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ABUSE OF STUDY DRUGS: PREVALENCE, CONSEQUENCES, AND IMPLICATIONS FOR THERAPEUTIC PRESCRIPTION AND POLICY

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ABSTRACT

Recent concerns over the potential dangers of drugs that are used for Attention-Deficit/Hyperactivity Disorder (ADHD) have led to consideration of stronger warnings on pill box labels. These drugs are also being misused by approximately 4% of older teens and emerging adults (annual use). This paper reviews the current prevalence of ADHD drug use among young people, the consequences of use of these drugs, and implications of this information for improving the study habits of youth, drug abuse prevention and cessation efforts, and drug prescription policy.

Key Words: "Study drugs", drug abuse.

Drugs that are used to try to enhance one's study time have been referred to as "study drugs" or "cramming drugs," and sometimes "kiddy coke." Ritalin (methylphenidate) is the most widely used of these drugs and has been referred to as "Vitamin R", "Skippy", "the Smart Drug", "Smarties", "Poor Man's Cocaine", "West Coast", and "R Ball". While prescribed for sufferers of Attention-Deficit/Hyperactivity Disorder (ADHD), and costing approximately $0.50 a pill, pills can bring in $3 to $15 each when sold illicitly (Kapner, 2003).

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Potential overuse of stimulants has been a controversial topic in the media and government since at least 1970 (Safer, 2000) and has even produced its own references in popular culture. On the Chevelles's "This Type of Thinking (Could Do Us In)" album (Epic, 2004), lead singer Pete Loeffler wrote and performed "Vitamin R (Leading Us Along)," a song about a friend of his who suffered from Ritalin misuse. The Riddlin' Kids (2002)—a post-punk Texas band whose homonym avoided legal action and a first album called *Hurry Up and Wait*—were promoted as fired-up energy balls with a hyped-up stage antics, while 2004's "Ritalin Reading Series" on New York City's Lower East Side restricted creative writers to four-minute performances (Tavernise, 2004). Over the last decade, Ritalin has made guest appearances on *Dateline NBC*, *Good Morning America* on ABC, CNN's *Larry King Live* (featuring George W Bush's dyslexic brother and ADHD-diagnosed nephew explaining why Ritalin must be abjured), *48 Hours* and *Eye on America* from CBS, and Cleveland's WKYC-TV. These programs screened investigative reports and punditry on Ivy-League Ritalin abuse and drug dealing, emergency-room visits, and school complicity as a means of controlling conduct. PBS and AandE aired documentaries, with journalist Bill Kurtis intoning that Ritalin was challenging the very essence of childhood itself (Leo 2002: 58; House of Representatives, Subcommittee 2000: 14; Kurtis quoted in McDonald, 2001). The *New York Post* headlined the dangers of the "Ritalin Pusher," and the *New York Times* noted the panic (Montero, 2002; Zernike and Petersen, 2001). Several recent news articles have been published about potential dangers of study drugs, and in February 2006, a Food and Drug Administration advisory panel urged that the strongest possible safety warning (the "black box") be used on these drugs (Alonso-Zaldivar, 2006).

This review will describe the history of study drugs, their prevalence of use, potential negative consequences, and the debate over their use for prescription purposes. Alternatives to use of study drugs for students will be suggested. Implications for drug abuse prevention, cessation, and policy will also be discussed.

History and Current Status of Study Drugs

Amphetamines were first developed in the 1880s, and their capacity to stimulate activities has been known since the 1920s (Miller and Leger, 2003). Stimulants speed up the central nervous system, for as long as two to four hours on a single dose. Desirable effects induced by stimulants generally include euphoria, fatigue reduction, a "sense" of mental acuity, energy, and decreased appetite (Sussman and Ames, 2001). Stimulants were examined for their potential effects on keeping people awake (narcolepsy) and as a means of weight control, for depression, and for a paradoxical effect on decreasing hyperactivity among children. The only current primary clinical uses for stimulants are for ADHD and narcolepsy and, perhaps for a few people as a means of weight control (Sussman and Ames, 2001).

Methylphenidate (Ritalin) was first created in 1944 as part of a search for a non-addictive stimulant, and it was suggested as a means of regulating children's behavior in 1963, to control "hyperkinesis" among children (Freedman, Kaplan, and Sadock, 1976). Eventually such problematic behavior among children became labeled as "Attention-Deficit/Hyperactivity Disorder" (ADHD; APA, 2000). ADHD refers to a constellation of dysfunctions that hinder attention regulation, motor behavior, impulsivity, emotional

expression, and planning (Braun et al., 2004). Persons with ADHD may show hyperactivity/impulsivity, attention deficits, or both (three subtypes; APA, 2000). ADHD sufferers are more likely to engage in risky behaviors including drug abuse (Braun et al., 2004). Diagnoses in general are reliable though less so for the attention component than the activity component (Braun et al., 2004; Goldman et al., 1998; Safer, 2000).

By 1970, 15 different pharmaceutical companies manufactured over 30 kinds of amphetamine-related products. Eventually a very large ADHD drug market developed. The ADHD therapy market has always been dominated by stimulants. These currently include methylphenidate (brand names: Ritalin, Methylin, Metadate), demethylphenidate (Brand name: Focalin) and amphetamine preparations including D-amphetamine (Brand names: Dexedrine, Dextrostat), methamphetamine (Brand name: Desoxyn) and D,L-amphetamine (Brand name: Adderall). Methylphenidate preparations with a short duration of action have been the mainstay of the market. However, there are now extended-release preparations. They offer the benefit of once a day dosing to cover the full school day. The first to reach the market was Alza's once-daily methylphenidate formulation, Concerta, followed by Celltech's Metadate ER, and then Adderall XL, Shire's once-daily version of Adderall, a mixed amphetamine salts preparation. Adderall has attained approximately 36% of the United States ADHD market. Ritalin SR and Methylin ER also are marketed, as well as D-amphetamines (Brand names: Dexedrine, Spansule). These stimulants, particularly use of methylphenidate, are what are referred to as the "study drugs." While prescribed for youth and adults with ADHD to increase attention span and focus for the purposes of learning and better behavior, they are also misused in at least two ways. First, some researchers argue that lower doses of these drugs than are typically prescribed can be used to achieve the same effects (e.g., Pelham et al., 2005; Sonuga-Barke, Swanson, Coghill, DeCory, and Hatch, 2004). Second, people have observed the use of drugs among those not diagnosed with ADHD. Many use these drugs to help keep alert and concentrate as they prepare ("cram") for tests or complete term papers—hence the term "study drugs."

