and soldiers, allowing them to use cognitive enhancers legally and ethically. However, Goodman argued then that those who participate in the realms of art or philosophy should also be granted exemptions. In these fields it is the end state, the painting or theory, that people care about, not the process by which one achieves this product (Goodman, 2010). Chatterjee, with a forward thinking business mind, believed that in a world of enhancement, there would be fewer artists and more accountants (Armstrong, 2010). Goodman supposed that artists would also be enlightened and reach greater potential in their creative endeavors, which is contrary to Chatterjee's theory (Goodman, 2010).

Another argument regarding the character of those who use CEDs is that there will be no distinction between true accomplishments and false accomplishments (Goodman, 2010). Judy Illes (2006), associate at Stanford Center for Biomedical Ethics and Department of Radiology, and Stephanie Bird, associate at Massachusetts Institute of Technology, reported that cognitive enhancement causes more dispute over validity than any other area of neuroscience. People

should not be able to take credit for accomplishments that were not completely done in their own strength. People in this school of thought believe that surgeons who may perform operations under the influence of cognitive enhancers should be mandated to make that known to the public. Goodman argued this point from the perspective of influence. He said that nobody is free from influence, and nobody can take full credit for their accomplishments whether they are under the influence of cognitive enhancers or not. He shared that this may even lead to a greater good. With the question of credit becoming less distinctive, people will judge accomplishments solely on their quality and no longer on who or what may have influenced it (Goodman, 2010).

Coercion

Coercion is an immense ethical concern when considering wide spread use of cognitive enhancers. Society has become so competitive that the pressure to excel and get ahead is both an internal stressor that people put on themselves as well as an external pressure that may be felt from people around them. Coercion from external forces may affect populations such as soldiers who are at war. They must stay vigilant in order to fight most effectively. However, the difference between a choice and an order becomes a gray area in these situations. It has also been suggested that airline pilots and surgeons who are required to focus intently for many hours could see a great benefit from the use of these drugs. There is some concern that this could become a stipulation for accepting a position in either of these fields (Chatterjee, 2004).

Coercion brings up ethical dilemmas in many professions. One of the most important discussions regarding this issue is among those in the Department of Defense in the United States military. Marten Meijer (2007), Human Factors and Medicine Panel Executive for the NATO Research and Technology Organisation, posed four important questions that must be asked while considering the ethical use of cognitive enhancers by those in the military and they

were: “Is the use truly voluntary? Is the medication safe for use in this individual in his operational environment? Is the use of the medication consistent with its dosage and pharmacological function? Have non-pharmacologic alternatives fully been utilized?”, (p. B131). He gave various scenarios in which these questions were applied and the ethically correct answer was that cognitive enhancers should be used. The most interesting scenario that he explained was if a military unit was surrounded by an attacking force and the surrounded troops could receive help for at least twenty-four hours, then it would be acceptable for the soldiers to take amphetamines to stay alert and awake to ward off the enemy. A scenario regarding this issue that is not hypothetical is that the night before the D-Day invasion, eleven million amphetamine tablets were given to Allied troops in what is known as the largest distribution of stimulants (Armstrong, 2010). It is important to keep the fundamental goal of the military in mind, which is to protect, defend, and use aggression when necessary (Meijer, 2007).

In order to generate the most combat power possible, it is important that soldiers train to their fullest capacity and prepare for the day when their lives and freedom depend on their level of combat power. Preparing for combat is not merely considered in terms of physical training, but a large portion of it is also obtaining as much information and knowledge as possible. In a military study done observing the correlation between sleep deprivation and cognitive function, it was found that after thirty- nine hours without sleep, soldiers showed significantly decreased vigilance that was able to be partially compensated by caffeine. Although cognitive enhancers may benefit soldiers in these specific instances in battle, long- term use or even use in training has not been supported. Furthermore, critics are concerned that cognitive enhancers will do more harm than good because soldiers will overestimate their abilities while taking the enhancers (Meijer, 2007).

Education has been referenced as the most basic form of cognitive enhancement. If schools and employers are allowed to require a certain educational level, would they also be allowed to require cognitive enhancement in the form of drugs before granting acceptance or offering a position? The United States military already has the power to order soldiers to take enhancers such as amphetamine and modafinil legally. Henry Greely and his colleagues of Stanford Law School asserted that policies to ban coercion should be implemented with limited exceptions to a few necessary professions. As the evidence concerning enhancers became more substantial over time, the legislation could lessen their regulations and allow general use. New laws do not need to be created, but current laws should be edited to include relevant issues, such as cognitive enhancers (Greely et al., 2008).

