

Stimulant Misuse: Strategies to Manage a Growing Problem

Donald E. Greydanus, MD

Professor

Pediatrics and Human Development

Michigan State University College of Human Medicine

Kalamazoo Center for Medical Studies

Sindecuse Health Center

Western Michigan University

Kalamazoo, Michigan

Individuals diagnosed with attention-deficit/hyperactivity disorder (ADHD) as children are increasingly likely to continue receiving treatment—usually in the form of prescription stimulants—into their later teenage and young adult years. In addition, many people are also diagnosed with the condition during their high school and college years, which has led to a growing controversy over the extent of prescription stimulant use for ADHD. These concerns revolve around the notion that greater access to prescription-grade stimulants in the general population has led to a greater potential for their misuse. This article reviews information about the use and misuse of stimulants among high school and college students and offers recommendations to school health officials on recognizing the signs and symptoms of stimulant misuse, education on the risks and benefits of stimulant use, and opportunities for prevention of misuse.

Approximately 4% to 10% of high school and college students suffer from attention-deficit/hyperactivity disorder (ADHD).^{1,2} Prescription stimulants (eg, methylphenidate or amphetamines) are the most common pharmacologic treatments for ADHD. Stimulants are classified as Schedule II drugs (ie, providing positive medicinal effects but also considerable abuse potential). The Controlled Substance Act mandates that Schedule II drugs may only be used if the drug is provided by a prescription written and signed by a licensed practitioner, and also dictates that a refill is only permitted if the patient returns to the practitioner for further assessment.^{3,4}

Recent observations and academic research suggest that inappropriate use of stimulants in adolescents and young adults, both with and without clinically diagnosed ADHD, is a grow-

ing concern. Stimulant misuse of these medications is often predicated on students' misconceptions or a simple lack of knowledge on the associated risks. Indeed, many consider stimulants—whether obtained by prescription or illicitly—a convenient option to improve performance or to induce euphoria.

There are 4 main types of stimulants used for the treatment of ADHD—the most commonly used options are amphetamines (mixed amphetamine salts immediate- and extended-release) and methylphenidate (osmotically-controlled release oral delivery system, diffucaps methylphenidate, spheroidal oral drug absorption system methylphenidate long-acting). Dextroamphetamine is another of the 4 main types of stimulants.

Amphetamines. Amphetamine products have been used as medication since the early 1880s, and the abuse potential for these products has been observed and studied for nearly 100 years.^{5,6} Amphetamine misuse is considered to be principally related to the drug's euphoria-inducing effects.⁶ Users' desire to achieve euphoric effects frequently involves administration of high doses, which increases the risk for compulsive abuse.⁷ Chronic amphetamine abuse has been shown to result in malnutrition, paranoid schizophrenia-like mental illness, sleep deprivation, cerebrovascular accidents, and death.^{6,9} Specific amphetamine disorders (eg, amphetamine dependence and amphetamine abuse) and amphetamine-induced disorders (eg, amphetamine intoxication, amphetamine withdrawal, amphetamine intoxication delirium) are described in the American Psychiatric Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)* classification.^{6,8-11}

Table 1. DSM-IV-TR Criteria for Substance Dependence¹¹

Meeting 3 or more of the following criteria classifies an individual as substance dependent

- Tolerance
- Withdrawal
- More drug consumption than intended (in overt amounts or time of abuse)
- Consistent longing or craving to control the abuse or failed attempts for control
- Persistent drug use despite knowledge of its negative consequences
- Spending excessive time in finding the drug or recovering from its use
- Reduction in positive living (ie, less time in class or at work)

DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision.

Methamphetamine, now infrequently prescribed for ADHD, has the greatest addiction potential of the stimulants and is currently difficult to obtain by prescription in many places in the United States. Methamphetamine and 3,4-methylenedioxymethamphetamine (MDMA) abuse has become a serious problem in many parts of the world, including the United States.^{6,9} Street names for amphetamine include speed, meth, and chalk; names for methamphetamine include crank, fire, glass, meth, and chalk.⁹ Street names for MDMA include ecstasy, dex, essence, diamonds, lover's speed, Adam, X, bean, and others.⁹

