

# Methylphenidate and Dextroamphetamine Abuse in Substance-Abusing Adolescents

Robert J. Williams, PhD<sup>1</sup>; Leslie A. Goodale, RN<sup>2</sup>; Michele A. Shay-Fiddler, MSW<sup>2</sup>;

Susan P. Gloster, BN<sup>3</sup>; Samuel Y. Chang, MD<sup>2</sup>

- <sup>1</sup>. Addiction Counselling Program; School of Health Sciences; University of Lethbridge
- <sup>2</sup>. Addiction Centre; Foothills Medical Centre; Calgary, Alberta
- <sup>3</sup>. Lethbridge Regional Hospital; Lethbridge, Alberta

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Address Correspondence:

Dr. Robert Williams  
Addiction Counselling Program  
School of Health Sciences  
University of Lethbridge  
4401 University Drive  
Lethbridge, Alberta  
T1K 3M4  
403-382-7128 (phone)  
403-329-2668 (fax)  
[Robert.Williams@uleth.ca](mailto:Robert.Williams@uleth.ca)

### Abstract

The prevalence of methylphenidate and dextroamphetamine misuse and abuse was examined in 450 adolescents referred for substance abuse treatment. Twenty three percent reported nonmedical use of these substances and six percent were diagnosed as methylphenidate or dextroamphetamine abusers. Abuse was more common in individuals who were out of school and had an eating disorder. Methylphenidate and dextroamphetamine abuse appears to be much less common than abuse of most other substances. It does occur, however, and parents and schools need to exert greater control over the dispensing of these medications. Physicians are advised to prescribe non-stimulant medications (e.g., bupropion) when treating attention deficit hyperactivity disorder in substance-abusing individuals.

Key Words: methylphenidate, Ritalin, dextroamphetamine, adolescent, abuse

Psychostimulants such as methylphenidate (Ritalin®), dextroamphetamine (Dexedrine®), and Adderall® are well established as effective treatments for attention deficit hyperactivity disorder<sup>1,2,3,4</sup>. They have potential risks, however, with one of the more important ones being the risk of drug abuse. These medications are classified as Schedule II substances in the Controlled Substances Act, which contains medically prescribed substances with the highest abuse potential and dependence profile.

However, considerable controversy exists about how serious a problem prescribed stimulant abuse actually is. On the one hand, the Council on Scientific Affairs of the American Medical Association concluded that "there is little evidence that stimulant abuse or diversion is currently a major problem, particularly among those with ADHD"<sup>5</sup>. Another review reports "a nearly total absence of methylphenidate abuse reported in methylphenidate-treated children and adolescents in spite of its very widespread application"<sup>6</sup>. An even stronger statement is made in the *Practitioners Guide to Psychoactive Drugs for Children & Adolescents 2<sup>nd</sup> ed.*, where it states, "There are no reported individual cases of addiction or serious drug dependence to date with these medications."<sup>7</sup> Similar sentiments have been echoed elsewhere<sup>8,9</sup>.

On the other hand, the U.S. Drug Enforcement Administration <DEA> has expressed serious concern about methylphenidate being diverted and abused. This was first stated in an October 1995 press release<sup>10</sup> and background paper<sup>11</sup> that pointed out that methylphenidate ranks in the top 10 most frequently reported controlled pharmaceuticals stolen from licensed handlers. These concerns were reiterated in congressional testimony to the Subcommittee on Early Childhood, Youth and Families in May 2000. In this testimony the DEA indicated that methylphenidate has a high abuse liability and that the magnitude of methylphenidate diversion and trafficking is comparable to pharmaceutical drugs of similar abuse potential such as morphine<sup>12</sup>.

There is good evidence that a small percentage of adolescents and young adults are using these substances for non-medical purposes. In the national Monitoring the Future survey of high school students, the percentage of seniors reporting non-medical use of Ritalin® in the past year was .1 - .7% between 1976 and 1993; .8 - 1.2% between 1994 and 1996; and 2.2 - 2.8% between 1997 and 2000<sup>13</sup>. A 1998 state-wide survey of Indiana students found that approximately 5% of students in grades 9-12 reported non-medical use of Ritalin® in the past year, with 2.5% reporting non-medical use in the past month<sup>14</sup>. In Canada, 6.3% of Ontario high school students reported past-year non-medical use of stimulants other than methamphetamine in 1994<sup>15</sup>.

However, it is unclear how much actual abuse and dependence is occurring. By definition, substance abuse is a pattern of use leading to clinically significant impairment or distress as manifested by either failure to fulfil major role obligations; recurrent use in physically hazardous situations (e.g. driving); recurrent substance-related legal problems; or serious social or interpersonal problems<sup>16</sup>. Abuse does occur, as evidenced by several case reports of regular use leading to medical problems or death<sup>17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28</sup>. Some of these case reports include individuals who were abusing their own prescriptions<sup>29, 30, 9</sup>.