Justice

Justice and equality are also of great ethical concern pertaining to cosmetic neurology. There are concerns that those who already have high cognitive functional capabilities will increase exponentially, while those with lower cognitive capabilities will only reach the standard of today. Furthermore, due to the expense of these cognitive enhancing drugs, they could cause an even greater disparity between the rich and the poor. As people who can afford these drugs acquire a higher learning capacity, attain increased wakefulness, and become more productive, they will find more ways to make money (Sahakian & Morein-Zamir, 2010).

Many people have argued against those who purport inequality and suggested that many studies have shown that people with lower cognitive abilities receive greater benefit from cognitive enhancement than people with higher cognitive function. Drugs cannot be categorized under the umbrella of cognitive enhancement, but each drug's efficacy should be tested for individual tasks. Bromocriptine, for example, has been found to increase executive function in

those with low working memory capacities, but it actually decreases executive function in those with high working memory capacities (Farah et al., 2004). Many people do not believe that inequality is a good enough reason to halt the progression of cognitive enhancement due to the fact that so many other aspects of society are distributed in unequal increments already (Turner & Sahakian, 2006).

John Harris (2011), professor of Bioethics at the University of Manchester, also shared that inequality is not an issue to be concerned with in this matter. He pointed out that candles were an early enhancement that had serious social implications. During this time, people worked and socialized while it was still daylight, and they went to bed when it got dark. After the creation of candles, people who could afford them were able to work through the night. They could also work all day, and socialize at night if they chose. Candlelight expanded people's abilities to the extent that they could afford candles, which was undoubtedly unequal when they were first introduced. This also introduced a sense of coercion as it initiated pressure on people who had worked all day to come home and read through the night because they now had the ability. Over time, candles were made to be more affordable and widely distributed, and a general expectation of working hours was established. Rather than outlawing candle use, the problems were solved with regulation and ensuring equality (Harris, 2011).

Some researchers and ethicists have even become concerned with thoughts of homogeneity due to cognitive enhancement. Modern day society is used to functioning on an unequal plane, and cognitive enhancers could result in a greater level of social equality. American society, as well as much of the world, is driven by competition and the need to get ahead. While there may be technological advances that lessen various societal disparities, nothing will ever remove them (Sahakian & Morein-Zamir, 2010).

Addiction

Frank Pasquale addressed the issue of addiction in regard to cognitive enhancers. He pointed out that addiction must be distinguished from virtuous commitment. He gave the examples that cocaine users are addicted to cocaine, but people who exercise regularly have made a virtuous commitment to exercise in order to experience well being. With the rise of cognitive enhancement he believes that the distinction between these two traits will be blurred. People will not be addicted to taking these cognitive enhancing drugs, but they will be virtuously committed to taking them everyday to perform consistently at their highest capability (Pasquale, 2010)

Researchers still do not know the long-term effects of cognitive enhancing drugs (CEDs), and therefore users should consciously be vigilant of signs of addiction and other effects. In order to ethically use CEDs, there must be constant evaluation of their effects, both negative and positive. Goodman (2010) believed that the use of CEDs is under reported).

Human Dignity

Before one can even take into account the ethics behind cosmetic neurology, he or she must consider the foundation upon which all bioethics are based. The concept that must always be kept in mind is the issue of human dignity. Dignity is a Latin term that translates as "worthiness for honor and esteem" (Schulman, 2008, p. 6). Humans are beings that deserve respect, not merely clusters of cells that are at the hand of researchers to do whatever they would in the name of science. Humanity differs from other creatures, and even ancient philosophers such as Immanuel Kant believed that dignity is the innate value of people that no other creatures possess due to the property of autonomy. Under his terms for dignity, an individual may not use

another to accomplish his or her own end, which he referred to as instrumentalization of human subjects (Kant, 1916). By this, he was a proponent of rational autonomy (Schulman, 2008).

Autonomy is a fundamental human right that should never be discounted or taken for granted. Turner and Sahakian argued that people often discount others' abilities to use sound judgment based on knowledge (Turner & Sahakian, 2006). It is important to note that even when cognitive enhancement does become possible and readily available, not everyone will want it. Most would agree that humans are creatures of free will, and although many people in today's society are driven by a desire to compete and outperform, there are those who are not. This is especially evident in those who measure virtue, not by comparing one's goodness to another, but in those who see virtue as a measure against a certain level of decency (Kass, 2008).

The concept of personhood has been challenged by the ideology of cosmetic neurology. Martha Farah and her colleagues observed that three primary aspects that make up personhood are essentially health, the ability to be productive, and finding worth in human life despite its flaws. They stated that these ethical dilemmas are not black and white with a right and wrong answer. Most decisions are right from one perspective and wrong from another (Farah et al., 2004).