Public-Policy Dilemmas. More and more public schools now threaten parents with removal of their children from classes absent medication (Diller, 2000). And so some critics suggest that the psychologization and therapization of teaching have produced the rush to have people use Ritalin. These trends have turned educators towards diagnostics, such that schools are viewed as mental-health institutions. Conservative critics attribute this to egalitarianism in progressive educational philosophy, alleging that it makes teachers responsible for students' performance against a presumed *tabula rasa* of equal innate ability. They contend that this philosophy, along with pharmacology's displacement of old-style physical sanctions as a means of disciplining children, have encouraged educators to recommend that their charges be put on Ritalin (Livingstone, 1997). Additionally, it has been suggested that with the introduction of high-stakes testing into many states—in which funds are allocated to school districts based upon improvements in students test scores—counselors, teachers, and principals recommend Ritalin to parents in a desperate attempt to improve performance. Indeed, property values, jobs, and salaries can depend upon grades (Sax, 2000). Meanwhile, critics accuse the Federal Government of exacerbating the trend by creating incentives to define pupils as disabled, via special-education programs that support low-income parents and schools once children are diagnosed with ADHD (Murlowe, 1997). In 1999, the Colorado Board of Education resolved to discourage teachers from recommending the drug. The Ohio State Board of Pharmacy has expressed worries about these programs

heightening stimulant prescriptions, while both CBS's *Eye on America* and the Drug Enforcement Administration refer disparagingly to Ritalin as the fourth R in schools (House of Representatives, Subcommittee 2000: 11; Woodworth, 2000).

Congressional hearings were prompted by a story in the *Washington Post* entitled "Omaha Pupils Given Behavior Drugs," which raised the specter of mind control, and merged with popular concerns about diet to suggest a more natural form of treatment (Diller 1998: 30-31; Sandberg and Barton 1996: 3, 18-19). The House of Representatives, Subcommittee on Early Childhood, Youth and Families, Committee on Education and the Workforce (2000: 7) queried whether the problems of accurate diagnosis meant that youthful rambunctiousness or serious stressors like divorce or neglect saw Ritalin being prescribed erroneously. Congressman Bill Goodling said 'Ritalin may be the biggest drug problem we have in the country, and it drives me up the wall to see little children get hooked so early' (House of Representatives, Subcommittee 2000: 9).

Prevalence of the Use of Study Drugs

From 1990 to 2000, use of Ritalin increased five-fold in the United States, which consumes approximately 90% of all Ritalin (Schetchikova, 2002). As many as four million Americans take these medications, primarily or purportedly as prescribed by a physician for ADHD disorders (see APA, 2000). Approximately 10% of all 10 year old boys and 4% of all 10 year old girls receive them (Alonso-Zaldivar, 2006). Approximately 2.5 million ADHD medication users are children (0.5 of whom are preschoolers), one million are adults.

The Monitoring the Future research group has been studying the annual prevalence of use of Ritalin (as a stand-alone question) since 2001 (Johnston, Bachman, O'Malley, and Schulenberg, 2005). The annual prevalence among 8th, 10th, and 12th graders has averaged about 2.7%, 4.3%, and 4.5%, respectively, over the period from 2001 to 2004. Its use among college students has averaged 5.0% over this period, whereas its use among non-college young adults has averaged approximately 2.9% over this period. (About 25% of these users use Ritalin about once a month.)

Its use remains at approximately 3.5% through 24 years age. At 25 years of age its use decreases to 1.5% and then below 1% at 29-30 years of age. Thus, use of this study drug appears to peak from the ages of 16 to 24 years of age (older adolescence through emerging adulthood), following the same course of use as other drugs such as alcohol and illicit drugs. Males are relatively likely to use Ritalin (3.7% versus 1.6%), and use appears slightly higher in the southern states (2.8% versus 2.0-2.5%), and in very large urban areas (about 3.0% versus 1.9-2.7%). Amphetamines, which also may be used as study drugs, showed a National annual prevalence of 4.9%, 8.5%, and 10.0%, among 8th, 10th, and 12th graders, respectively, in 2004 (and 30-day use was 2.3%, 4.0%, and 4.6%, respectively) indicating that use of other amphetamine-like drugs may be of higher prevalence than Ritalin. Thus, Ritalin appears most likely to be used by male college students in large cities. Approximately 25% of Ritalin use is by persons over 18 years of age (Miller and Leger, 2003). Thus, while of lower prevalence per capita, many more preteens are Ritalin users.

Wu and Schlenger (2003) drew a study sample from the 1995 to 1998 National Household Surveys on Drug Abuse (n=1047, 12 years or older who reported nonmedical use

of stimulants in the past year). This was less than 1% of the US Household population 12 years or older. Arguably, most use of legal stimulants may be as prescribed (Goldman et al., 1998; Safer, 2000). However, among all past year stimulant users, 19% met criteria for stimulant dependence in the past year, and an additional 16% reported having one to two dependence problems. Adjusting for demographics and drug use characteristics, female stimulant users were an estimated 2.6 times more likely than male users to develop dependence. Stimulant users most likely to suffer stimulant dependence were those who began use early, and had used multiple drugs.

Medical Use of Prescription Stimulants in College Settings

Upadhyaya et al. (2005) studied 334 students at a local South Carolina college. Subjects with ADHD as ascertained by medication treatment of ADHD reported greater past-year tobacco and marijuana use. Among those with ADHD, participants with active ADHD symptoms were more likely to report past-year tobacco and other drug (besides tobacco, alcohol, and marijuana) use as compared to those without active ADHD symptoms. In addition, participants with active ADHD symptoms were more likely to have past-month "other" drug use as compared to those without active ADHD symptoms. Among those prescribed medications for ADHD, 25% reported ever using their medication to "get high" and almost 29% reported ever giving or selling their medication to someone else.

Universities have experienced several controversies over ADHD and its treatment. Some U.S. medical students who failed their National Board of Medical Examiners tests claimed that this was due to ADHD, and sued the Board for additional exam time-unsuccessfully, because the Courts found that their completion of medical school indicated they could perform intellectually above the national average. The National Collegiate Athletic Association, on the other hand, allows athletes with proof of ADHD to take stimulants (Presidents Council on Bioethics, 2002). Colleges across the U.S. ponder statistics that put the number of ADHD university students anywhere between 65,000 and 650,000; a Federal Rehabilitation Act that *prima facie* requires them to offer special services to sufferers, although they often seek exemption from it; and evidence that more and more co-eds are using prescription drugs as study aids (Farrell, 2003; Nichols, 2004).

