

# Medical and nonmedical stimulant use among adolescents: from sanctioned to unsanctioned use

*Research*

*Recherche*

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## Abstract

**Background:** The past decade has seen a generalized upward trend in the prevalence of adolescent use of substances, including stimulants. The purpose of this article was to determine the prevalence of and risk factors for the medical and nonmedical use of stimulants, and the diversion of prescribed stimulants among adolescent students, and to demonstrate links between medical use, nonmedical use and the diversion of stimulants.

**Methods:** A self-reported anonymous questionnaire was administered in 1998 to a random sample of students in grades 7, 9, 10 and 12 in New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador about their medical and nonmedical use of stimulants (Benedrine, Dexedrine, Ritalin, Cylert, diet pills, "speed," "uppers," "bennies" and "pep pills"). A total of 13 549 students completed the questionnaire, representing a 99% participation rate among the students present at school on the day of the survey.

**Results:** Of the 5.3% of students who reported medical use of stimulants in the 12 months before the survey, 14.7% reported having given some of their medication, 7.3% having sold some of their medication, 4.3% having experienced theft and 3.0% having been forced to give up some of their medication. Non-medical stimulant use by students who did not have a prescription for stimulants was significantly related to increased numbers of students who gave or sold some of their prescribed stimulants, at both the school class and individual student levels ( $p < 0.001$ ).

**Interpretation:** Although the vast majority of adolescent students taking prescribed stimulants appeared to be using their medication as sanctioned, a link was found between medical and nonmedical stimulant use and the diversion of medication from sanctioned to unsanctioned use.

The past decade has seen a generalized upward trend in the prevalence of substance use among adolescents, with Canada and the United States reporting marked increases in the use of many substances, including stimulants.<sup>1-5</sup> The annual prevalence of nonmedical stimulant use among adolescents in Nova Scotia increased from 5% in 1991 to 11% in 1998.<sup>2-4</sup> In the United States, from 1992 to 1997 the annual prevalence of stimulant use increased from 8.2% to 12.1% among students in grade 10 and from 7.1% to 10.1% among students in grade 12.<sup>1</sup>

Concurrently, major increases in the prescribing of methylphenidate have been observed in Canada and the United States.<sup>6-8</sup> In Canada, the amount of methylphenidate prescribed increased about five-fold from the early to the mid-1990s.<sup>6</sup> In the United States the number of prescriptions given to youths increased about three-fold from 1990 to 1995, the largest increase (311%) occurring among high school students 15-19 years of age.<sup>7,8</sup> About 90% of all methylphenidate in the United States is thought to be prescribed to children and adolescents with attention deficit/hyperactivity disorder.<sup>7,8</sup> Considerable variation in methylphenidate use has been reported according to sex, age, geographic region and health care system.<sup>6-9</sup>

Increased prescribing of stimulant medication is of concern, in part because of the

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*This article has been peer reviewed.*

CMAJ 2001;165(8):1039-44

increased potential for the diversion of the drug from the licit to the illicit market.<sup>10,11</sup> Little is known about actual diversion of stimulant medication. In the peer-reviewed literature, there is a report on attempted prescription fraud, where large quantities of amphetamines were to be procured illegally from legitimate manufacturers and physicians.<sup>12</sup> In the case of youths, however, diversion activity may take place on a smaller scale and on a more personal level. For example, a representative survey in Wisconsin enquired whether schoolchildren prescribed methylphenidate had been approached to sell, give or trade their medication.<sup>13</sup> There is also anecdotal evidence of youths being forced to give up their stimulant medication, experiencing theft, or willingly giving or selling some of their pills.<sup>14,15</sup>

The present research provides population-based data about the actual outflow of prescribed stimulants from sanctioned to unsanctioned use among adolescents. The objectives of the research were (a) to determine the prevalence of and risk factors for the medical and nonmedical use of stimulants, and the diversion of prescribed stimulants among adolescent students, and (b) to demonstrate links among medical use, nonmedical use and the diversion of prescribed medication to unsanctioned use in the general adolescent population.