The United Nations Educational Scientific and Cultural Organization (UNESCO) was established on November 16, 1945, and it was immediately ratified by twenty countries, including the United States. This was just after the end of World War II, and the organization was created in an effort to bring countries together and promote peace. UNESCO now has 195 member states. Their intention of bringing unity and peace is with the purpose to establish justice and equality of human rights for everybody in the world (UNESCO, Article I).

With the growing controversy about the relation of neuroscience to ethics and human dignity, UNESCO released a Universal Declaration on Bioethics and Human Rights in 2005. In this document they addressed the freedom that science and research have and the benefits that they have and have yet to bring about. However, they also emphasized that the primary goal, even when benefiting an individual, should always be to promote the wellbeing of humanity as a whole (Universal Declaration).

The aim of this declaration is not to set up policies for researchers around the world to follow, but rather, it seeks to establish a global framework by which each individual member state can create policies under the constructs of Article 2 of the Declaration. The purpose also falls under the umbrella of raising further awareness for human rights around the world, regardless of various conflicting cultures. UNESCO combated the apprehensions associated with homogeneity by highlighting their belief in respecting diversity (Universal Declaration-Article 12).

Other people do not accept ideas of cognitive enhancement because they consider it to be, "man playing God" (Kass, 2003, p. 287). They take what they believe to be the humble approach, and judge researchers as arrogant for even thinking that they can improve the Creator's handiwork. If this were applied to cognitive enhancement, it could then be applied to all forms of medicine. In seeking enhancement, humanity is not despising its current state, but finding ways to use their gift of knowledge in order to function at an even greater degree (Kass, 2003).

As much as people would like to keep religion separate from every aspect of life, it is an integral part of every person's ethical basis. Each religious system, whether it be Christianity or not, takes some position on human dignity directly or indirectly. The Judeo-Christian worldview

has taken the position that man is created in the Imago Dei or "image of God", and therefore they are the highest created beings on the earth. However, this is not to say that mankind does not possess a sinful nature. Human dignity is at the center of the balance between being made in the likeness of God with intelligence and creativity and using any means necessary in order to become more like God (Illes & Bird, 2006, p. 514).

Conclusion

Cosmetic neurology is the next step to allow this rapidly increasing world to move even faster. While there are still some issues that need to be addressed, scientists and neurologists such as Dr. Anjan Chatterjee are making great strides to turn this seemingly utopic idea into a reality. Philosophers and ethicists have also become involved as this is a matter that could potentially alter the way the world functions, and there may be negative repercussions along with the positive effects. Since cosmetic neurology is an optional enhancement rather than a therapy, there is no need to incur negative effects. As scientists, ethicists, and lawmakers continue to work together, cosmetic neurology draws closer to becoming a practice rather than a discussion.

The objective of the investigative research was to determine what percentage of students know other students that are abusing ADHD medication (taking it without a prescription, in larger doses, or more frequently than prescribed), what those who abused ADHD medication expected the results to be, and what results they actually saw. The survey also inspected the students' perception on advantages to taking ADHD medication, and their perception of themselves both academically and socially. The researcher's hypothesis was that non-Liberty students would have a significantly higher incidence of knowing students involved with ADHD medication abuse, and those who abused ADHD medication expected and saw increased concentration while doing schoolwork.

Method

Participants

In the fall of 2011, a convenience, snowball sample of undergraduate and graduate students that the researcher had e-mail contact with were asked to participate in the anonymous web-based survey and send the e-mail with the participation request to other undergraduate and post- graduate students. There were 82 students who consented to participate in the survey; 71% were female. There were 76 students who indicated which college or university they attend, and 53% were Liberty University students whereas 47% were not. There were 18 of the 82 students that answered who said they lived on their college campus. The average GPA of the participants was 3.46.

Instruments

This was a web-based survey in order to maintain anonymity. It was modeled after a survey that was used by a group of experts who then published the method and results in the *Journal of Attention* (Rabiner et al., 2009). I received permission to use the survey, and it was emailed to me from one of the co-authors. The first questions were about demographic information, the second questions assessed the diagnosis of ADHD, the use and type of ADHD medications, as well as the misuse of ADHD medication. The third set of questions assessed the motives for taking these medications using a rating scale of 1 (never) to 5 (always). The fourth set of questions assessed the perceived effects after taking the medication using the same scale, and also asked participants to rate the overall effect as 1 (very negative) to 5 (very positive). The fifth set of questions assessed the perceived side effects that the person experienced. The sixth set of questions assessed the ADHD symptoms that the patient reports experiencing by having him or her rate his or her level of agreement with various statements. The survey then addressed

the number of students the participant is aware of that take ADHD medication without a prescription, the various ways they obtain these drugs, if they experienced any negative effects, and whether there is a perceived academic advantage. Alcohol, tobacco, and illicit and prescription drug use were questioned after that. Various risk-taking behaviors were addressed as well as the participant's perception of his or her own task completion and attentiveness for various academic behaviors. Then various questions were asked about the participant's perception of his or her social life. Lastly, participants were asked about their personality traits. All together, there were 173 questions that could be asked, but participants were directed to various questions in the survey depending on the answers they gave to certain questions.