Physicians are not immune to the controversies surrounding diagnosis of ADHD and related disorders, and research has demonstrated strong physician ambivalence in diagnosis and treatment (Rafalovich, 2005). While long-term effects of drugs used to treat ADHD in humans are not well known, recent animal studies showed that long-term adolescent exposure to methylphenidate resulted in adult individuals exhibiting persistence of some adolescent behavioral features including a basal tone of unsatisfaction and anhedonia due to reduced reward sensitivity, depressive-like status, and significant gene expression changes (Adriani et al., 2005; Vastag, 2001). In addition to concerns regarding the long-term effects of methylphenidate and other drugs, there is concern about these drugs' social psychological impact, for instance the possible dislocation of locus of behavioral control away from personal and parental responsibility (Rafalovich, 2005).

Diagnoses of ADHD are most frequently pronounced during childhood and early adolescence. These diagnoses are often not revisited before college, which may be ill advised due to the proportion of spontaneous remissions (approximately 40%; Harpin, 2005), and possible negative effects of long term use. Importantly, the most frequently mentioned source for illicit prescription stimulants are peers who have prescriptions (McCabe and Boyd, 2005).

Non-Medical Use of Prescription Stimulants in College Settings

High school and college students, particularly those that have difficulties planning a reasonable preparation schedule to get work completed, or have difficulty focusing or following through with a schedule, tend to cram for exams or to complete term papers at school. Sometimes these students turn to drug use to help them stay awake for long hours and concentrate on what needs to be accomplished in a relatively brief period of time—or to derive pleasure from recreational use of the same drug.

McCabe and colleagues (2005) examined the prevalence rates and correlates of non-medical use of prescription stimulants (Ritalin, Dexedrine, or Adderall) among U.S. college students. One hundred and nineteen nationally representative 4-year colleges in the United States were selected and a sample of 10,904 randomly selected college students in 2001 were examined via self-report surveys. The life-time prevalence of non-medical prescription stimulant use was 6.9%, past year prevalence was 4.1%, and past month prevalence was 2.1%. A total of 5.8% of males and 2.9% of females reported annual use of non-prescribed stimulants. In addition, 2.8% of males (1.6% of females) reported use in the past month. Whites were relatively likely to use stimulants compared to African American, Asian, or other groups (annual use: 4.9% versus 1.6%, 1.3%, and 3.1%, respectively).

Past year rates of non-medical use ranged from zero to 25% at individual colleges. Non-medical use was higher among college students who were members of fraternities and sororities (annual use: 13.3% if living in a fraternity or sorority house, 3.5%-4.5% otherwise; 8.0% versus 1.8%-2.5% last month use), and earned lower grade point averages (annual use: B or lower average, 5.2%; B+ or higher, 3.3%). Rates were higher at colleges located in the north-eastern region of the U.S. (6.3% annual use), and southern region (4.6%), then other regions (2.8-3.2%), and colleges with more competitive admission standards (5.9% versus 1.3-4.5% annual use). Non-medical prescription stimulant users were more likely to report use of alcohol, cigarettes, marijuana, ecstasy, cocaine and other risky behaviors, raising the possibility that use of Ritalin for non-medical purposes may be related as much to an addiction disorder as to an aid to study.

The same research group (Teter and colleagues, 2005) assessed the prevalence and motives for illicit use of prescription stimulants (Ritalin, Dexedrine, Adderall, Concerta) to a random sample of 9,161 undergraduate college students. Of the study participants, 8.1% reported lifetime and 5.4% reported past-year illicit use of prescription stimulants. The most prevalent motives given for illicit use of prescription stimulants were to (1) help with concentration (approximately 30% of the motives), (2) increase alertness, and (3) provide a high. Men were more likely than women to report illicit use of prescription stimulants (9.3% versus 7.2%), and Whites and Hispanics (9.5% and 8.9%, respectively) were more likely to use them than African American or Asian students (2.7% and 4.9%, respectively). Illicit use of prescription stimulants was associated with elevated rates of AOD use, and number of motives endorsed and AOD use were positively related.

The McCabe and Teter studies examined a variety of stimulant drugs, not just Ritalin. Thus, a 4.1-5.4% annual prevalence represents the most accurate statement regarding those at highest prevalence of non-prescription use.

Several convenience sample surveys of college students have reported a range of use reports. Massachusetts, Maine, Florida, Pennsylvania, Wisconsin, and Texas samples are reported herein. In one convenience sample at a Massachusetts college of liberal arts (n=283), 16.6% of the sample reported having taken Ritalin for fun (non-medical purposes), and 12.7% reported having snorted Ritalin; a majority of the self-reported users were under 24 years of age (Babcock and Byrne, 2000). In another convenience sample survey of 150 undergraduates at a small U.S. college (in Maine), 10% were prescribed amphetamines and 35.5% took prescription amphetamines (Adderall, methylphenidate, or dextroamphetamine) illegally. A total of 24% of the illicit users used amphetamines to study, but 19.3% used them in combination with alcohol for recreational reasons (Low and Gendaszek, 2002).

Kapner (2003) summarized four additional surveys of Ritalin use at colleges from college reports, and found that 1.5% of students surveyed at the University of Florida in 2002 reported using Ritalin recreationally in the last 30 days, 9% of those undergraduates surveyed at the University of Pennsylvania in 2000 had used someone else's ADHD prescription medication, 20% of those students surveyed at the University of Wisconsin, Madison, in 1998, had illegally taken an ADHD medication at least once, and 2% and 1.5% of those students surveyed at the University of Texas in 1997 had misused Ritalin in their lifetimes and the past year, respectively.

To summarize, lifetime, past year, and past month illicit use of study drugs among emerging adults appears to vary widely while averaging approximately 7%, 4%, and 2%, nationally. Use is most prevalent among sensation seeking, white or Hispanic male college students, who are associated with fraternities (or less so in co-ed dorms), struggling with their grades, and who generally live in larger urban areas (though not always). These youth also tend to use other drugs, particularly cannabis, alcohol, MDMA, and cocaine (Barrett et al., 2005). They use study drugs to enhance their study and social life, and sometimes to stay awake while using another drug such as alcohol.

Potential Negative Consequences of "Study Drug" Use

There are four general potential negative consequences of using study drugs. These include: (a) potential for addiction, (b) potential for overdoses and crime, (c) potential for psychiatric or chronic medical complications, and (d) as a means of bypassing study planning skills, and perhaps receiving more poor grades. These four consequences are discussed next.