## Methods

The present study is based on the 1998 Student Drug Use Survey in the Atlantic Provinces, a self-reported anonymous survey of students in grades 7, 9, 10 and 12 of the public school systems in New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador.<sup>4,16-18</sup> The 1998 survey was the second application of a protocol developed and pilot tested in 1994/95.<sup>19</sup> Ethics approval was obtained from the Dalhousie University Faculty of Medicine Ethics Committee. The sample design was a cluster sample of randomly selected classes stratified by grade and by either health region (in Nova Scotia and Newfoundland) or school district or board (in New Brunswick and PEI).

The survey used a computer-scannable instrument of 94 items. The methods to assess validity and reliability of the survey are reported elsewhere.<sup>20</sup> A test-retest took place in Nova Scotia in March 1998, with an initial sample of 240 students in grades 7, 9, 10 and 12, yielding 225 completed test-retest surveys paired on encoded unique identifiers. The test-retest revealed fair to good agreement for medical stimulant use in the 30 days before the survey and for medical and nonmedical stimulant use in the 12 months before the survey (kappa values 0.68, 0.60 and 0.62 respectively).<sup>21</sup>

Nonmedical stimulant use in the 12 months before the survey was defined as an affirmative response to the question "In the past 12 months, have you taken stimulants (Benzedrine, Dexedrine, speed, uppers, bennies, pep pills) without a prescription or without a doctor telling you to do so?" Medical stimulant use in the 12 months before the survey was defined as an affirmative response to the question "In the past 12 months, have you taken stimulants (Benzedrine, Dexedrine, Ritalin, Cylert, diet pills) as prescribed for you by your doctor?" Medical stimulant use in the month before the survey was defined as an affirmative response to the question "In the past 30 days, how often did you usually take stimu-

lants (Benzedrine, Dexedrine, Ritalin, Cylert, diet pills) as prescribed for you by your doctor?"

The diversion of prescribed stimulants was defined as an affirmative response to any of the following questions: "Have you ever given any of your stimulant pills to friends? Have you ever sold any of your stimulant pills? Have any of your stimulant pills ever been taken away from you against your will (by force or threats)? and Have any of your stimulant pills ever been stolen from you?"

The statistical analysis took into account the stratified cluster sample design. The prevalence estimates were weighted according to the number of students responding in each stratum and the total number of students enrolled in each stratum. The extent of ever giving, selling, or experiencing coercion or theft was expressed as proportions of students who reported medical stimulant use in the year before the survey. The standard errors used to compute the 95% confidence intervals (CIs) were adjusted for the intraclass correlation by means of the Kish design effect.<sup>22</sup>

Considered as potential risk factors for stimulant use were sex, grade, province, any alcohol use, any cigarette smoking and any cannabis use. The proportions of students reporting use and non-use of stimulants were compared using logistic regression analysis, initially with unadjusted odds ratios (ORs) and subsequently with adjusted ORs in multivariate models. Statistical significance was set at  $p < 0.05$  with Bonferroni adjustment for the number of variables in the multivariate models, which resulted in a  $p$  value of 0.008 or 0.01 depending on the model.

Finally, the influence that the number of students who gave some of their prescribed stimulant medication had on nonmedical stimulant use was determined at the school class and individual student levels, using multivariate logistic regression analysis. Giving and selling prescribed medication were assessed in separate multivariate models because of collinearity. The samples of students in the 2 mainland provinces, and of those in the 2 island provinces, were combined in order to preserve an adequate sample size according to place.

## Results

A total of 13 549 students in grades 7, 9, 10 and 12 completed the questionnaire, representing a 99% participation rate among the students present at school on the day of the survey. About 13% of the students in the participating classes were absent on the day of the survey. The mean age of the respondents was 15.2 years. The median age was 13 years in grade 7, 15 years in grade 9, 16 years in grade 10 and 18 years in grade 12. The samples in the 4 provinces did not differ significantly in terms of age, sex and absenteeism.

### Stimulant use

Overall, 2.6% of the students reported medical stimulant use in the 30 days before the survey. Significantly more male than female students reported such use (3.2% v. 2.1%,  $p < 0.001$ ). The prevalence was significantly lower among grade 12 students than among students in grades 7 to 10 (1.6% v. 2.8% to 3.2%) and among students in Newfoundland and Labrador than among those in the other 3 provinces (1.6% v. 2.7% to 3.3%).