Procedure

The anonymous web-based survey was sent as a link in an email to 247 people that the researcher knew in various universities in the United States. These people were then asked to send it to people that they knew in various universities. The first question in the survey regarded their agreement to participate in the survey after reading the informed consent page, which included information about the type of questions that would be asked, the purpose of the survey, and the guarantee of maintaining confidentiality. If they answered yes, they would continue on to the survey, and if they answered no, it would take them to the final page thanking them for their time. The participants were not compensated for participation in any way. The data collection period took place between November 27, 2011 and December 6, 2011, and 82 students responded during this time. The data collector was based at Liberty University, however all of the data collection was done online.

Results

The survey showed that 14% of the students who participated had taken a prescribed dose of ADHD medication in the past six months, and that 62% of those students have abused ADHD medication (taking a larger dose, taking it more often, or taking someone else's). Of the sixty-five people who answered the question, 12% reported that they had abused ADHD medication at some point within the last six months to concentrate better while studying. This was the most common reason for abusing ADHD medication, and it was also tied with better concentration in class as the most noticed effect for 15% of the sixty-three people that answered these two questions. While there were some minor side effects reported, 0% of students reported any negative side effects that resulted in them seeing a doctor or visiting the Emergency Department. While only 22% of students stated that they felt having a prescription for ADHD medication gives a student an academic advantage over other students, 56% answered that students who took ADHD medication without a prescription had an academic advantage. The study showed that of the students who answered the question and attend Liberty University, 58% know students who have abused ADHD medication. However 68% of students at the other four-year universities who answered the question stated that they knew people who abuse ADHD medication. Furthermore, 17% of the Liberty University students who responded to the survey had been diagnosed with ADHD, but only 11% of students who went to other four- year universities had been diagnosed with ADHD.

Discussion

This data collection process was helpful in assessing the use and perceptions of ADHD medications in college students. This survey contributed to the research showing that nonmedical use of ADHD medication is frequently occurring on college campuses across the

country. This survey also used a different sample of college students than the original survey utilized. Dr. Rabiner reported that a national study of 119 colleges showed that 10% of colleges had incidence rates of 10% or higher. This survey showed that 61% of the students who participated know students at their school who use ADHD medication for nonmedical purposes. At Liberty University, a Christian university, 58% of the students who participated in the survey reported knowing students who misused ADHD medications. The 12% of students who reported that their motive for abusing ADHD medication was to concentrate better while studying correlated with the research findings of other surveys about nonmedical use of ADHD which found that the most frequent motive was to enhance the ability to study. The survey also contributed to the research that the negative effects of nonmedical use of ADHD medication rarely leads to an emergency room visit. Of the 62 students who answered the question, 0% reported visiting the emergency room as a result of abusing ADHD medication. Another survey also reported that in a sample of over 3,000 students, only one reported visiting the emergency room as a result of abusing ADHD medication. The means by which students are obtaining these medications is also a problem. The survey showed that 84% of students who know students that abuse ADHD medication reported that the students abusing the ADHD medication had it given to them from someone who did not have a prescription. This varies from other research showing that the most common way for students to acquire ADHD medication was for a student with a prescription to give it to them. However, the survey did report that a high number of students attained ADHD medication from students with a prescription who gave it to them. Of the students who know other students who abuse ADHD medication, 67% reported that those students receive it from students who do have a prescription (Rabiner et al., 2009).

Limitations

There were many factors to this study that separate it from other research. The author did not provide the survey in its entirety. He sent me the questions, but the answer choices were not displayed, and several questions had to be changed. Due to this fact, the validity and reliability of the survey changed, and I was unable to attain this information for my survey. Although it was conducted among students across the country, the sample size was small at only 82. Of the 82, fewer people answered each question as the participants were able to skip questions they did not want to answer. Also, the survey was sent to people that the one conducting the survey had contact with and they sent it to other people that they knew.

Future Research

In future research I would like to be more focused with more objective questions about ADHD abuse, awareness of ADHD abuse, and perceptions on future possibilities concerning the availability of cognitive enhancers. I would choose to include fewer ranges concerning the likelihood of agreement on motives and emotions concerning ADHD use. I would also like to track the total number of participants to whom the survey was sent.

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