Potential for Addiction

A review of 60 studies suggested that the reinforcing or subjective effects of methylphenidate (in 80% of these studies) functions similarly to d-amphetamine or cocaine, and that there is definite abuse potential (Kollins, MacDonald, and Rush, 2001). Certainly, tolerance develops and some characteristic stimulant withdrawal symptoms have been reported including fatigue or exhaustion, depression, unpleasant and vivid dreams, insomnia or hypersomnia, increased appetite, or psychomotor retardation or agitation, or irritability (Braun et al., 2004; Coetzee, Kaminer, and Morales, 2002; Klein-Schwartz, 2002; Meririnne, Kankaanpaa, and Seppala, 2001). However, such reinforcing effects and withdrawal symptoms vary as a function of means of use. Oral use of methylphenidate results in a relatively mild symptomatology. Intranasal or intravenous use is what can lead to noticeable symptoms. For example, in a case study of a 45-year old white, male Ritalin abuser, who experienced intranasal binges (e.g., 3+days, 700-mg), most of these withdrawal symptoms were observed, and there were problems with hypertension, work, and marriage that might have been Ritalin related (Coetzee, Kaminer, and Morales, 2002). The extended-release formulas can be misused and abused as well as the older shorter-release formulas; for example, by breaking open a capsule and snorting the contents), so there appears to be no means to protect users of amphetamine-like drugs from misusing them if the users so desire. Additional misuse may occur as a result of non-compliance with treatment regimens. For example, one study of children prescribed methylphenidate showed that compliance ranged from 25 to 47% (Hugentburg et al., 2005).

Stimulants tend to increase or augment dopaminergic (reward, anticipation) and serotoninergic (self-administration initiation, maintenance of pleasure) neurotransmission (Julien, 2005). Ritalin appears to work by blocking post-synaptic dopaminergic transporters (Volkow et al., 1998), and does not appear to affect the serotonergic system (Meririnne, Kankaanpaa, and Seppala, 2001). While its effects on dopaminergic transmission are similar to cocaine, and may lead to similar consequences through intranasal administration or injection, oral use produces its effect in approximately an hour compared to a couple of minutes for cocaine or other routes of Ritalin administration. Oral intake does not produce nearly as much reinforcing effect and, hence, has much less abuse potential (Volkow and Swanson, 2003).

Overdoses and Crime

Symptoms, if one takes too much, can include emotional lability, anxiety, twitchiness, aggressiveness, loss of appetite, confusion, dizziness or blurred vision (and potential car accidents related to impaired vision), insomnia, headaches, sweating, and dryness of the mouth and eyes (Braun et al., 2004). In 1990, there were about 271 emergency room reports of Ritalin, 1,727 in 1998, and 1,478 in 2001 (Miller and Leger, 2003). There are approximately 25 deaths per year among up to 3 million users of ADHD drugs. Thus, the likelihood of dying from such drugs appears to be 1 in 120,000. In addition, Ritalin is one of the top 10 most frequently reported drugs stolen from Registrants. For example, approximately 2,000 instances of Ritalin theft were reported between 1990 and May of 1995, 700,000 dose were reported stolen from 1996 through 1997, and 376 cases of theft from pharmacies were found in 1998 (Kapner, 2003).

Potential for Psychiatric or Chronic Medical Problems

Use may temporarily suppress growth among children, temporarily (Safer, 2000). Chronic use of cocaine and methamphetamine may result in the temporary loss of approximately 20% of dopamine receptors in the nucleus accumbens, at least for four months since the last exposure (Volkow et al., 2001). In addition, chronic cocaine and methamphetamine users may experience formification hallucinations (e.g., there being bugs in their skin that need to be scratched out), repetitive behaviors ("tweaking"), and bizarre delusions (e.g., personalization of objects, paranoia). Use of Ritalin and other study drugs may result in these types of symptoms as well (Braun et al., 2004; Kapner, 2003), particularly if used in high doses, chronically, especially by intranasal administration or injection. In addition, intravenous (IV) abuse of Ritalin may result in Talcosis (a reaction to talc, a filler and lubricant in Ritalin and other oral medication) in the lungs and related consequences including lower lobe panacinar emphysema (Ward et al., 2000).

Most study drugs raise blood pressure and may place users at risk for heart attacks and stroke (Alonso-Zaldivar, 2006). For example, side effects may include irregular heartbeat and very high blood pressure (Kapner, 2003; Schetchikova, 2002).

Should Study Drugs Be Endorsed for Students?

Some authors, while not denying the existence of ADHD and the potential importance of medication, point out a modern tendency toward endorsing a biocosmetic alteration of youth so that they may perform more prosocially (i.e., greater obedience and focus; Miller and Leger, 2003). Some youth do swear that study drug use greatly improves their performance (e.g., http://www.voxmagazine.com/story.php?ID=12605). The biocosmetic-valued perspective might suggest that use of others' ADHD drugs to study is acceptable if it really improves performance, even though possession of unprescribed ADHD drugs is a Class C felony (up to a 7 year jail sentence if enforced) and distribution and sales is a Class B felony (up to a 15 year jail sentence if enforced).

However, it is not clear to what extent study drugs can enhance one's ability to learn new knowledge. Cognitive processing enhancement from stimulant use generally is for well-learned behaviors, not creative behavior. Also, to the extent that new information is learned under the influence of stimulants, recall is likely to be better under the influence of those same stimulants and may decrease without them (potential state-dependent learning and testing; Sussman and Ames, in press). Given these potential limitations, the paucity of evidence that long-term use of these drugs improves academic performance among ADHD sufferers, and the knowledge that study drugs tend to be used more by those with relatively poor grades, it appears that use of study drugs to improve work represents a relatively desperate attempt to improve one's study. Other means of improving study may be preferable, as discussed below.

On the other hand, Goldman and colleagues (1998) conducted a literature review of National Library of Medicine database and Drug Enforcement Agency (DEA) documents from 1975 to March 1997. They found that approximately 3% to 6% of elementary through high school youth may suffer from ADHD though only 3% of U.S. youth are being treated for ADHD. Pharmacotherapy provided short-term symptomatic and academic improvement. They found little evidence of misdiagnosis or overdiagnosis of ADHD or widespread overprescription of methyphenidate by physicians. Another recent review made similar observations, including that physicians appear to do careful evaluations before prescribing these drugs, that most also recommend non-medication treatments, that children who receive stimulant medication tend to show rather visible problems at school and home, and that the medications work and produce relatively mild side effects, which usually decrease over time (Safer, 2000). While there is little evidence that stimulant use increases future academic performance or delinquency among children suffering from ADHD (Safer, 2000), its use might be helpful in the long-run if combined with other treatment modalities such as instruction in study skills and cognitive-behavior therapy (Pelham et al., 2005). Continued stimulant treatment for ADHD into adulthood now is recommended (Upadhyaya et al., 2005) and continued use, along with study skills instruction, may be a key to long-term improvements (assuming that these drugs do not cause damage on neurotransmission through long-term use).