Medical stimulant use in the year before the survey was re-

ported by 5.3% of the students (Table 1). Simultaneous adjustment for all student characteristics revealed that alcohol use, cigarette smoking and cannabis use were all independent risk factors for medical stimulant use. The prevalence of medical use in the year before the survey was significantly lower among students in grade 12 than among students in grades 7 to 10 after adjustment for all variables (OR 0.4,  $p < 0.001$ ).

Nonmedical stimulant use in the year before the survey was reported by 8.5% of the students (Table 1). Again, alcohol use, cigarette smoking and cannabis use were found to be independent risk factors. The strengths of those associations were considerably greater for nonmedical use (OR range 2.3 to 5.9) than for medical use (OR range 1.5 to 2.2). Once substance use was taken into account, the only demographic characteristic found to be an independent protective factor for nonmedical stimulant use was residence in Newfoundland and Labrador (OR 0.6,  $p < 0.001$ ).

Medical and nonmedical stimulant use in the year before the survey were not mutually exclusive. About 3.5% of the students reported only medical use, 6.8% reported only nonmedical use, and 1.8% reported both medical and non-medical use.

### ***Diversification of prescribed stimulants***

Of the students who reported medical stimulant use in the year before the survey, 14.7% reported having given, and 7.3% having sold, some of their prescribed stimulants (Table 2). About 80% of the students who reported having sold some of their medication also reported having given some away. Grade and province were not associated with giving or selling stimulant medication. The only drug use pattern found to be predictive of giving or selling stimulant medication was nonmedical stimulant use. Compared with students who did not report nonmedical stimulant use, those who did report nonmedical use were about 3.3 and 4.6 times more likely to report having given or sold some of their medication, respectively. Male sex was found to be an independent risk factor for selling medication.

Regarding coercion and theft, 3.0% (95% CI 1.6%–4.4%) and 4.3% (95% CI 2.7%–5.9%) of the students taking prescribed stimulants in the 12 months before the survey reported that some of their pills had been taken from them against their will or had been stolen, respectively. Sex, grade and province were not found to be risk factors.

**Table 1: Medical and nonmedical stimulant use reported by adolescent students in the year before a student drug use survey**

Characteristic	No. of students	Medical stimulant use			Nonmedical stimulant use		
		Weighted % of students (and 95% CI)	Unadjusted OR	Adjusted OR*	Weighted % of students (and 95% CI)	Unadjusted OR	Adjusted OR*
<b>Overall</b>	13 549	5.3 (4.9–5.7)			8.5 (7.9–9.1)		
<b>Sex</b>							
Male	6 731	5.7 (5.1–6.3)	1.18	1.17	9.0 (8.2–9.8)	1.13	1.07
Female	6 779	4.8 (4.2–5.4)	1.00	1.00	8.1 (7.3–8.9)	1.00	1.00
<b>Grade</b>							
7	3 553	4.2 (3.5–4.9)	1.00	1.00	3.2 (2.5–3.9)	1.00	1.00
9	3 589	6.1 (5.1–7.1)	1.49†	0.87	9.3 (8.0–10.6)	3.14‡	0.99
10	3 173	6.2 (5.2–7.2)	1.62‡	0.81	10.6 (9.3–11.9)	3.63‡	0.86
12	3 235	4.0 (3.3–4.7)	0.95	0.44‡	10.9 (9.8–12.0)	3.75‡	0.80
<b>Province</b>							
Nova Scotia	3 755	6.1 (5.2–7.0)	1.00	1.00	10.5 (9.3–11.7)	1.00	1.00
New Brunswick	3 298	4.7 (4.0–5.4)	0.75	0.83	8.4 (7.3–9.5)	0.79	0.90
Prince Edward Island	2 825	5.6 (4.7–6.5)	0.90	1.17	6.7 (5.6–7.8)	0.61‡	0.94
Newfoundland and Labrador	3 671	4.6 (3.8–5.4)	0.73†	0.77	6.3 (5.3–7.3)	0.57‡	0.59‡
<b>Alcohol use</b>							
No use	6 055	2.8 (2.3–3.3)	1.00	1.00	0.9 (0.6–1.2)	1.00	1.00
Any use	7 430	7.1 (6.4–7.8)	2.62‡	1.54†	14.4 (13.4–14.4)	17.60‡	4.59‡
<b>Cigarette smoking</b>							
None	8 952	3.3 (2.9–3.7)	1.00	1.00	2.9 (2.5–3.3)	1.00	1.00
Any smoking	4 501	9.0 (8.0–10.0)	2.93‡	1.75‡	19.1 (17.6–20.7)	7.79‡	2.28‡
<b>Cannabis use</b>							
No use	9 482	3.1 (2.7–3.5)	1.00	1.00	1.9 (1.6–2.2)	1.00	1.00
Any use	4 022	9.6 (8.5–10.7)	3.32‡	2.18‡	22.3 (20.7–23.9)	15.50‡	5.91‡

