A B S T R A C T

Despite a growing interest in the use of methylphenidate (Ritalin) to treat attention deficit/hyperactivity disorders, prevalence data has been scarce in Canada. A probability school survey conducted in 1997 among Ontario students in grades 7, 9, 11 and 13 is used to collect data on such use. Overall, 3.4% of students (5.3% of males, 1.7% of females) used methylphenidate in the previous year. Rates and patterns are similar to those found in the United States. Future research needs to examine reasons and correlates of use, extent of medical supervision and possible non-medical use of methylphenidate.

A B R É G É

En dépit d'un intérêt croissant pour l'usage du méthylphénidate (Ritalin) dans le traitement des troubles d'hyperactivité avec déficit de l'attention (THDA), les données sur sa prévalence sont rares au Canada. Nous recueillons des données sur cet usage par le biais d'une enquête probabiliste menée en 1997 dans les écoles auprès d'élèves ontariens inscrits en 7^e, 9^e, 11^e et 13^e années. Dans l'ensemble, 3,4 % des élèves (5,3 % des garçons et 1,7 % des filles) ont fait usage de méthylphénidate durant l'année précédente. Les tendances et les taux observés au Canada sont semblables à ceux observés aux États-Unis. Des recherches plus poussées devraient établir des corrélations entre l'usage, l'ampleur de la supervision médicale et le potentiel d'usage non médical du méthylphénidate.

Prevalence of Methylphenidate Use Among Adolescents in Ontario

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Although methylphenidate has been intensely studied and widely used as a treatment for Attention Deficit/Hyperactivity Disorders (ADHD) for approximately 30 years,¹ the drug is still a subject of controversy. In the United States, use of methylphenidate rose steadily between 1971 and 1987.² A subsequent wave of negative publicity and lawsuits involving Ritalin³ appears to have caused a significant decline in the use of the drug to treat hyperactivity and inattentiveness between 1989 and 1991.⁴ More recent data suggests that methylphenidate use is increasing once again in the 1990s.^{5,6}

There may be a number of potential problems linked to such an increase which should be a cause for some concern. One obvious question is whether the prevalence of ADHD is actually increasing, or is methylphenidate being prescribed to children and adolescents who do not really need it? The very concept of ADHD has undergone numerous changes through the years,⁷ so it is possible that a wider range of symptoms has led to a wider use of methylphenidate. For instance, one notable change has been the distinction between Attention Deficit Disorder with and without hyperactivity.² Students who are inattentive, but not necessarily hyperactive are now more likely to be treated with stimulants than in the past. A related issue is whether the increasing number of students receiving methylphenidate are also receiving the psychological, social or edu-

cational treatment which is often critical for successfully treating ADHD. Recent surveys of pediatricians suggest that this may not be the case; methylphenidate is often the sole treatment for patients with ADHD.^{8,9} Given increases in methylphenidate use, adverse side effects due to methylphenidate may also increase. While methylphenidate is generally considered a relatively safe stimulant,¹ a surprising number of adverse side-effects have been noted in the literature,¹⁰ the prevalence of which may become more common if methylphenidate is inappropriately prescribed or if the patient lacks proper supervision. An additional concern is that the increase in prescribed use will allow more of the drug to be diverted for non-medical use among various subpopulations including other children, adults and drug use addicts.¹¹ Various clinical studies have found serious consequences of methylphenidate abuse, including morbidity and mortality that is similar to, or exceeds that of cocaine and amphetamines.^{12,13}

Despite the fact that methylphenidate use has become an important public health issue, reliable prevalence estimates have been scarce.⁶ Data for elementary and secondary students, the most common users of methylphenidate, has been especially absent. Past reports of prevalence estimates have relied on a number of methods. One approach is to use the prevalence of ADHD as a proxy to estimate the drug prevalence, since roughly 90% are likely to be treated with methylphenidate.^{5,9} For example, the Ontario Child Health Study reported rates of hyperactivity for boys and girls aged 4-16 to be 8.9% and 3.3%, respectively.¹⁴ In the United States, one potentially alarming indicator of rising prevalence was the 6-fold increase in

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methylphenidate production since 1990.¹¹ In response to these reports, Safer and colleagues used a variety of data sources to estimate trends in methylphenidate use in the United States, including repeated surveys of school nurses, pharmaceutical databases and physician surveys, and found much more modest increases.⁵ Overall, they estimate that approximately 2.8% of youths in the United States used methylphenidate in 1995.