Given recent research suggesting that lower doses of methylphenidate may achieve the same goals of improving concentration as higher doses (Pelham et al., 2005; Sonuga-Barke et al., 2004), physicians should consider adopting or at least exploring a lowest dose regimen for individuals diagnosed with ADHD. Additionally, while it is suggested that physicians include non-medical interventions for ADHD along with medication in their treatment programs, there is little support for aggressively recommending non-medical interventions over the use of prescription drugs, or using them in tandem, or deliberately sequencing their use. This is despite recent research supporting the greater effectiveness of interventions combining stimulant medication and behavioral modification (e.g., Pelham et al., 2005). Changes in protocols for therapeutic regimens could help reduce physician preference for prescribing drugs as a solution to behavioral and learning problems associated with ADHD. However, such shifts in protocol would most likely have to include additional continuation education training for physicians to familiarize them more with non-medical treatment options and referral sources.

Implications for Drug Abuse Prevention

Many strategies used to prevent other drug use are relevant to the prevention of study drug abuse. The many types of drug-abuse prevention programs include the universal, selective, and indicated (Sussman et al., 2004). *Universal* programs aim to influence all subjects in a context. With youth, these programs generally focus on keeping an entire school or community drug-free by preventing youth from initiating use of alcohol, tobacco, or other drugs (ATOD). These programs frequently address large populations of youth and are often called primary prevention because they tend to focus on nonusers or early experimenters. Principles of this approach can be useful. However, youth are prescribed these medications.

They are useful to some youth. Therefore, an approach of preventing use would have to be focused on those not prescribed these medications. Creating a dichotomy between those who can use these medications and can't use these medications can create a "forbidden fruit" phenomenon in which they become even more attractive to youth. Helping youth differentiate between a stimulant drug that is publicly available and appears to be relatively safe (caffeine; Sussman and Ames, in press), proscribed use of stimulant drugs that may be relatively safe among ADHD sufferers, and stimulant drugs that appear to be unsafe and have little medical benefit (e.g., crack, crank) is difficult/complex to cognitively process, and may be difficult to introduce into a prevention program.

Still, some techniques of universal programs may be helpful. The main universal types of programs are social influences-oriented, and are implemented with young teens. Social influences programs rely on the theory that inoculation against social pressures to use drugs will help prevent later misuse. Social influence-oriented information and skills training, along with drug use consequences instruction, might help counteract a high-risk social milieu, which implies that using drugs is common and desirable among peers. This approach serves as the foundation for the entire curriculum of social influence prevention programs. For example, in a prevalence overestimates reduction session, instructors attempt to modify overestimates of the prevalence of drug use; they take a poll of self-reported drug use in the class and compare the actual frequency to student estimates of that frequency, which are often markedly higher. Youth might be thus instructed that only 10% of youth their age are prescribed study drugs, contrary to a polled much higher percentage that is likely to be perceived.

This information could be instructed in the context of consequences information. The dangers of intranasal and injection use should be instructed, particularly regarding the dangers of addiction and use of fillers such as talc on pulmonary damage. In addition, even oral intake is counter-indicated among some populations. Drugs such as Adderall and Ritalin are not recommended for those suffering who are allergic to them (e.g., suffer difficulty breathing, swelling of the lips, hives, after taking the drugs), those who suffer from severe anxiety, glaucoma, motor tics (or Tourette's syndrome), a psychotic condition, depression, a seizure disorder, high blood pressure or other cardiovascular-related concerns, a history of drug abuse, or a narrowing of ones gastrointestinal tract or a damaged liver. In addition, one should not take these drugs if taking certain other drugs (e.g., one should not take Ritalin if taking MAO inhibitors; e.g., see www.drugs.com; Klein-Schwartz, 2002).

In addition, one might be instructed about safer alternatives. There are two relatively novel drugs, Lilly's atomoxetine (brand name: Strattera) and Gliatech's selective H3 receptor antagonist, Perceptin, which have the advantage of not being classed as central nervous system stimulants. Atomoxetine is a norepinephrine transporter inhibitor. It has a does have similar side effects as the other drugs as well as potentially leading to urinary hesitation or retention. Such drugs probably have less abuse potential (Braun et al., 2004).

Comprehensive social influences programs can be differentiated from more narrowly focused social influence programs. The latter programs focus on instruction of refusal assertion training and combating direct social influences. Comprehensive social influences programs often contain other skills training (e.g., communication skills, assertiveness), provide instruction in decision making, and include activism and public commitment components. While social influenced-based, these additional components permit youth to act on their environment change it, make lower risk friends, or otherwise enter lower-risk

contexts. Not surprisingly, these programs exert a stronger effect than narrow-based social influence programs (Sussman et al., 2004). In the context of study drugs, the goal would be to educate youth on dangers of study drug use, and develop social norms to decrease acceptability of use (Kapner, 2003).

In contrast, the other two types of programs target more specific groups. Sometimes these two types of programs are grouped together as "targeted" programs. On the one hand, *selective* drug-abuse prevention programs serve groups at greater risk of ATOD use—for example, children of alcoholic parents. They are at psychosocial risk for drug use and abuse. The goal of a selective prevention program is to impede the onset or increase of ATOD use by these at-risk youth. On the other hand, *indicated* drug-abuse prevention programs attempt to benefit individuals who already show signs of drug involvement or related risk factors. In indicated prevention programs, the primary goal is to stem the progression of ATOD use, or reduce drug involvement among the high-risk youth.

A model of prevention that may have greater relevance for at risk teens incorporates motivation, skills, and decision-making. Relevant programs attempt to enhance students' motivations, skills, and decisions to avoid drug abuse, and anticipate or avoid problematic situations that may facilitate drug use. Ideally, youth learn that stereotypes about drug use are inaccurate, that their perceptions of drug users are overly positive and are not shared by other teens, that their own attitudes about drugs may reflect their attitudes about themselves and their health, and that valuing health can facilitate other meaningful goals. In addition, students can learn *skills for making changes*, including effective listening, communication, and self-control. Finally, they learn to make *decisions* about their behavior by weighing accurate information about drug use myths, the negative consequences of drugs, and the cognitive process of decision-making. These three basic elements - motivation, skills, and decision-making ("MSD" model) - comprise prototypical targeted prevention programming (Sussman et al., 2004). The MSD model is readily inclusive of study drugs and has shown an effect on use of stimulants lasting up to five years post-program (Sun et al., in press).