Note: CI = confidence interval, OR = odds ratio.

\*Adjusted for sex, grade, province, alcohol use, cigarette smoking and cannabis use.

†0.001 ≤  $p < 0.008$ .

‡ $p < 0.001$ .

### Relation between stimulant use and diversion of prescribed stimulants

The relation between medical use, nonmedical use and diversion was examined on the basis of 2 assumptions. First, it was assumed that actively giving or selling stimulants and, reciprocally, taking or buying stimulants might happen among students in the same school class. Second, it was assumed that students who reported nonmedical stimulant use who did not have a prescription for stimulants might obtain the drugs from students with a ready supply, that is, from students reporting medical stimulant use.

Nonmedical stimulant use was found to be significantly associated with the giving of prescribed stimulant medication. With the school class as the unit of analysis, the proportion of classes experiencing nonmedical stimulant use was found to increase in relation to the number of students in a class who reported having given some of their medication away. (For this analysis, the responses of 181 students in 63 of the 719 participating classes were excluded because the class had fewer than 6 students.) For example, in Nova Scotia and New Brunswick, 66%, 78% and 89% of the classes with 0, 1, and 2 or 3 students who gave medication, respectively, had at least 1 student who reported nonmedical stimulant use in the year before the survey ( $p < 0.001$ ) (Fig. 1). Nonmedical stimulant use was also found to be significantly associated with the giving of prescribed stimulant medication on the individual student level. Compared with students in classes in which no one reported having given

some of his or her prescribed medication away, those in classes with 3 students who did so were twice as likely to report nonmedical stimulant use (OR 2.1,  $p < 0.001$ ). The proportion of classes and individual students experiencing or reporting nonmedical stimulant use, in relation to the

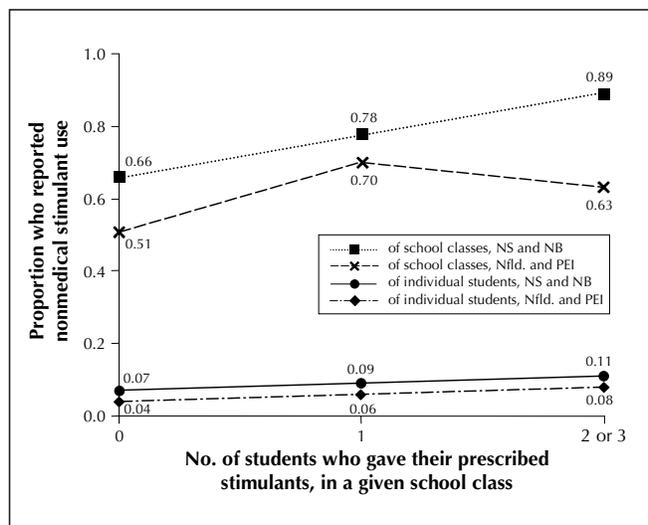


Fig. 1: Nonmedical stimulant use reported by adolescent students in Atlantic Canada who did not have a prescription for stimulant medication (shown as proportions of school classes and individual students, stratified by province), according to the number of students in their class who gave away some of their prescribed stimulant medication.