Surprisingly, self-report student surveys have not been used for collecting data on methylphenidate use. In the United States, large-scale student drug use surveys such as Monitoring the Future ask about illicit drugs only.¹⁵ Although past student drug use surveys in Canada have asked about the use of medical drugs, including stimulants, they have not included specific questions about Ritalin.^{16,17} It is doubtful whether such questions are useful as indicators of methylphenidate use, given that they combine all stimulants and presuppose that students could correctly classify a drug which reduces inattention and hyperactivity as a stimulant. Furthermore, doctors prescribing stimulant medication typically tell patients not the name of the drug, but that the drug will allow them to concentrate, calm them or assist them with schoolwork.⁹

The aim of this study is to present prevalence and population estimates of methylphenidate use among Ontario students based on a self-report drug use survey. As far as we are aware, this is the first time in Canada that data on methylphenidate has been collected from a large-scale probability survey of youth.

METHOD

We use data from the 1997 cycle of the Ontario Student Drug Use Survey,¹⁸ a cross-sectional probability survey of Ontario students enrolled in grades 7, 9, 11 and 13 (ages 10 to 20 years). Because the OSDUS is a biennially-repeated monitoring survey, it provides a timely vehicle to address various public health issues among adolescents, such as in this case, the self-reported use of methylphenidate. The OSDUS, administered by the Institute for Social Research, York University, employs

a single-stage cluster probability design stratified proportionately into four geographical regions (Toronto, West, East and North Ontario) and equally within the four grades. In total, 3,990 students from 22 school boards, 168 schools and 234 classes comprise the final sample. The overall student participation rate is 77%. Further details of the study design are available.¹⁸ All analyses are conducted with Stata 5.0 using the *svy* procedure in order to properly account for the stratification and clustering of the survey design.¹⁹

We ask students two questions concerning Ritalin use. The first is a measure of 12-month prevalence: "Sometimes doctors give medicines such as Ritalin to students who are hyperactive or have difficulties concentrating in school. This is sometimes called Attention Deficit Disorder. During the last 12 months, have you taken any medicine like Ritalin that was prescribed by a doctor?" The response categories are either yes or no. Although this question cannot directly determine the prevalence of prescribed medication for ADHD, it can provide useful bounds in establishing the magnitude of methylphenidate usage. The question specifically mentions Ritalin, since it is the most well-known name, but is also general enough to include other drugs which may be used to treat ADHD. The second question is a measure of the duration of current daily Ritalin use: "If you have used Ritalin within the last two days, how long have you been using it daily?" Although regular use does not necessarily imply daily use, since methylphenidate may not be prescribed on weekends or summer months, we consider daily use to be a reasonable indication of typical Ritalin use. A detailed study of duration would require many more questions, but we were restricted to one question due to time constraints. The response categories include: never in my lifetime; I have used Ritalin but not in the last 12 months; less than 1 month; daily for 1 to 6 months; daily for 7 to 12 months; daily for 1 to 2 years; daily for 3 to 4 years; and daily for more than 4 years. Because of the small number of current daily users, we collapse the last six categories into 1 to 12 months, 1 to 4 years and more than 4 years.

We present prevalence estimates and 95% confidence intervals for the total sample as well as by sex, grade and region. In addition, all grade and region estimates are further disaggregated by sex, given the consistent finding that males are much more likely to receive stimulants.⁵ In addition to prevalence estimates, we include population estimates for the total and males and females. Finally, we include data on the duration of daily Ritalin use.

RESULTS

As seen in Table I, the prevalence of past 12 months' Ritalin use among Ontario students is 3.4% (2.6% to 4.2%, 95% CI), an estimate within the range of the 2.8% found in the United States in 1995.⁵ Despite differences in study design and population, rates of Ritalin use for males (5.3%) and females (1.7%) are also consistent with, although somewhat lower than, the prevalence of hyperactivity in Ontario among 12 to 16 year old males (7.3%) and females (3.4%).¹⁴ Our data likely underestimate the prevalence of methylphenidate use, given that our sample includes students 18 and older and we do not include special schools in our sample, so students with the most serious learning disabilities would be excluded. The prevalence rates for males and females also reflect the narrowing of the traditional sex differences. We find a 1:3 female/male ratio, a figure consistent with recent reports from the United States which range from 1:5 to 1:2.5.^{5,9} Projecting our prevalence rates to the population of grades 7, 9, 11 and 13 students, we estimate that approximately 16,187 students (11,835 males and 4,352 females) used methylphenidate in the previous 12 months.

