Adderall, Attention, and Ethics of Amphetamine Use

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Would you let yourself or your child take amphetamines?

Hopefully not, but the reality is that these drugs are prescribed to children and adults every year for attention disorders and narcolepsy. Interestingly, attention disorders occupy an area of science and medicine that has fallen under mush skepticism and criticism since the early 1970s until present times. Namely, speculation has been directed at the nature of these disorders and even questions if they actually are legitimate pathological conditions. For example, there were many arguments made in the early 2000s that questioned the validity of the conditions' diagnosis as well as the practices of psychiatry in general, especially with respect to prescribing psychostimulants to young children. In recent years, we have also seen an alarming increase in amphetamine abuse in academic contexts, as students use the drugs to increase their focus for extended periods of time. I find both the prescription of these drugs to children and their abuse in academics troublesome and wish to address the science and ethics behind these issues.

Since this discussion is still controversial with respect to science, I do not wish to inquire into the nature or causes of attention disorders, theorize about mechanisms of drug action or biological effectiveness. Instead, I wish to discuss the apparent lack of understanding about the drugs involved in treating attention disorders, especially considering many of these drugs are

prescribed to developing children and abused in academic and recreational settings. We will need to say something about pathology to discuss these points, however the reader should know that I am not an expert on the topic, nor do I wish to make any original arguments in these areas – I will simply present relevant literature. Rather, I wish to address the drugs used, the current understanding of their mechanisms and the ethical and health concerns therein in the context of attention, that is, how they are relevant to the treatment of attention disorders and the use 'study drugs' in academic contexts.

What is ADHD and how is it treated?

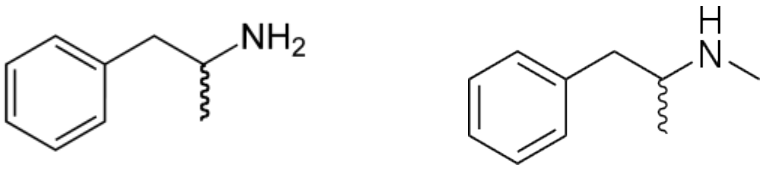
Attention-Deficit Hyperactivity Disorder (ADHD) is one of the most common attention disorders diagnosed in children with symptoms that include persistent hyperactivity, inattentiveness and impulsivity.[1,2] Biologically, the exact pathology of ADHD is ill defined, but studies argue that it involves reduced activity of the neurotransmitter dopamine (which is involved in 'fight or flight' responses and sensations of pleasure and reward) in the frontal lobes and basal ganglia of the brain.[3] Additionally, genetic studies have described an association between ADHD and human dopamine transporter (*dat*) genes, suggesting a heritable or mutative cause of dopamine dysregulation.[4] Clinically, ADHD is often treated by prescription of various types or combinations of different amphetamines, and these drugs provide relief of symptoms for nearly 80% of patients.[1,5,6,7] Adderall is a commonly known and widely prescribed ADHD medication for this purpose. This drug is a combination of two types of amphetamines: dextroamphetamine and amphetamine.[8] These compounds are stereoisomers of one another, meaning that they are related as mirror images, just as our right and left hands are related. Thus, for our discussion we can understand these substances to act similarly in brains.

What is an amphetamine and what does it do?

Since these drugs are widely prescribed to treat ADHD and are also a source of performance enhancement in academics, we ought to inquire further into their nature. It will be helpful to understand exactly what kinds of chemicals are making their way into human brains, exploring how and why they appear useful and destructive in both contexts. There are several important plain facts at the biological, chemical and psychological levels that I believe may go unnoticed to many in both medical and academic instances of amphetamine usage, and I seek to inform the reader on current understanding in this area.

Basically, an amphetamine is a chemical stimulant. It increases overall activity in the nervous system, putting the system into overdrive so to speak. Caffeine also belongs to this category of drugs. In the context of our discussion about attention, stimulants are referred to as psychostimulants, and act in the central nervous system (namely, the brain) to induce alertness and wakefulness in the user, as any coffee drinker will admit. This then, makes stimulants relevant for treatment of ADHD and related disorders, as these drugs can improve focus and attention in the user. Amphetamines accomplish this by increasing dopamine levels in the brain, reportedly through blocking transportation of dopamine from chemical from synapses between neurons, thus flushing parts of the brain with the chemical.[9]

Amphetamines are part of a larger group of chemicals called phenethylamines, a class of chemicals that are known for their psychostimulative effects by mechanisms involving dopamine transport as discussed above. These and many other similar drugs, particularly methamphetamines, are FDA approved psychostimulants for ADHD treatment and produce similar observable psychological effects. This being said, we should appreciate that the commonality in observed effects of these drugs is also reflected in their in chemical structures:



amphetamine methamphetamine

Figure 1: Chemical Structures of Amphetamines

All the reader needs to know to understand these diagrams is the following: solid lines represent chemical bonds (of which there can be two), N means nitrogen, H means hydrogen, the absence of a letter indicates a carbon atom. Zigzag lines are variable, nonessential chemical groups.