Methylphenidate. The US Drug Enforcement Administration (DEA) has stated that methylphenidate confers a “high potential for abuse and produces the same effects as cocaine or the amphetamines,” and cases of oral, intranasal, and intravenous abuse of the drug are well documented.^{3,12,13} Although misuse of methylphenidate is considered to be less common than that of amphetamines, methylphenidate misuse may be underreported.¹³

The notion of tolerance to methylphenidate remains controversial, and is usually described in those who have been taking the drug at high doses over a period of several months or years.¹ There are no well-controlled studies examining methylphenidate tolerance; anecdotally, however, clinicians and patients describe situations where decreased efficacy of methylphenidate, in addition to psychological dependence, appears to occur.¹⁴ Street names for methylphenidate include vitamin R, the smart drug, R ball, the cramming drug, and poor man's cocaine.^{9,15} Depression may develop in students taking amphetamines or methylphenidate, and those taking either of these medications should be monitored for mood changes.¹⁶

The potential for misuse has made the prescribing of stimulant medications for the management of ADHD symptoms in high school and college students an area of some controversy. Awareness of this potential risk has encouraged clinicians to evaluate students presenting with ADHD symptoms with a more critical eye so as to ensure appropriate ADHD diagnoses. In order to provide guidance to school health officials—who

are responsible for addressing the needs of students with ADHD while discouraging misuse of stimulant medications—the remainder of this article will review information about the use and misuse of stimulants, offering recommendations to school health officials on improved recognition of signs and symptoms of stimulant misuse, and addressing student education on the risks and benefits of stimulant use, and opportunities for misuse prevention.

Defining Substance Misuse, Abuse, and Dependence

Initial misuse of a stimulant medication—taking a stimulant not prescribed by a physician or in a manner not in accordance with physician guidance—is frequently the prelude to chronic abuse (ie, use of nonprescribed doses nearly every day) or to drug dependence. The APA's *DSM-IV-TR* views substance abuse as a mental disorder involving the use of a substance to a point that induces considerable dysfunction in the life of the abuser.¹¹ In the life of a student, medication abuse may impair his or her ability to achieve maximal success in school and to maintain social relationships. Abuse may also continue unabated even as abuse-related issues worsen. Such issues may include falling grades or overt academic failure, increased violence, legal troubles, overdose, and other compounding complications.

Dependence may be diagnosed if the abuser qualifies for at least 3 of 7 *DSM-IV-TR* criteria for substance dependence (**Table 1**).¹¹ As the abuser builds a tolerance to a substance, the usual drug dosage provides less of the desired effect and increased amounts of the chemical may be necessary to achieve the same effect, often compounding the negative physical effects of the drug and increasing the potential for overdose.

Prevalence of Stimulant Misuse

Nonmedical use of prescription medications represents the second most common form of illicit drug use in the college population, second only to marijuana use and abuse.¹⁷ According to the University of Michigan's Monitoring the Future study, college students report a 5.7% rate of nonprescription methylphenidate use in contrast to 2.5% in noncol-

Table 2. Reasons/Rationale Why Individuals Misuse Prescription Stimulants

- Achieve a euphoric state
- Increase mental alertness
- Increase energy level
- Ease of obtaining these medications from peers or clinicians
- Reduce the pressures of academic life
- Seen as a part of a plan to improve poor grades
- Unsolicited “gift” from other students (eg, for sex or friendship)
- Belief that it is a safe practice
- Selling these medications to make money
- Consistent with a lifestyle of polypharmacy (illicit and nonillicit)

lege peers.¹⁷ A 2001 study of 10,904 college students using self-reports identified a 6.9% lifetime prevalence of nonmedical prescription stimulant misuse, including a past-year prevalence of 4.1% and a past-month prevalence of 2.1%.¹⁸ A recent study by Teter et al of 9161 undergraduates reported an 8.1% lifetime prescription stimulant abuse rate among college students, including 5.4% over the past year.¹⁹ A smaller study found that out of 179 college males and 202 college females surveyed, 17% of males and 11% of females had engaged in illicit prescription stimulant misuse.²⁰ According to a 2002 survey of a single US college, 35.5% of undergraduates reported using stimulants without a prescription, with greater frequency occurring in males compared with females.²¹