Table 2: Prescribed stimulants given or sold among students who reported medical stimulant use in the year before the survey

Characteristic	No. of students	Prescribed stimulants given			Prescribed stimulants sold		
		Weighted % of students (and 95% CI)	Unadjusted OR	Adjusted OR*	Weighted % of students (and 95% CI)	Unadjusted OR	Adjusted OR*
<b>Overall</b>	710	14.7 (11.8–17.6)			7.3 (5.1–9.5)		
<b>Sex</b>							
Male	384	17.5 (13.3–21.7)	1.62	1.58	11.0 (7.1–14.9)	4.05†	4.53†
Female	324	11.6 (7.7–15.5)	1.00	1.00	3.0 (0.9–5.1)	1.00	1.00
<b>Alcohol use</b>							
No use	170	6.4 (2.6–10.2)	1.00	1.00	3.9 (0.8–7.0)	1.00	1.00
Any use	539	17.3 (13.8–20.8)	3.07†	0.94	8.4 (5.7–11.1)	2.21	0.33
<b>Cigarette smoking</b>							
None	295	9.3 (5.6–13.0)	1.00	1.00	2.7 (0.6–4.8)	1.00	1.00
Any smoking	412	18.5 (14.4–22.6)	2.20†	1.16	10.4 (7.2–13.6)	4.07†	3.30
<b>Cannabis use</b>							
No use	305	5.7 (2.7–8.7)	1.00	1.00	2.6 (0.6–4.6)	1.00	1.00
Any use	402	20.8 (16.6–25.0)	4.30‡	2.54	10.5 (7.1–13.9)	4.31†	2.23
<b>Nonmedical stimulant use</b>							
No use	479	8.0 (4.9–10.9)	1.00	1.00	3.2 (1.3–5.1)	1.00	1.00
Any use	231	28.2 (22.2–34.2)	4.53‡	3.28‡	15.5 (10.1–20.9)	5.49‡	4.59†

\*Adjusted for sex, alcohol use, cigarette smoking, cannabis use and nonmedical stimulant use.

†0.001 ≤  $p < 0.01$ .

‡ $p < 0.001$ .

giving of medication, were significantly higher in Nova Scotia and New Brunswick than in PEI and Newfoundland and Labrador ( $p < 0.001$ ) (Fig. 1). Similar findings were observed relative to the selling of stimulant medication.

## Interpretation

The present study provides a population-based estimate of the proportion of students with prescriptions for stimulant medication who experienced a diversion of their medication to nonmedical use. The vast majority of students taking stimulant medications appeared to be using them as sanctioned. A relatively small proportion who were prescribed stimulants had their medication stolen or were forced to give it up. Musser and colleagues<sup>13</sup> found that 16% of Wisconsin school children had been approached to give, sell or trade their prescribed methylphenidate; unfortunately, the authors did not ask whether the children had actually done so. In the Atlantic provinces about 15% and 7% of the students who reported medical stimulant use in the 12 months before the survey reported actually having given or sold, respectively, some of their medication. Thus, a subset of students apparently misused or abused their stimulant medication for its recreational potential or currency as a street drug.

In addition, the present survey provides empirical evidence about the relation between medical and nonmedical stimulant use and the diversion of prescribed stimulants among students. The most direct evidence was the reporting of giving or selling of stimulants by some students with prescriptions. Students most likely to have given or sold some of their medication were those who also reported nonmedical stimulant use. Medical and nonmedical stimulant use were also associated with substance use. Compared with students who reported medical stimulant use, students who reported nonmedical use appeared to be much more committed users of alcohol, cigarettes and cannabis. At the school class level, an increasing proportion of students per class reporting the giving or selling of medication was found to be an independent predictor of at least 1 student per class reporting not having a prescription but nonetheless using stimulants. Thus, it appears that the school class may constitute not only an administrative collective but also a natural social group or informal economic market in which drug transactions can occur.