Our data show a clear decrease in methylphenidate use by grade (Table II). Use is highest among Grade 7 students (5.1%) and declines to 1.5% for Grade 13 students. Similarly, use among males declines from 8.6% to 1.7%. However, rates among females only vary between 1 and 2%. It should be noted that younger students not included in our sample would likely have much higher prevalence rates than the Grade 7 students. Medication for ADHD is typically most common by grade

TABLE I
Prevalence of Ritalin Use and Population Estimates Among Ontario Students, 1997 (n=3949)

	%	95% C.I.	Population Estimate*	95% C.I.
Total	3.4	(2.6, 4.2)	16,187	(12,443, 19,932)
Males	5.3	(4.1, 6.6)	11,835	(8,634, 15,035)
Females	1.7	(1.0, 2.5)	4,352	(2,509, 6,195)

* Based on an estimated population of 473,604 grades 7, 9, 11 and 13 students

TABLE II
Prevalence of Ritalin Use Among Total, Males and Females by Grade and Region, 1997

	Total (n=3949)		Males (n=1823)		Females (n=2124)	
	%	95% C.I.	%	95% C.I.	%	95% C.I.
Grade						
7	5.1	(2.9, 7.2)	8.6	(4.9, 12.3)	1.9	(0.3, 3.6)
9	3.9	(2.5, 5.3)	6.1	(3.8, 8.5)	2.2	(0.7, 3.6)
11	2.3	(1.4, 3.3)	3.3	(2.6, 4.0)	1.3	(0.2, 2.5)
13	1.5	(0.5, 2.4)	1.7	(0.1*, 3.4)	1.2	(0.8, 1.6)
Region						
Toronto	2.7	(1.1, 4.3)	3.8	(1.8, 5.8)	1.6	(0.1*, 3.2)
North	2.9	(1.8, 3.9)	5.8	(2.7, 8.9)	0.7	(0.1*, 1.8)
West	3.5	(2.3, 4.7)	5.8	(3.5, 8.1)	1.4	(0.7, 2.1)
East	4.0	(2.3, 5.6)	5.6	(3.5, 7.8)	2.6	(0.6, 4.5)

* Estimate less than 0.1%

TABLE III
Duration of Daily Ritalin Use, 1997 (n=3836)

	%	95% C.I.
Never Used Ritalin in lifetime	94.7	(93.8, 95.6)
Used Ritalin in lifetime, but not past 12 months	3.1	(2.6, 3.6)
Used daily for 1 to 12 months	1.1	(0.6, 1.6)
Used daily for 1 to 4 years	0.6	(0.3, 0.9)
Used daily for more than 4 years	0.6	(0.3, 0.9)

three and declines thereafter.² Differences by region, however, are much less pronounced. Estimates range from 2.7% to 4.0% among the total sample, 3.8% to 5.6% among males, and 1.6% to 2.6% among females. Lastly, the duration of daily Ritalin use is shown in Table III. Overall, 5.3% of students used Ritalin in their lifetime. Lifetime, but not past 12 months use is 3.1%, higher than all the current daily users (2.3%).

DISCUSSION

The lack of prevalence data for methylphenidate use among students in Canada makes it difficult to put the current findings into context. In addition, our sample does not include special schools or younger grades where methylphenidate tends to be more prevalent. Also, since this is the first time we included methylphenidate in our survey, we have no trend data with which to compare it. Unlike the United

States, which has data going back to the 1970s, we have no way of knowing whether our current estimates for Ontario are higher or lower than in the past. Still, there are enough similarities to the recent US data to suggest that the situation in Ontario may be comparable to that in the United States and that our data provide reasonable estimates of methylphenidate use. Both the total prevalence rate and the female-male ratios are close to recent US figures.

Our results also support the use of self-report drug use surveys as a means of collecting and monitoring data on methylphenidate. Alternative methods, such as production quotas, prescription databases or physician surveys often are not practical, have serious limitations or provide only limited data. The advantage to the self-report survey is that it also allows the opportunity to investigate a wide range of social, behavioural and demographic variables and their relationships to methylphenidate use.

In addition to studies of prevalence and incidence of use, a number of important research topics involving methylphenidate need to be addressed. One issue is whether students who are being treated with methylphenidate for ADHD are also receiving complementary non-drug care such as behavioural treatments, educational care or psychological counselling, and whether such a multimodal approach is more effective than drug treatment alone. School surveys could also be used to examine whether students using methylphenidate differ from their peers on such variables as educational attainment, mental health or illicit drug use. One last emerging issue especially suited to the survey approach is that of non-medical use of methylphenidate. As the drug becomes more popular, there have been numerous anecdotal reports of students sharing, stealing and buying methylphenidate for their own non-medical use.²⁰ It would be valuable to obtain more rigorous and systematic evidence of such diversion before it becomes a potential public health issue.