However, the reader may know the above-pictured methamphetamine more readily by its common name – "crystal meth," a form of synthetic amphetamine that makes its way onto the streets. Chronic users abuse these synthetic drugs for their induction of euphoria, while those seeking cognitive enhancement seek the affects on attention provided from prescription attention disorder drugs. The consequences of abusing these drugs are very serious in both contexts, namely physical and psychological dependence that can lead to addiction and severe withdrawal symptoms after long-term usage and potentially psychosis.[10,11] Clearly, these medications are dangerous in the wrong contexts and doses, thus forming a preliminary point about the ethics of their abuse.

Is there a functional relationship between prescribed and synthetic substances? In cognitive enhancement cases, the types of abused amphetamines abused illicitly are usually identical to their prescription counterparts. Comparatively, chronic drug abusers often turn to synthetic compounds sold illicitly. Considering this, the chemicals abused may differ slightly in structure, but their function and effects remain the same regardless of being prescribed or synthesized in an illegal manner. Skeptics may

argue that these chemicals are structurally different, thus making my assertion invalid, however, let us consider consider a class of structural homologs ("homology" meaning sameness) that millions of people use daily in place of a natural compound in the human body: synthetic insulin. Although insulin is a natural protein (a biological macromolecule constructed from chains of molecules called amino acids) and much larger molecule than any phenethylamine, the analogues used in diabetes treatment differ in composition from the natural compound by one or more amino acids, just as methamphetamines and amphetamines only differ by a few constituents from each other and their illegal synthetic analogues. Like in the case of insulin, they can produce very similar effects inside the human body. Is it then not valid to realize that a substance not terribly unlike that in the hypodermic needles of drug abusers is making its way into the brains of children and students? The truth is evident, and considering recent efforts to diagnose attention disorder at earlier ages and the prevalence of its abuse in academics, it ought not go unnoticed.

Are prescription amphetamines warranted?

My purpose to this point was to make the reader aware of the facts, and now we can enter the discussion of the ethical concerns of these issues. First let us consider amphetamine use in a medical context. It is understood that drugs like Adderall can alleviate symptoms of attention disorder in these cases. Rather than refuting this use of amphetamines through complicated biological arguments, I want to make an appeal to the symptoms that serve for the basis of diagnosis in these cases. Recall that symptoms of ADHD include inattention, hyperactivity and impulsivity. However, this list of characteristics reads more like the typical character of a young child rather than the symptoms of a disorder – in fact, it seems perfectly *in order* from a behavioral standpoint. A parent should not be worried if their child is interested in everything around them, but worried if a

child exhibits sedative, uninterested behavior. Often times, it seems we are making a conclusion about a child's cognitive and mental states and a decision to medicate with serious chemicals exclusively from observations of behavior, which also seems flawed. Until better testing for conditions such as ADHD are implemented and more definitive biological markers or symptoms are identified, we out to have trouble accepting that we should continue to treat attention disorders with amphetamines so readily.

Given the clearly vague understanding of the causes and pathology of attention disorders, the use of chemicals such as amphetamines and other psychoactive drugs to treat disorders in children is questionable at best. Although symptoms may be alleviated, we cannot be sure of the long-term effects of such drug use, nor how it is affecting children developmentally. Let us also not forget that the use of such drugs is also altering the perception of the children they are prescribed to, and perhaps in a negative way. Although we cannot communicate with the youngest of children, personal accounts of older individuals medicated for attention disorders with these drugs report thoughts, feelings and character of experience quite different from sobriety as well as undesirable effects when the drug is clearing their system. Given our expanding wealth of scientific knowledge, we ought to be more critical and cautious about chronically inducing altered consciousness in young people and children through the use of psychoactive drugs.

What justifies classifying children as cognitively disordered at younger ages?