Obtaining Stimulants Through Illicit Means

Amphetamine and methylphenidate products are acquired in a number of ways, such as from classmates, friends, clinicians, or through the Internet. School health officials should be aware that students misusing stimulant medications may employ various means to gain access to these medications, such as stealing pills from a teacher’s desk (when a teacher is chosen to dispense medication to students), making arrangements with or exerting pressure on a classmate who has a legitimately prescribed medication, or presenting symptoms of ADHD at the college health center in an attempt to be prescribed a stimulant.^{20,22} The DEA reported nearly 700,000 methylphenidate doses stolen in the United States in 1996 and 1997.¹⁵

The diversion of stimulants is very common and can begin in childhood, adolescence, or young adulthood. One survey reported that 23.3% of middle and high school students taking prescribed stimulants had been solicited to divert their medication to others at a rate that increased from middle school to high school.²³ A review of 161 elementary and high school students prescribed the stimulant methylphenidate revealed that 16% had been asked to give or sell their medication to others.²⁴ A self-reported anonymous questionnaire administered to a random sample of Canadian students in grades 7, 9, 10, and 12 found that of the 5.3% of students who had used a legitimately prescribed stimulant over the previous 12 months, 14.7%

reported having given their medications to others, 7.3% had sold their medications to others, and 4.3% had their medications stolen.²⁵ Data have shown that the diversion continues among college students.^{5,18} A recent survey of 334 college students who were prescribed stimulants for ADHD revealed that nearly 29% had sold or given their medication to others.¹⁰

Reasons for Misuse

The motives for misuse and abuse of stimulants are numerous (Table 2). Studies have shown that students with and without ADHD misuse these medications to achieve euphoria.^{10,20} According to a survey of 334 ADHD-diagnosed college students taking prescription stimulants, 25% misused their own prescription medications to get high.¹⁰ Students may also use stimulants to help cope with stressful factors related to their educational environment. Pressures such as a persistent desire to succeed academically, erratic and poor sleep habits due to large workloads, and the persistence of underlying social and financial demands may place students at an increased risk for misuse of various drugs, including stimulants.^{19,20,26} Students often assume these drugs are safe to use for improving their energy levels, increasing their capacity for concentration, enhancing school performance, or for recreational use, while lowering their desire for sleep.²⁶ Stimulants are especially popular at the end of a school term when students will often use the drugs to stay awake through the night to study for exams or complete academic projects.

Any type of student may misuse stimulants, but there may be an increased risk among students with low grade-point averages (or an average that falls below a student’s personal standards) or those at very competitive schools.¹⁸ Athletes may see stimulants as a way to help maintain physical fitness for their competitive sport or to improve their concentration.²⁷ Men appear to be more likely than women to misuse these drugs, but both sexes show similar motives for drug misuse.^{18,19}

Relationship of Stimulant Use to Substance Misuse

A frequent concern regarding the use of stimulant medications is that their mechanisms of action, which provoke

changes in dopamine regulation in the central nervous system, may increase the risk for overt, illicit drug abuse. However, research points to the conclusion that people of any age receiving a medication for ADHD have no greater risk for illicit substance abuse compared to the general population.²⁸⁻³⁰ A meta-analysis of research studies concludes that there is a 50% reduction in later-life use of illicit drugs by those who have been prescribed stimulants in comparison to peers without ADHD.³¹ One study observed that adolescents with ADHD who went untreated had a 3 to 4 times greater rate of illicit substance abuse patterns than those adolescents whose ADHD was treated with stimulants.³²

A 13-year follow-up study of 147 individuals with ADHD confirmed data from 11 previous studies observing that illicit drug use in adulthood is not associated with childhood stimulant treatment of ADHD.³³ A subsequent study examining adults who were prescribed stimulants as children also noted no increase in substance use or abuse patterns at a mean follow-up age of 26 years.³⁴ Some research suggests a protective effect in which those who use prescription stimulants to manage their ADHD are less prone to using alcohol, cigarettes, marijuana, hallucinogens, or other drugs.^{10,30} Thus, it may be concluded that while stimulant abuse warrants caution in prescribing to avoid inappropriate use of these medications, withholding stimulants from legitimate ADHD patients may confer an increased risk of future drug abuse.

Stimulant Misuse Prevention: School-Based Modifications and Education

Drug misuse on high school and college campuses in the United States has been a challenging issue for decades.^{6,9,35} While officials should be encouraged to improve their knowledge and resources for managing students who misuse these medications, treatment of overt stimulant addiction is difficult and prevention remains the most effective approach.⁸ **Table 3** outlines basic steps that can be taken by school officials to decrease the incidence of stimulant misuse on campus.