Limiting access to prescription stimulants may be a very important approach along with the previous demand reduction techniques (Pentz, Bonnie, and Shopland, 1996). Those who are correctly prescribed ADHD medications could be involved in a monitoring system to try to make sure that they are not serving as suppliers to others. One recommendation that has been made in the New York University Health Center is that those persons prescribed ADHD drugs while in college should keep their drug in a private location, and give reasons for not providing the drugs to others (e.g., to avoid a potential allergic reaction, not enough to share, claim that one has stopped using the drug; http://www.nyu.edu/nyuhc/studydrugs/). In addition, these may perhaps should be required to register with school authorities and check in periodically to account for their use, in cooperation with their physician.

The ethical issues involved in medicating children, particularly in the face of the vast marketing mechanisms behind prescription stimulants, also contribute to physician ambivalence in diagnosing and treating ADHD (Sparks and Duncan, 2004). This ambivalence, along with the fact that at least 40% of children diagnosed with ADHD are not expected to experience difficulties in adulthood (Harpin, 2005), suggest that college entrance may provide an opportunity to reexamine earlier diagnosis. Such a practice could lower the number of entering students with prescriptions as well as reduce unnecessary long-term use.

Instruction in good study skills is one way to try to bypass reliance on medications to cram for exams. There are a variety of self-help courses that universities provide to help

improve study skills (e.g., http://www.ucc.vt.edu/stdysk/stdyhlp.html at Virginia Polytechnic Institute). These skills involve time management (e.g., scheduling classes and study times, keeping track of tasks to be completed (task lists, charting work tasks on a timeline), placing a priority on studying (treating it as a full-time job), identifying and removing time wasters, and learning how to concentrate better (e.g., removing distractions from environment, studying in fixed locations, using a timer to increase concentration time, taking scheduled breaks).

IMPLICATIONS FOR TREATMENT OF "STUDY DRUG" ABUSE

In one case study, simply engaging in a written therapeutic contract, and eventually administering Bupropion SR and a low dosage of Ritalin (requesting only oral intake), was able to stabilize a chronic intranasal methylphenidate user (Coetzee, Kaminer, and Morales, 2002). These authors recommended that the contract should set clear boundaries and contingencies regarding contract violations, that stimulants should be kept at home in a safe place, that prescriptions should be written only for single weeks at a time, that the physician and patient should be vigilant regarding drug-seeking behavior, that medication use should be monitored by a responsible other person, and that education should be provided to physician and family regarding stimulant prescription abuse. In addition, they recommended that all family members should be evaluated for potential prescription or other drug abuse.

Basic treatment approaches for those who have abused stimulants might also be considered. These persons are likely to have abused other drugs as well. There have been four primary treatment models used with adolescents and emerging adults: (1) the Minnesota Model, which is based on the 12 steps of Alcoholics Anonymous (AA); (2) the therapeutic community (TC) model; (3) family therapy; and (4) cognitive behavioral therapy (Sussman, Skara, and Ames, in press). The Minnesota Model emphasizes the following: inpatient or residential care for a few weeks or months; a focus on psychoactive substance use disorder with little attention directed to associated psychiatric conditions or individual psychosocial factors; use of AA concepts, resources, and precepts including "12 steps" central to recovery; and referral to self-help groups such as AA upon discharge from residential or inpatient care.

In the therapeutic community (TC) group model, the community serves as the primary therapist. While the client may have a primary counselor, everyone in the community has the responsibility to act as therapists and teachers. Nearly all activities are part of the therapeutic process. Peer-group meetings are often led by a peer. Clients are provided with increased responsibilities and privileges as they pass through structured phases of treatment within the TC. Probably only 1% of the population are serious "study drug abusers." This may be sufficient to form groups (i.e., http://www.voxmagazine.com/story.php?ID=12605). Naturally occurring groups are evident on the web in the context of ADHD, but not among those without ADHD who abuse only these drugs (http://mentalhelp.net/poc/view_doc.php?type=docandid=445andcn=3 mentions the National ADDA, CHADD, ADD Action Group, and ADD Anonymous, as examples; Google Search, March 1, 2006, with terms "Ritalin Abuse" and "support groups"; 581 hits).

Family therapy tends to view alcohol and drug abuse as a family (systems) problem. Family relationships are viewed as problematic and family boundaries are viewed as distorted. Family therapy with professional staff is the main treatment modality (Blum, 1995), although therapies

that involve specific training for parents and the teen substance abuser also have been developed (Sussman et al., 2004). Family groups exist for ADHD sufferers, and there is some discussion of stimulant abuse in these groups (e.g., in CHADD, http://www.chadd.org/parent2parent/index.htm). However, it should be noted that in the 1990s, the manufacturer of Ritalin gave the supposedly independent CHADD 9% of its annual revenue. Despite adverse publicity, and a stern reprimand from the DEA, CHADD continued to secure funding from pharmaceutical corporations—for 2002-03, 17% of its operating funds. CHADD's magazine *Attention!* has a 100,000 print-run—with 65,000 copies bought by Shire Pharmaceuticals for product placement in doctors' waiting rooms (Russell, 1997; House of Representatives, Subcommittee 2000: 43; Hearn, 2004).

Behavioral and cognitive-behavioral approaches seek at least three goals. First, they desire to decrease or increase the frequencies of certain behaviors (i.e., decrease the frequency of behaviors compatible with drug use and increase the frequency of behaviors incompatible with drug use). Second, they desire to shape new adaptive behaviors (e.g., social skills development). Finally, they desire to modify cognition appropriately (i.e., decrease the frequency of cognition compatible with drug use and increase the frequency of cognition incompatible with drug use). Training new behaviors can be accomplished through use of shaping, modeling or observational learning, role playing, and assertiveness training. Further, modifying one's thinking or inner speech can be accomplished through various strategies, including self-instructional training and cognitive restructuring. Other strategies used to modify one's thinking include self-verbalizations, positive affirmations, thought stopping, rehearsal, and imaging. Cognitive behavioral approaches such as social control contracting, emotional regulation training and anger management, social and environmental support seeking, problem solving, coping skills training, environmental resource acquisition skills, and relapse prevention also ideally would be instructed (Sussman, Skara, and Ames, in press). Cognitive-behavior therapy is popularly suggested for treatment of study drug abuse, but little empirical data exists specifically on its use with these drugs (e.g., Coetzee, Kaminer, and Morales, 2002).

Implications for Policy Change

Current rates of misuse and abuse of Ritalin and other medically-prescribed study drugs, while low, show the potential to increase dramatically in direct proportion to the prevalence of prescription. Three types of policy change are recommended to curb the misuse of these drugs.

The first is policies aimed at warning the public as well as users about the negative consequences of misuse and abuse. The FDA while having declared most of these drugs as controlled substances, should provide a wider array and more visible platforms (e.g., on labels, public announcements) discouraging misuse and highlighting negative consequences of use, unauthorized sales, and distribution of these drugs.