However, there is very little known about the general prevalence of methylphenidate abuse and dependence. There are a few studies on treatment populations that shed some light on this issue. Haglund and Howerton<sup>31</sup> found that 59% of 192 adult patients admitted to a drug abuse treatment program reported non-medical use of methylphenidate at some point, mostly in combination with opiates such as pentazocine<sup>31</sup>. However, only 1.5% were using methylphenidate on a daily basis. Raskin and Bradford<sup>32</sup> reported that 18/40 methadone maintenance patients were regular

intravenous users of methylphenidate. Marsh et al.<sup>33</sup> found that 10.4% (24/231) of adolescents referred for an assessment at a community based alcohol/drug treatment facility in South Carolina between 1992 and 1996 reported non-medical use of methylphenidate. No details were provided concerning frequency of use.

Clearly, more research is needed to establish the actual prevalence of prescribed stimulant abuse. The purpose of the present study is to investigate this issue in a group of substance-abusing adolescents with comorbid mental health problems. Our first objective is to determine the prevalence of methylphenidate and dextroamphetamine misuse and abuse in this population. Our second objective is to investigate characteristics that differentiate abusers from nonabusers. This latter information will be particularly useful to physicians in their decisions about when to prescribe stimulants.

### Method

The Addiction Centre is located at the Foothills Medical Centre, Calgary, Alberta, Canada. It specializes in the assessment and treatment of substance-abusing adolescents with comorbid psychiatric conditions. It is primarily an outpatient program, but a small percentage of patients are admitted to an affiliated inpatient unit. All adolescents receive a comprehensive 3-4 hour assessment. The assessment begins with an interview using the Adolescent Drug and Alcohol Diagnosis (ADAD), a structured questionnaire with established reliability and validity<sup>34,35</sup>. This interview is followed by urinalysis drug testing, and then the adolescent's family is interviewed. All interviews are conducted by a nurse, social worker or psychologist, while a family physician and an adolescent psychiatrist observe behind a 2-way mirror. The psychiatrist makes diagnoses (current) at the end of the assessment, after reviewing the background file and information presented during the interviews. An extensive 10 to 15- page report is produced from the assessment.

A retrospective file review was conducted of the 450 adolescents seen at the Addiction Centre between January 1993 and May 1999. Each assessment was read by the second and third authors (LG, MS-F) and information was extracted using a coding sheet with the following categories: age, gender, race/ethnicity, school attendance, residency, psychiatric and substance use diagnoses (current), a list of all substances used (lifetime), and whether the adolescent had ever been prescribed methylphenidate or dextroamphetamine (Dexedrine® or Adderall®). For all individuals who reported non-medical use of methylphenidate or dextroamphetamine, information was also extracted concerning the method of administration, frequency of use, the length of time using, where they obtained the medication, and reasons for discontinuation.

The sample was divided into methylphenidate/dextroamphetamine abusers and nonabusers to investigate variables that differentiated the groups using a forward stepwise logistic regression. "Abusers" were individuals who received a diagnosis of current methylphenidate or dextroamphetamine abuse at the time of the assessment. "Non-abusers" were individuals who did not receive a diagnosis of current methylphenidate or dextroamphetamine abuse (although some of these individuals may have used these substances occasionally for non-medical purposes at some point in their lives ("misusers") and some may have had a past history of methylphenidate or dextroamphetamine abuse).

### Results

Age range of the sample was 12 to 18 years, with an average of 15.4. Fifty-two percent were male, 82 percent were Caucasian, 69 percent were attending school, and 78 percent were living at home. The most common psychiatric diagnoses were Conduct

Disorder (26%), Major Depression (26%), Attention-Deficit Hyperactivity Disorder (25%), Oppositional Defiant Disorder (18%), Post-Traumatic Stress Disorder (17%), Dysthymia (15%), Substance-Induced Mood Disorder (11%), and Learning Disability (10%).

Twenty three percent (105/450) of adolescents reported non-medical use of either methylphenidate or dextroamphetamine at some point in their lives (“Misusers”). Of these 105 adolescents, 92 reported non-medical use of methylphenidate, 7 reported non-medical use of dextroamphetamine (Dexedrine), and 6 reported non-medical use of both. The median number of times used was 3 (range 1 – 700), and the median length of time used was 26 days (range 1 day – 3 years). Of the 87 adolescents ever prescribed methylphenidate or dextroamphetamine, 38/87 (44%) reported non-medical use.