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tout au long de l'année. La surveillance hospitalière de la morbidité et de la mortalité dues à la grippe devrait être envisagée comme moyen de disposer de données exactes sur la gravité et sur l'impact des épidémies et des pandémies. Le renforcement de la surveillance pendant une pandémie peut comprendre la surveillance des cliniques pour les voyageurs internationaux et celle de ces derniers lorsqu'ils proviennent de régions où de nouvelles souches ont été identifiées. Au niveau mondial, le renforcement de la surveillance de la grippe en Asie ainsi que dans d'autres régions densément peuplées où il existe des possibilités de contact entre l'homme et l'animal peut contribuer à une détection précoce des futurs virus à caractère pandémique.⁷

De nouveaux progrès dans les technologies de vaccination contre la grippe et dans les thérapies antivirales au cours des dernières années vont aussi influencer la gestion des futures pandémies et épidémies. La vaccination est le principal outil disponible pour atténuer l'impact d'une épidémie ou d'une pandémie de grippe. Le processus de fabrication des vaccins à partir des oeufs que l'on utilise aujourd'hui fait que les premiers vaccins ne seraient pas disponibles avant au moins trois mois après le déclenchement d'une pandémie. L'émergence d'infections humaines par des virus de la grippe aviaire (par ex., *influenzae A H5N1* et *influenzae A H9N2*) qui sont mortels pour les oeufs a accentué les efforts pour trouver de nouvelles façons de produire des vaccins antigrippaux en grande quantité.^{4,8} Il s'agit notamment de fabriquer des vaccins avec les moyens existants (par ex., en atténuant la virulence du vaccin sur les oeufs, en recourant à des virus de substitution avirulents) et en mettant au point d'autres tech-

niques (par ex., culture cellulaire de virus, vaccins ADN).^{5,9} On a montré que les vaccins antigrippaux vivants atténués, adaptés au froid et administrés par voie intranasale, étaient efficaces et sans danger chez les jeunes enfants, et qu'ils pouvaient prévenir la grippe et l'otite moyenne due à la grippe au sein de cette population.¹⁰

Un des principaux éléments du plan d'urgence pour le cas d'une grippe pandémique au Canada est de garantir un approvisionnement en vaccins sécuritaires au cours de la pandémie. L'augmentation de la vaccination antigrippale entre les pandémies est la meilleure façon de renforcer la capacité de fabrication et le système de distribution des vaccins, tout en facilitant le passage à des niveaux pandémiques de vaccination. Le Comité consultatif national de l'immunisation recommande de vacciner chaque année contre la grippe les personnes âgées ainsi que toutes celles souffrant de maladies chroniques; on estime que 7 millions de Canadiens appartiennent à ces groupes à risque élevé.¹¹ Bien que la quantité de vaccin antigrippal distribuée au Canada ait augmenté au cours des vingt dernières années, 4,6 millions de doses seulement sont distribuées chaque année, et il convient de redoubler d'efforts pour sensibiliser davantage le public à la vaccination contre la grippe.

Le seul antiviral disponible au Canada pour la chimioprophylaxie et le traitement de la grippe est l'amantadine; un médicament voisin, la rimantadine, est également disponible aux États-Unis. L'utilisation de ces médicaments présente comme restrictions des effets secondaires, un manque d'efficacité contre la grippe de type B et le développement d'une résistance virale. Une nouvelle catégorie d'antiviraux, les inhibiteurs de la neuraminidase, a été mise au point à partir d'une conception

rationnelle de médicament. Ces médicaments agissent spécifiquement sur l'action de la neuraminidase de la grippe, un enzyme essentiel pour la réplication des virus de type A et B. Le zanamivir est le premier composé à être autorisé aux États-Unis pour soigner les infections grippales A et B, mais n'est pas encore disponible au Canada. Chez les adultes, le zanamivir a permis d'atténuer la gravité et de réduire de 1 à 1 journée et demi la durée d'une infection grippale sans complication, mais d'autres études sont nécessaires pour les populations à risque élevé de pathologie grave.^{12,13} Lors d'un essai clinique récent, l'efficacité du zanamivir a été de 67 % (95 % IC : 39 % – 83 %) pour prévenir l'infection grippale confirmée en laboratoire, en l'administrant une fois par jour pendant quatre semaines au cours de la saison des gripes à des adultes de moins de 65 ans.¹⁴ La tolérance au zanamivir peut faire problème car il doit être inhalé; les inhibiteurs de la neuraminidase par ingestion orale sont en cours de développement. Les cibles des inhibiteurs de la neuraminidase sont fortement concentrées et la résistance clinique à ces médicaments n'a jusqu'à maintenant pas été considérée comme un problème grave. Toutefois, des souches résistantes au médicament ont été produites en laboratoire et on a rapporté un cas de résistance au zanamivir après utilisation prolongée chez un enfant immuno-déprimé souffrant de la grippe de type B.¹⁵ Les antiviraux ne devraient pas être considérés comme la principale stratégie de prophylaxie contre les pandémies de grippe, étant donné leur coût, le besoin de doser individuellement l'amantadine et le suivi à faire auprès de ceux qui courent davantage de risques d'effets indésirables, et enfin à cause du potentiel de non observance.

...voir Grippe, à la page 319