The second is policies aimed at interdiction. These policies would be enforced by local law enforcement personnel to disrupt unauthorized points-of-sale or distribution. However, based on review of interdiction policies aimed at other drugs, this type of policy may be largely ineffective (Pentz, Bonnie, and Shopland, 1996).

The third, and perhaps the most promising, are policies aimed at institutionalizing education about study drugs. Education would include changes in physician treatment regimen protocols that are formalized by the AMA, including requirements for additional continuing education for pediatricians and family physicians to learn about non-medical treatment options. Evidence-based universal prevention programs could be expanded to include resistance to offers of study drugs other than those prescribed by a physician. Prevention and counseling programs, particularly at the college level, could be required to address misuse of stimulants as much as they currently do for alcohol abuse. Selective and indicated prevention programs that include ADHD youth who are on medication could include components that focus on improving compliance with medication, as well as improving self-esteem in peer group situations.

Conclusions

Study drug misuse deserves more study. It appears to be concentrated in certain groups for whom programming might be tailored (e.g., males who abide by a fraternity college lifestyle, persons with friends who are prescribed the medication). Abuse occurs when used in rather high doses or when administered intransally or injected. Monitoring its spread among high risk populations is important. Importantly, for most youth, these drugs are relatively unlikely to replace the need for training in good study habits within a solid study environment. Aggressive marketing of study habit courses is needed. Youth that use these stimulant drugs for recreational purposes are relatively likely to use other drugs and suffer from drug abuse (Barrett et al., 2005). They are also relatively likely to incur serious damage from improper administration of these drugs. Strong warning labels may help, but are limited as a means of drug control (U.S. DHHS, 2000). Assessment, reducing access, and prevention and cessation education are all important modalities to try to limit its misuse and abuse. There may also be room for further research to assess linkages between medically-sanctioned high-school usage and college abuse.

References

Adriani, W., Leo, D., Greco, D., Rea, M., di Porzio, U., Laviola, G., Laviola, G., and Perrone-Capano, C. (2005). Methylphenidate administration to adolescent rats determines plastic changes on reward-related behavior and striatal gene expression. *Neuropsychopharmacology*. [Nov 23, Epub ahead of print]

Alonso-Zaldivar, R. (February 10, 2006). *Warning urged for ADHD drugs: An FDA panel cites heart risks in its advisory on Ritalin and similar medications*. Los Angeles Times, The Nation section.

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (DSM-IV-TR). Washington, DC: American Psychiatric Association.

Babcock, Q., and Byrne, T. (2000). Student perceptions of methylphenidate abuse at a public liberal arts college. *Journal of American College Health*, 49, 143-145.

Barrett, S.P., Darredeua, C., Bordy, L.E., and Pihl, R.O. (2005). Characteristics of methylphenidate misuse in a university student sample. *Canadian Journal of Psychiatry*, 50, 457-461.

Braun, D.L., Dulit, R.A., Adler, D.A., Berlant, J., Dixon, L., Fornari, V., Goldman, B., Hermann, R., Siris, S.G., Sonis, W.A., and Richter, D. (2004). Attention-Deficit/Hyperactivity Disorder in adults: Clinical information for primary care physicians. *Primary Psychiatry*, 11, 56-65.

Coetzee, M., Kaminer, Y., and Morales, A. (2002). Megadose intranasal methylphenidate (Ritalin) abuse in adult Attention Deficit Hyperactivity Disorder. *Substance Abuse*, 23, 165-169.

Diller, L.H. (1998). *Running on Ritalin: A Physician Reflects on Children, Society, and Performance in a Pill*. New York: Bantam.

Diller, L.H. (2000, September 25). *Just Say Yes to Ritalin*. Salon.com.

Farrell, E.F. (2003, September 26). Paying Attention to Students Who Cant. *Chronicle of Higher Education*, A50-A51.

Freedman, A.M., Kaplan, H.I., and Sadock, B.J. (1976). *Modern synopsis of psychiatry/*II. Baltimore, Maryland: The Williams and Wilkins Co.

Goldman, L.S., Genel, M., Bezman, R.J., and Slanetz, P.J. (1998). Diagnosis and treatment of attention-deficit/hyperactivity disorder in children and adolescents. Council on Scientific Affairs, American Medical Association. *JAMA*, 279, 1100-1107.

Harpin, V. A. (2005). The effect of ADHD on the life of an individual, their family, and community from preschool to adult life. *Archives of Diseases in Childhood*, 90(suppl_1), i2-7.

Hearn, K. (2004, November 29). *Here, Kiddie, Kiddie*. AlterNet.org.

House of Representatives, Subcommittee on Early Childhood, Youth and Families, Committee on Education and the Workforce. (2000, May 16). *Ritalin Use among Youth: Examining the Issues and Concerns*.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., and Schulenberg, J. E. (2005). *Monitoring the Future national survey results on drug use, 1975-2004.* Volumes I and II: Secondary school students and College students and adults ages 19-45. Bethesda, MD: National Institute on Drug Abuse (NIH Publication Nos. 04-5727 and 05-5728).

Kapner, D.A. (June, 2003). *Recreational use of Ritalin on college campuses*. Newton, Massachusetts: The Higher Education Center for Alcohol and Other Drug Prevention.

Klein-Schwartz, W. (2002). Abuse and toxicity of methyphenidate. *Current Opinion in Pediatrics*, 14, 219-223.

Kollins, S.H., MacDonald, E.K., Rush, C.R. (2001). Assessing the abuse potential of methylphenidate in nonhuman and human subjects: A review. *Pharmacology, Biochemistry and Behavior*, 68, 611-627.

Leo, J. (2002). American Preschoolers on Ritalin. *Society*, 39, 52-60.

Livingstone, K. (1997). *Ritalin: Miracle Drug or Cop-out?* Public Interest, 127.

Low, K.G., and Gendaszek, A.E. (2002). Illicit use of psychostimulants among college students: A preliminary study. *Psychology, Health and Medicine*, 7, 283-287.

McCabe, S. E., and Boyd, C. J. (2005). Sources of prescription drugs for illicit use. *Addictive Behaviors*, 30, 1342-1350.

McCabe, S.E., Knight, J.R., Teter, C.J. and Wechsler, H. (2005). Non-medical use of prescription stimulants among US college students: prevalence and correlates from a national survey. *Addiction*, 100, 96-106.

McDonald, W. (2001, April 9). *Ifs, ands or buts of Drugs for Restless U. S. Children*. New York Times, E8.

Meririnne, E., Kankaampaa, A., and Seppala, T. (2001). Rewarding properties of methylphenidate: Sensitization by prior exposure to the drug and effects of dopamine D1 – and D2 – receptor agonists. *Pharmacology and Experimental Therapeutics*, 298, 539-550.