Six percent (26/450) of the sample was diagnosed as current methylphenidate or dextroamphetamine abusers (23 were methylphenidate abusers and 3 were methylphenidate and dextroamphetamine (Dexedrine) abusers). The most common method of administration was crushing tablets and taking the drug intranasally. The median number of times used was 80 (range 21 – 700). The median length of time using was 120 days (range 21 days – 3 years). The median frequency of use was daily (range 3 times/week – 5 times/day). Twenty-two individuals reported where they obtained the medication: 41% (9/22) obtained it from their own prescription; 23% (5/22) from the street; 23% (5/22) from a friend’s prescription; and 15% (4/26) from a sibling’s prescription.

For comparison purposes, Table 1 lists the reported lifetime use and current abuse of all substances. As can be seen, methylphenidate and dextroamphetamine were both the 7<sup>th</sup> most commonly used and abused substances.

<Insert Table 1 here>

An SPSS forward stepwise logistic regression investigated characteristics differentiating individuals with diagnosed methylphenidate/dextroamphetamine abuse and those without this diagnosis. Variable entry order was determined by the size of the Wald statistic, with a minimum entry level of  $p = .05$  and a removal level of  $p = .10$ . Thirty-two demographic, psychiatric, and substance use predictor variables were used. After deletion of 5 cases with missing values, data from 445 adolescents were available for analysis: 26 abusers and 419 nonabusers.

Maximal discrimination between the groups occurred with a constant and only two predictor variables: being in school and having an eating disorder. Abusers were significantly more likely to be out of school and to have an eating disorder. A test of the full model with the two predictors against a constant-only model was statistically reliable,  $\chi^2 (2, N = 445) = 12.1, p < .005$ , indicating that the two predictors reliably distinguished between abusers and nonabusers. The variance accounted for was small, however, with Nagelkerke R squared = .075. Overall prediction success was 93.8%. Table 2 lists the demographic and psychiatric characteristics of the two groups as well as the Wald statistics for each of these variables. Table 3 lists the substance use characteristics of the two groups and the Wald statistics for these variables.

<Insert Table 2 here>

<Insert Table 3 here>

## Discussion

The present study found that 23% of adolescents referred for a substance-abuse assessment at an outpatient clinic reported non-medical use of methylphenidate or dextroamphetamine at some point in their lives. Most of these individuals misused these substances a few times on a few occasions. However, a small portion of the sample used on a much more frequent and sustained basis. Six percent of the total sample was

diagnosed as methylphenidate or dextroamphetamine abusers at the time of the assessment.

Our results indicate that for this population, prescription stimulant abuse is neither at crisis proportions nor is it a nonexistent problem. It is clear that prescribed stimulants are misused and abused. However, it is also clear that the misuse and abuse is not occurring on the same scale as other substances. Methylphenidate and dextroamphetamine were the seventh most commonly used substances after alcohol, cannabis, hallucinogens, cocaine or crack, over-the-counter drugs (non-medical use), and methamphetamine; and the seventh most commonly abused substances after alcohol, cannabis, hallucinogens, cocaine or crack, inhalants, and methamphetamine. To further put this in perspective, although there were 1,478 emergency room mentions of methylphenidate in the Drug Abuse Warning Network in 1999, there were 168,763 mentions of cocaine<sup>5</sup> (although it should be noted these statistics refer to all mentions, not just adolescents).

The rate of methylphenidate/dextroamphetamine misuse is roughly four times higher than the rate of abuse. It is fairly typical that a much higher percentage of individuals experiment with a drug than abuse the drug. However, it is worth noting that in the present study only phencyclidine, over-the-counter drugs, minor tranquilizers, and barbiturates had a higher ratio of misusers to abusers. Anecdotal evidence suggests that although methylphenidate is widely available and fairly inexpensive, it is not often a first choice of adolescent substance users because of its status as a synthetic medication. It should also be noted that although methylphenidate can produce comparable levels of "high" or "rush" compared to cocaine<sup>36</sup>, it is cleared from the brain much more slowly, which tends to be associated with less subsequent craving<sup>37</sup>.

There were very few demographic, psychiatric or substance use characteristics significantly differentiating abusers from nonabusers. The exception to this was school attendance and having a concurrent eating disorder. Abusers were significantly less likely to be attending school (41% attending versus 71% of nonabusers). This may be because methylphenidate/dextroamphetamine abuse makes ongoing school attendance more difficult. Or, it may be that methylphenidate/dextroamphetamine abuse and school absenteeism are both manifestations of more severe problems. The increased likelihood of abusers having an eating disorder (11% versus 2% of nonabusers) is likely because the decreased appetite and weight loss associated with these medications makes them appealing to individuals trying to control their weight.

### Limitations

The main limitation of this study is that the sample is not representative of substance-abusing adolescents generally, as it contains a greater proportion of dually-diagnosed individuals. Roughly 95% of individuals in the present study had a co-occurring psychiatric disorder, compared to approximately 50% in the general population of substance-abusing adolescents<sup>38</sup>. However, in all other respects the demographics of our sample appears to be similar to what is found in the general adolescent treatment population<sup>39,40</sup> and in the general adolescent substance-abusing population<sup>41</sup>. The present study also does not address the abuse of these substances in substance-using adults, which may be much higher or lower. A final limitation is that ascertainment of substance use was based primarily on self-report. Although the accompanying urinalysis helped ensure valid report at the time of the assessment, it did not ensure validity of the historical reports given.