Education Highlights on the Benefits of Stimulant Use, Risks of Misuse. The medical literature provides abundant data to support the potentially positive effects of prescription stimulants for the majority of children, adolescents, and adults with ADHD. At the same time, many studies have revealed

the numerous adverse effects associated with these medications when they are used inappropriately. With the aim of preventing drug misuse, it is advisable that all students be educated on the medical, psychological, and legal consequences of illicit drug use and abuse. The misconceptions of many students regarding the safety and benefits of stimulants can be effectively countered with education about the potential adverse effects of these drugs, including drug dependence, abuse, tolerance, withdrawal, and overdose. Adverse effects associated with amphetamines and methylphenidate are listed in **Table 4**. It is important to note, however, that for students with an accurate ADHD diagnosis who are receiving physician-prescribed stimulant therapy, many of the listed adverse effects will likely be transient and may be mitigated by initiating therapy with a low dose and slowly titrating upward.^{1,16,36}

Since there are no long-term studies (ie, longer than 24 months) on the use of stimulants for the management of ADHD, precise long-term effects—either adverse or positive—remain unknown.³⁷ Nevertheless, it is clearly understood that addiction may result from abusing stimulants to achieve euphoria, especially if combined with alcohol.¹⁵ An overdose of stimulants can result in toxicity, especially when part of a polydrug abuse pattern. When combined with alcohol, methylphenidate produces the metabolite ethylphenidate, which can induce toxic effects while simultaneously encouraging more drug ingestion due to the drug abuser’s sensation of less drunkenness and an elevation in euphoria.^{12,38} Large doses of stimulants can lead to psychosis, seizures, and cardiovascular accidents, although sudden death is rarely reported in individuals taking stimulants.³⁹ If the drug is snorted, it can cause nasal cartilage damage and nosebleeds. Injection of stimulants is associated with increased risk of overdose, infection (including HIV, hepatitis B and C, abscesses, septicemia, and endocarditis), pulmonary embolism, retinal damage, and skin tracts.⁹

The ongoing availability and publicization of drug and alcohol abuse prevention programs may help offset the idea that drugs are a necessary and legitimate part of successful adulthood. Such programs should be aimed at teaching students to live successfully without resorting to drug use. Student athletes, in particular, should be apprised of the very serious consequences that can emerge when stimulants are used to improve

Table 3. Steps for Improving Management of Stimulant Misuse on the School Campus

- Recognize the existence of this problem; survey one’s campus environment
- Cooperation of university officials, health clinicians, college pharmacies, and local law enforcement officials
- Limit availability and access to prescription stimulants
- Educate high school and college students regarding the dangers of stimulant abuse
- Recognize signs of stimulant misuse and abuse and provide management options

sports performance.²⁷ Alcohol-free and other drug-free social, recreational, and extracurricular options and public service should be made available, providing students with opportunities to develop feelings of accomplishment and happiness within the community while free from the use of drugs.¹⁵

The Role of the Campus Health Center Clinician. The health center can serve as the hub of a drug abuse prevention effort to recognize, prevent, and manage prescription stimulant misuse and abuse among students.³⁵ College health center clinicians who prescribe stimulants (even if only refilling the prescription of another clinician) should be knowledgeable about ADHD and its treatments, should be able to recognize stimulant misuse as a serious problem, and should not be guided by preconceptions that stimulant misuse, abuse, and diversion are inevitable. Both clinicians and pharmacists need to be appropriately licensed to work with these drugs and observe DEA and local state laws for dispensing Schedule II drugs.

High school health officials can help prevent diversion and misuse by forbidding students to be in possession of ADHD medication on school property, and to require a parent, guardian, or other appropriate adult to be responsible for the delivery and removal of medications from the school health center. Medication should be administered to the student through the school nurse, with the name, prescribed dosage, and dosing schedule clearly labeled on the container. The DEA

recommends that school nurses keep a detailed log to monitor the treatment history and schedule of each student.²² In addition, healthcare providers wishing to access additional resources on stimulant abuse may benefit from visiting the National Institute on Drug Abuse website at www.nida.gov/NIDAHome.html.