Miller, T., and Leger, M.C. (2003). A very childish moral panic: Ritalin. *Journal of Medical Humanities*, 24, 9-33.

Montero, D. (2002, September 27). *Ritalin Pusher Changes his Tune on Schools*. New York Post, 19.

Murlowe, J. (1997, October 16). Public Schools: Pushing Drugs? *Investors Business Daily*, 1-2.

Nichols, K. (2004, December 17). The Other Performance-Enhancing Drugs. *Chronicle of Higher Education*, A41-42.

Pelham, W.E., Burrows-Maclean, L., Gnagy, E.M., Fabiano, G.A., Coles, E.K., Tresco, K.E., Chacko, A., Wymbs, B.T., Wienke, A.L., Walker, K.S., and Hoffman, M.T. (2005). Transdermal methylphenidate, behavioral, and combined treatment for children with ADHD. *Experimental and Clinical Psychopharmacology*, 13, 111-26.

Pentz, M.A., Bonnie, R.J., and Shopland, D.R. (1996). Integrating supply and demand reduction strategies for drug abuse prevention. *American Behavioral Scientist*, 39, 897-910.

Presidents Council on Bioethics. (2002, December 12). *Session 3: Prescription Stimulant Use in American Children: Ethical Issues.*

Rafalovich, A. (2005). Exploring clinician uncertainty in the diagnosis and treatment of attention deficit hyperactivity disorder. *Sociology of Health and Illness*, 27, 305-323.

Riddlin' Kids. (2002). Sony.com.

Russell, J. (1997, December 1). The Pill that Teachers Push. *Good Housekeeping*, 110-117.

Safer, D.J. (2000). Are stimulants overprescribed for youths with ADHD? *Annals of Clinical Psychiatry*, 12, 55-62.

Sandberg, S., and Barton, J. (1996). Historical Development. In S. Sandberg (Ed.), *Hyperactivity Disorders of Childhood*. Cambridge: Cambridge University Press. 1-25.

Sax, L. (2000). Ritalin: Better Living through Chemistry? *The World and I* 15: 286.

Schetchikova, N.V. (2002). Children with ADHD: Medical vs. chiropractic perspective and theory. *Journal of the American Chiropractic Association*, July, 28-38.

Sonuga-Barke, E.J., Swanson, J.M., Coghill, D., DeCory, H.H., and Hatch, S.J. (2004). Efficacy of two once-daily methylphenidate formulations compared across dose levels at different times of the day: preliminary indications from a secondary analysis of the COMACS study data. *BMC Psychiatry*, 4, 28.

Sparks, J. A., and Duncan, B. L. (2004). The ethics and science of medicating children. *Ethical Human Psychology and Psychiatry*, 6, 25-39.

Sun, W., Skara, S., Sun, P., Dent, C.W., and Sussman, S. (In press). Project Towards No Drug Abuse: Long-term substance use outcomes evaluation. *Preventive Medicine*.

Sussman S., and Ames S.L. (2001). *The social psychology of drug abuse*. Buckingham, GB: Open University Press.

Sussman, S., and Ames, S.L. (in press). *Tobacco and other drug abuse prevention and cessation*. New York, N.Y.: Cambridge University Press, in preparation.

Sussman, S., Earleywine, M., Wills, T., Cody, C., Biglan, T., Dent, C.W., and Newcomb, M.D. (2004). The motivation, skills, and decision-making model of drug abuse prevention. *Substance Use and Misuse*, 39, 1971-2016.

Sussman, S., Skara, S., and Ames, S.L. Substance abuse among adolescents. In T. Plante (Ed.), *Abnormal Psychology in the 21st Century*. Westport, CT: Greenwood Publishing Group, Inc, in press.

Tavernise, S. (2004, May 10). *Authors, Get Out There and Break a Leg*. New York Times, E1, E5.

Teter, C.J., McCabe, S.E., Cranford, J.A., Boyd, C.J., and Guthrie, S.K. (2005). Prevalence and motives for illicit use of prescription stimulants in an undergraduate student sample. *Journal of American College Health*, 53, 253-262.

Upadhyaya, H.P., Rose, K., Wang, W., O'Rourke, K., Sullivan, B., Deas, D., and Brady, K.T. (2005). Attention-Deficit/Hyperactivity Disorder, Medication Treatment, and Substance Use Patterns Among Adolescents and Young Adults. *Journal of Child and Adolescent Psychopharmocology*, 15, 799-809.

U.S. Department of Health and Human Services (U.S. DHHS). *Reducing Tobacco Use: A Report of the Surgeon General. (2000)*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

Vastag, B. (2001). Pay Attention: Ritalin Acts Much Like Cocaine. *JAMA, 286*(8), 905-906.

Volkow, N.D., Chang, L., Wang, G-J., Fowler, J.S., Leonido-Yee, M., Franceschi, D., Sedler, M.J., Gatley, S.J., Hitzemann, R., and Hitzemann, R., Ding, Y.-S., Logan, J., Wong, C., and Miller, E.N. (2001). Association of dopamine transporter reduction with psychomotor impairment in methamphetamine abusers. *American Journal of Psychiatry*, 158, 377-382.

Volkow, N.D., and Swanson, J.M. (2003). Variables that affect the clinical use and abuse of methylphenidate in the treatment of ADHD. *American Journal of Psychiatry*, 160, 1909-1918.

Volkow, N.D., Wang, G-J., Fowler, J.S., Gatley, S.J., Logan, J., Ding, Y.-S., Hitzemann, R., and Pappas, N. (1998). Dopamine transporter occupancies in the human brain induced by therapeutic doses of oral methylphenidate. *American Journal of Psychiatry*, 155, 1325-1331.

Ward, S., Heyneman, L.E., Reittner, P., Kazerooni, E.A., Godwin, J.D., and Muller, N.L. (2000). Talcosis associated with IV abuse of oral medications: CT findings. *American Journal of Roentgenology*, 174, 789-793.

Woodworth, T. (2000, May 16). *Ritalin: The Fourth R in Schools: Discussing the use of Psychotropic Drugs for Youth: DEA Congressional Testimony before the Committee on Education and the Workforce: Subcommittee on Early Childhood, Youth, and Families*. United States Drug Enforcement Administration.

Wu, L.-T., and Schlenger, W.E. (2003). Psychostimulant dependence in a community sample. *Substance Use and Misuse*, 38, 221-248.

Zernike, K. and Petersen, M. (2001, August 19). *Schools Backing of Behavior Drugs comes under Fire*. New York Times, 1.