### Clinical Implications

Psychostimulants are effective treatments for attention deficit hyperactivity disorder. However, they do have risks, with one of the more important ones being the risk of misuse and abuse. Although not directly tested, the present results suggest that the most important risk factor for methylphenidate/dextroamphetamine misuse and abuse is the abuse of other substances (i.e., only 2% of senior high school students in the latest Monitoring the Future study misused prescribed stimulants versus 23% of substance abusing adolescents in the present study). Substance abusing adolescents who are out of school and/or have a concurrent eating disorder appear to have an even higher risk.

Thus, routine screening for substance abuse and eating disorders is a sensible precaution that should occur before any medication is prescribed. Furthermore, considering the efficacy of certain non-stimulant medications for attention deficit hyperactivity (e.g., bupropion)<sup>42,43</sup>, it is recommended that non-stimulant medications be used as a first line pharmacological treatment for these higher risk groups.

Although physicians need to be cautious about to whom they prescribe psychostimulants, parents have an even more important role to play. In the present study, roughly three-quarters of the methylphenidate and dextroamphetamine abused came from the adolescent's own prescription or the prescription of a friend or sibling. The risk of psychostimulant abuse could be substantially reduced if parents became more aware of the abuse potential of prescription stimulants and exerted greater control over the dispensing of these medications.

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Table 1

Lifetime Use and Current Abuse of Substances for the Entire Sample

	Lifetime Use	Current Abuse
Alcohol	98%	80%
Cannabis	96%	85%
Hallucinogens	79%	46%
Cocaine or Crack	38%	18%
Over-the-Counter Drugs (non-medical use)	27%	6%
Methamphetamine	24%	7%
<i>Methylphenidate/Dextroamphetamine (non-medical use)</i>	<i>23%</i>	<i>6%</i>
Inhalants	17%	9%
Prescription Opiates (non-medical use)	17%	6%
Phencyclidine	17%	4%
Nonprescription Opiates	9%	4%
Minor Tranquilizers (non-medical use)	7%	1%
Barbiturates	2%	0%

Table 2

Demographic and Psychiatric Characteristics of Methylphenidate/Dextroamphetamine Abusers and Non-Abusers

	Abusers (n=26)	Non- Abusers (n=424)	Wald Statistic <sup>1</sup>	
In school	41%	71%	7.3	p < .01
Caucasian	74%	82%	1.7	
Male	43%	52%	1.3	
Living at home	77%	78%	.3	
Age	15.6	15.4	.2	
Eating Disorder	11%	2%	8.4	p < .01
Substance-Induced Mood Disorder	21%	11%	3.2	
Major Depression	43%	25%	2.7	
ADHD	36%	24%	2.1	
Dysthymia	7%	15%	1.3	
Learning Disability	4%	10%	1.1	
Bipolar	4%	1%	.5	
Mental Retardation	0%	2%	.5	
Schizophrenia	0%	1%	.4	
Panic Disorder	0%	1%	.4	
Generalized Anxiety	0%	2%	.3	
Conduct Disorder	25%	26%	.2	
Oppositional Defiant Disorder	18%	18%	.1	
Post-Traumatic Stress Disorder	18%	17%	0	

<sup>1</sup> Wald statistics following entry of the two significant variables into the forward stepwise logistic regression. All Wald statistics were nonsignificant unless otherwise noted.

Table 3

Concurrent Substance Abuse by Methylphenidate/Dextroamphetamine Abusers and Non-Abusers

	Abusers (n=26)	Non- Abusers (n=424)	Wald Statistic <sup>1</sup>
Phencyclidine Abuse	11%	4%	3.2
Nonprescription Opiate Abuse	11%	4%	2.8
Methamphetamine Abuse	14%	6%	2.4
Prescription Opiate Abuse	14%	6%	1.9
Other Prescription Drug Abuse	4%	3%	1.4
Cocaine/Crack Abuse	32%	18%	.8
Inhalant Abuse	4%	10%	.7
Hallucinogen Abuse	54%	46%	.3
Over-the-Counter Drug Abuse	4%	6%	.3
Minor Tranquilizer Abuse	0%	1%	.2
Cannabis Abuse	85%	85%	0
Alcohol Abuse	79%	81%	0
Barbiturate Abuse	0%	0%	0
<i># Substances Abused</i>	<i>3.1</i>	<i>2.7</i>	<i>1.6</i>

<sup>1</sup> Wald statistics following entry of the two significant variables into the forward stepwise logistic regression. All Wald statistics were nonsignificant unless otherwise noted.