Stimulant Prescribing Protocols. It is important that clinicians follow strict and appropriate protocols when prescribing stimulant medications to students. College health centers may develop their own policies for stimulant prescriptions, including limiting the amount prescribed and requiring appropriate medical documents for an ADHD diagnosis, although state laws regarding the number of dosage units per prescription should be observed.

National prescribing standards dictate that a thorough neuropsychiatric evaluation be administered to any person requesting stimulants for attention-deficit problems.^{1,5,40} It is advisable that school policies require students requesting refills of their stimulant prescriptions to supply evidence from the prescribing clinician that a neuropsychiatric evaluation has been performed supporting a diagnosis of ADHD. The student should also supply documentation from the prescribing physician confirming that appropriate monitoring, via recognized rating scales—such as the Conners' Adult ADHD Rating Scales (CAARS)²⁴—has verified the effectiveness of the prescribed stimulant. If supportive documents are not available, the student should be carefully evaluated and screened by the school health center.

It is important that students with prescription stimulants understand that they are the main source of diversion to other students, and should receive education in the prevention of stimulant diversion. Additionally, students should be advised to not exceed the manufacturer's dose limits for prescription stimulants. Students with past or active drug abuse patterns should not be prescribed stimulants, as they are more likely to divert their prescription stimulants.⁴¹ It is also important that athletes be warned that methylphenidate is banned by the National Collegiate Athletic Association (unless "medically warranted"), the US Olympic Committee, and the International Olympic Committee.^{15,27}

The current epidemic of stimulant misuse in the United States has led some drug abuse experts to recommend that prescribing for ADHD begin with longer-acting stimulant formulations or those that cannot be easily

Table 4. Potential Adverse Effects of Stimulants ⁴
Abdominal pain
Anorexia
Constipation
Depression (not common)
Dizziness
Dry mouth
Headache
Height reduction in growing individuals (transient, secondary to anorexia)
Insomnia
Jitteriness
Moodiness (irritability)
Nausea
Palpitations
Psychosis (rare)
Rebound
Stimulation of vital signs (ie, mild increase in heart rate and blood pressure)
Sudden death (very rare)
Tolerance
Unmasking of underlying tics or Tourette syndrome
Weight loss
Withdrawal

altered.⁴² Longer-acting formulations may obviate the need for students with ADHD to bring their medications to school. One long-acting methylphenidate product, osmotically-controlled release oral delivery system methylphenidate, has the added advantage of being formulated such that it is difficult to tamper with or alter the medication for nasal or intravenous abuse.^{9,28,41}

Recognizing the Student Who Misuses Stimulants

Health centers should aim to balance the provision of services for students possessing an ADHD diagnosis with the ability to recognize students who are misusing stimulants.¹⁸ Students illicitly using stimulants may present with a variety of signs and symptoms (Table 5). Clinicians should be aware that individuals who insist that only a large dose is effective may be diverting the drug for money or personal abuse. Unexplained clinical features that do not fit with previous health records should prompt suspicion for drug misuse activity as well. Demanding times within the academic year, such as during finals, may lead to increased demand for stimulants. More students than usual may visit health services presenting unexplained anxiety, irritability, excited speech, tachycardia, hypertension, and confusion. Students with various unexplained negative behaviors, such as extreme irritability,

depression, or violence, may be involved with illicit substance abuse, and prescribing stimulants should be avoided as these students are at increased risk for the development of stimulant misuse, abuse, and dependence.^{18,42}

Summary

Although stimulants have shown safety and efficacy in managing the symptoms of ADHD when taken in accordance with a clinician's guidance, there exists a significant potential for misuse. School officials, health centers, and students all play an important role in the prevention of stimulant misuse. As a result, education on the proper use of stimulants and on the signs and symptoms of misuse and the health risks associated with misuse is an imperative. ■

Table 5. Signs and Symptoms of Stimulant Abuse

- Anxiety and excited speech (may look like an acute panic attack)
- Anorexia (can be severe)
- Confusion
- Depression
- Increased pulse rate (tachycardia) and blood pressure (even overt hypertension)
- Increased wakefulness and physical activity
- Irritability
- Infections from intravenous drug use (endocarditis, hepatitis, HIV, others)
- Memory loss
- Paranoia and aggressive tendency (even violent behavior)
- Profound insistence on prescription refill
- Psychosis
- Tremors and convulsions
- Worsening academic performance

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