The main limitation of the study was that it relied on self-reported information. School-based surveys are thought to systematically underestimate the prevalence of risk behaviours in the larger adolescent population, because youths not in school, through either absenteeism or school dropout, are more likely to engage in such behaviours than are adolescents in school.<sup>23</sup> Thus, the present study may provide an underestimate of the prevalence and diversion of stimulants in the adolescent population of Atlantic Canada. As well, the study is cross-sectional and thus provides correlational rather than causal evidence

about the relation between diversion and nonmedical stimulant use. Finally, the questionnaire asked about various stimulants in a single question rather than in separate questions, which may have led to an obscuring of the ratios of interest. For example, several studies have reported a preponderance of females taking diet pills<sup>1</sup> and males taking methylphenidate.<sup>7-9</sup>

Ultimately, public health and clinical practice must inform each other. From a clinical perspective, physicians prescribing stimulant medication should be vigilant concerning potential abuse, particularly among adolescent patients known or thought to be using other substances. Physicians and parents should keep track of stimulant medication, especially when several months' supply is prescribed.<sup>24</sup> The present study should not detract from the a priori value of methylphenidate and dextroamphetamine, which are well-established and safe medications of proven efficacy for attention deficit/hyperactivity disorder.<sup>25</sup> However, this study does underscore the need for a broad understanding of benefit versus risk, one that recognizes the impact of prescribing practices at the societal as well as the individual level.

*Competing interests:* None declared.

*Acknowledgements:* Thanks are extended to Linda Van Til, Department of Health and Social Services, Prince Edward Island; Jim Baker, Department of Health, Nova Scotia; Ron Tizzard, Department of Health and Community Services, Newfoundland and Labrador; and Bob Jones, Department of Health and Community Services, New Brunswick, for reviewing an earlier draft of the document.

This research was supported by Medical Research Council of Canada grant MA-14706 and a Clinical Scholar Award from the Faculty of Medicine, Dalhousie University. Funding for data collection was provided in part by the Departments of Health in Nova Scotia, Newfoundland and Labrador, Prince Edward Island and New Brunswick.

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## Association médicale canadienne

### Prix spéciaux de 2002

L'Association médicale canadienne lance un appel de candidatures pour les Prix spéciaux de 2002. Le Comité des archives étudiera les candidatures en janvier 2002, et les lauréats seront prévenus en mars. La remise des prix se fera dans le cadre de l'Assemblée générale annuelle de l'AMC, qui aura lieu à Saint John (Nouveau Brunswick), du 18 au 21 août 2002.

#### La médaille d'honneur

La médaille d'honneur est la plus haute distinction que l'AMC puisse conférer à une personne n'appartenant pas au corps médical.

Cette distinction est conférée en reconnaissance de contributions individuelles au progrès de la recherche médicale, de l'enseignement de la médecine, de l'organisation des soins médicaux et de l'éducation de santé du public, de services méritoires rendus à la population canadienne en relevant le niveau des soins médicaux au Canada, et de services méritoires rendus à la profession dans le domaine de l'organisation médicale.

#### Le prix F.N.G. Starr

Le prix Frederic Newton Gisborne Starr est la plus haute distinction que l'Association puisse décerner à l'un de ses membres. Les réalisations des candidats sont les critères déterminants de leur admissibilité.

Les récipiendaires ont su se distinguer de l'une des façon suivantes : en apportant une contribution exceptionnelle à la science, aux beaux-arts ou à la littérature (non médicale), ou en se signalant par leur courage et leur ténacité, dans des situations éprouvantes, pour faire avancer le domaine de la santé ou sauver des vies, en faisant progresser l'esprit humanitaire ou la vie culturelle de leur communauté ou en améliorant les services médicaux au Canada.

Ces réalisations doivent revêtir un caractère exceptionnel qui puisse inspirer la profession médicale canadienne ou lui poser un défi.

#### La médaille de service

La médaille de service de l'AMC est attribuée à un membre de l'AMC qui a apporté une contribution exceptionnelle et extraordinaire au progrès des soins de santé au Canada. Il peut s'agir de service à

la profession dans le domaine de l'organisation médicale, de service à la population canadienne en aidant à relever les normes de pratique de la médecine au Canada ou d'une contribution personnelle à l'avancement de l'art de la science de la médecine.

**Les candidatures, y compris les pièces justificatives, doivent être présentées par écrit avec un curriculum vitae en annexe à :**

**Kathy Hannam**  
Affaires générales  
Association médicale canadienne  
1867, prom. Alta Vista  
Ottawa (Ontario) K1G 3Y6

**La date limite de réception des candidatures est le 30 novembre 2001.**