Development clearly progresses rapidly and stepwise, especially in the early stages of life. Further, our understanding of the developing brain is in its infancy, thus providing more reason to less aggressively treat attention disorders with psychostimulants. Conceivably, a child may exhibit a certain biological motif at one point in development that is resolved or changed at the next stage in

growth. Again, the neurobiological facts about attention disorders remain unclear, which further lends credence to criticizing our apparent need to prescribe amphetamines to children. If anything, we should take a more reserved stance on chemically interfering with development given our increased knowledge of molecular genetics, developmental biology and chemical induced mutations. In this respect, we are readily discovering that many different compounds can interfere with gene expression and it is ignorant to think that the compounds in question could be inhibiting the function of essential developmental genes or activating inappropriate ones by saturating the brain with dopamine and other downstream products. However, since this treatment modality is relatively new, we will not fully understand its consequences until significant numbers of people prescribed amphetamines at early ages have reached a definitive point in cognitive development. Even then, can we argue that such a person would have lived a worse life without medication?

Can anything be done to reduce the use of prescription amphetamines?

Not surprisingly, there are alternative behavioral strategies to working with children with the symptoms of attention disorders. Notably, these approaches involve deliberate and structured behavioral intervention and human interaction toward children with ADHD symptoms rather than psychostimulants drugs. These methods include behavioral parent training and classroom management that educates parents on dealing behavioral problems and addresses learning deficits by working more closely with children with attention deficits.[12,13] Tackling attention disorders from a behavioral standpoint prior to any drug use seems both logical and conceivable. There seems to be no apparent reason that a child exhibiting unfocused attention, impulsivity and inattentiveness cannot be coached and taught to focus more strongly by behavioral reinforcement before they are

prescribed psychoactive drugs. In sum, it is evident that while prescription amphetamines may be a sufficient treatment for attention disorders, it is certainly not necessary.

What about cognitive enhancement?

Studies have shown that rates of non-medical use of prescription psychostimulants ranges from 0 to 25% at United States colleges.[14,15] However, we should consider that these statistics are self-reported, so actual figures may be more impressive. Given that there are approximately 20.1 million college students in the United States, this corresponds to as few as about 100,000 (5%) to up to 5.1 million (25%) students who use psychostimulants such as Adderall in the United States alone.[16] The advantages of psychostimulants use to these millions of students are clear: heightened focus and the ability to work unwaveringly by ingestion of a small capsule. Considering the previous arguments, is this not as impermissible as performance enhancement in other arenas and abuse of drugs in general? Consider the recent publicity surrounding steroids in sports and the correlation is unambiguous. Like their athletic counterparts, students are employing the use of an illicit substance to improve their performance relative to those they are in competition with. This gives stimulant users a clear advantage over their nonuser counterparts in that they can simply pull more intellectual weight due to the cognitive effects of drugs like Adderall. In a society where academic performance is ever increasingly becoming the standard parameter on which students are judged, stimulant use is a clear unfair advantage. Nevertheless, this behavior is also physiologically self-injurious for the user and can have undesirable long-term consequences that are not immediately apparent.

What could be done about non-medical prescription amphetamine abuse in academics?

Unfortunately, intervention in an illicit amphetamine use for cognitive enhancement is much more difficult that in the medical context. In the former, we are dealing with sporadic unapproved drug use that often goes largely unnoticed by physicians and family members. As such, it would be up to the student or their peers to employ behavioral intervention tactics to combat their abuse and foster genuine academic conduct honestly. However, if this were possible, an individual would conceivably have been no reason to continually abuse amphetamines in the first place. Alternatively, a student abusing performance enhancing prescription medication could realize their behavior and seek professional help. However, there remain instances where students continue to use prescription amphetamines for an academic advantage regardless of physio-psychological consequences, and thus academic institutions must intervene at this point as a governing body. In a time where the number of psychostimulant prescriptions written per year have been increasing since the 1990s[17,18] and the illicit use of such medications will certainly rise in accordance. Educational institutions must take aim at performance enhancement by prescription drugs with conduct codes and strict prohibited use policies. Regular student testing would be unrealistic at universities, but higher education ought to make it a priority to address this issue given the consistently increasing dependence on grades for admission to graduate or professional schools and in the job market. Honest students are competing with opponents who will stop at no cost to improve their performance and simply cannot unlock the supernatural cognitive abilities attained by those studying with illicit supplements. Remaining ignorant to the issue will only exacerbate the problem, as more students are likely to try their hand at cognitive enhancement as pressure and prevalence builds.

At least, I hope I have bestowed upon the reader a new sense of clarity with respect to the many details underlying psychostimulants and their use in medical and academic contexts. The

objective of this piece is to increase awareness and provoke thought about a topic that has truthfully become pervasive in our high schools, universities and doctors' offices. It is also eminently relevant to our health, minds and brains. Although science may still be refining its ideas about more concrete details pertaining to the biology of what was discussed, the arguments hopefully present a clear demonstration that willful ignorance of the issue at hand is irrational.

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