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## Hyperactivity and Inattention Symptoms in Children, from Preschool Years to Grade 2

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**A**ttention Deficit Disorder, with or without Hyperactivity (ADD/ADHD), is a neurological phenomenon usually characterized by lack of attention or concentration, and sometimes by hyperactivity or impulsivity behaviours. It manifests in childhood and can engender academic achievement problems in school<sup>1,2</sup> and low self-esteem, which in some cases, persists into adulthood. Although attention deficit is often diagnosed around 7 years of age, it seems that in some children it manifests in early childhood, before school entry.<sup>3</sup>

Data from the Québec *Longitudinal Study of Child Development* (QLSCD 1998-2010) provide a means of documenting the evolution of hyperactivity and inattention (HI) behaviours in children from the age of 3½ years, namely from before they entered the education system. This article covers trajectories of these behaviours between the ages of 3½ and 8 years, as reported by a parent, usually the mother.

To obtain a detailed portrait of the progress of HI behaviours, the results of our analyses are presented in a scale that combines both hyperactivity and inattention behaviours, and then a scale for each taken separately. We then explore associations between trends in these behaviours and various characteristics assessed in Grade 2 such as the level of HI and academic performance reported by

the teacher, the fact of having received a recognized diagnosis of attention deficit disorder, with or without hyperactivity (see Box 1), taking medication to treat HI,<sup>4</sup> and the type of class the child is in. When the numbers permit, the results are presented by sex.

### Box 1

#### Attention Deficit Disorder with or without Hyperactivity (ADD/ADHD)

Although many children present hyperactivity or inattention behaviours, they are not necessarily caused by attention deficit disorder with or without hyperactivity (ADD/ADHD). To be considered as having a disorder, a child must present symptoms to a degree of frequency and intensity that is maladaptive and inconsistent with his /her developmental age. Moreover, according to the DSM-IV, 1) the symptoms of hyperactivity-impulsivity or inattention that cause impairment must have been present before the age of 7; 2) some impairment from the symptoms is present in at least two settings (e.g. at home and at school); and 3) a clinically significant impairment in social or school functioning must be clearly demonstrated.<sup>5</sup>

1. J. FLUSS, D. BERTRAND, J. ZIEGLER and C. BILLARD (2009), "Troubles d'apprentissage de la lecture: rôle des facteurs cognitifs, comportementaux et socio-économiques," *Développements*, June, p. 21-33.
2. G. J. DUNCAN, C. J. DOWSETT, A. CLAESSENS, K. MAGNUSON, A. HUSTON, P. KLEBANOV, L. PAGANI, L. FEINSTEIN, M. ENGEL, J. BROOKS-GUNN, H. R. SEXTON, K. DUCKWORTH and C. JAPEL (2007), "School readiness and later achievement", *Developmental Psychology*, Vol. 43, No. 6, p. 1426-1446.
3. N. ENGELS, L. FIORENTINO, S. KARPMAN AND M. TURNLEY (2004), *Family Front and Centre: A Support Resource Promoting Healthy Child Development, Book 2: Attention*, Ottawa, Public Health Agency of Canada, 21 p. [Online]: [www.phac-aspc.gc.ca/hp-ps/dca-dea/publications/ffc-ief/book-livre-2-eng.php](http://www.phac-aspc.gc.ca/hp-ps/dca-dea/publications/ffc-ief/book-livre-2-eng.php) (page accessed April 6, 2010).
4. The question addressed the use of Ritalin® or any other medication taken to treat hyperactivity or inattention. For purposes of concision, only the term Ritalin® is used in certain sections of this article.
5. AMERICAN PSYCHIATRIC ASSOCIATION (1995, international version) French translation of the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) under the direction of J. D. Guelfi (1996), *DSM-IV, Manuel diagnostique et statistique des troubles mentaux*, Paris, Masson, 1008 p.

## Parental assessment of hyperactivity and inattention behaviours in their child between the ages of 3½ and 8 years

Hyperactivity and inattention behaviours were measured in the QLSCD by nine items included in the *Interviewer-Completed Computerized Questionnaire (ICCQ)*. These were the same items used in the *National Longitudinal Survey of Children and Youth*, which themselves were taken from the *Ontario Child Health Study (OCHS)* and the *Longitudinal and Experimental Study of Low Socio-Economic Status Boys in Montréal (ÉLEM)*.<sup>6</sup> From 2001 to 2004, and in 2006, the person most knowledgeable of the child (PMK), generally the mother, was asked how often during the past 12 months the child:

- (1) *Could not sit still, was restless or hyperactive*
- (2) *Couldn't stop fidgeting*
- (3) *Was impulsive, acted without thinking*
- (4) *Had difficulty waiting for his/her turn in games*
- (5) *Couldn't settle down to do anything for more than a few moments*
- (6) *Was unable to wait when someone promised him/her something<sup>7</sup>*
- (7) *Was unable to concentrate, could not pay attention for long*
- (8) *Was easily distracted, had trouble sticking to any activity*
- (9) *Was inattentive.*

The response choices were the following: 1) Never or not true; 2) Sometimes or somewhat true; 3) Often or very true. Based on the responses to the aforementioned items, scores were calculated to construct scales which were then transformed into values ranging from 0 to 10. Three scales were constructed for each round of the QLSCD for which relevant data were available – a hyperactivity scale comprising the first six items, an inattention scale comprising the last three items, and a scale combining the two types of symptoms. These scales provided an acceptable level of accuracy. The coefficient of internal consistency (Cronbach's alpha) for the HI scale was between 0.81 and 0.85 according to age. The coefficient of internal consistency for hyperactivity alone varied between 0.72 and 0.79 between 3½ and 8 years of age, and for inattention alone between 0.71 and 0.80 for the same period.

## Characteristics examined for associations with hyperactivity and inattention behaviours reported by the parent

### Hyperactivity and inattention reported by the Grade 2 teacher

The same type of data was collected from the child's teacher as part of the *Self-Administered Questionnaire for the Teacher (SAQT)* when the child was in Grade 2 of elementary school. Indeed, the items used to construct the

HI scale based on teachers' responses were the same used to construct the scale based on the mothers' responses. A scale with values from 0 to 10 was constructed based on the responses to the nine items. Reliability was considered to be at an acceptable level as shown by the coefficient of internal consistency (Cronbach's alpha = 0.82).

### Academic performance reported by the Grade 2 teacher

Academic performance in Grade 2 of elementary school was assessed using three questions asked of the teacher regarding performance in reading, writing and mathematics. The response choices were: 1) Near the top of the class; 2) Above the middle of the class, but not at the top; 3) In the middle of the class; 4) Below the middle of the class, but above the bottom; 5) Near the bottom of the class. A scale from 0 to 12 was constructed based on the teacher's responses, 12 being optimal academic performance.

### Type of Grade 2 class attended

In the Québec education system, particular attention is paid to students at risk, as well as students with handicaps, social maladjustments or learning disabilities (SHSMLD).<sup>8</sup> These children attend either regular or special needs classes. Five options are provided, namely 1) integration in a regular class with support for both teacher and student; 2) integration in a regular class with participation in a resource class or with support for the student; 3) homogeneous special needs class comprising students with the same type of difficulty; 4) heterogeneous special needs class comprising children with various types of difficulties; 5) special needs school where more than half of the students are considered to have special needs.<sup>9</sup> For this analysis, the *Fichier de déclaration des clientèles scolaires* (Declaration of School Enrolment) of the Ministère de l'Éducation, du Loisir et du Sport (MELS) (Ministry of Education, Leisure and Sport) was used to ascertain the status of the students, i.e. special needs or not, and the type of class attended. Special needs children were divided into two groups by whether they attended a regular class with support (categories 1 and 2) or a special needs class (categories 3, 4 and 5). A third group comprised all other students, namely those with no handicap, adjustment or learning problems, who attend regular classes.

### ADD/ADHD and taking Ritalin<sup>®</sup>

Beginning in the 2003 round of the QLSCD, parents have been asked each year whether their child had already been given a diagnosis by a health professional of attention deficit disorder with or without hyperactivity, and whether Ritalin<sup>®</sup> or any type of medications prescribed to treat HI had been prescribed to him or her in the 12 months preceding the round of data collection.

## Methods

Group-based trajectory modeling was used to describe the progress of hyperactivity and inattention in the children between 3½ and 8 years of age as reported by the parents (see Box 2).

6. J. THIBAUT, M. JETTÉ, H. DESROSIERS and L. GINGRAS (2003), "Concepts, Definitions and Operational Aspects, Part I – QLSCD: Overview of the Study and the Survey Instruments for the 1999 and 2000 Rounds," in: *Québec Longitudinal Study of Child Development (QLSCD 1998-2002) – From Birth to 29 Months*, Québec, Institut de la statistique du Québec, Vol. 2, No. 12, p. 19-80.

7. This question was not asked in 2001 and 2002.

8. In Québec in French, special needs students are referred to as *élèves handicapés ou en difficulté d'adaptation ou d'apprentissage (EHDA)*, which the Ministry of Education, Leisure and Sport has translated as Students with Handicaps, Social Maladjustments or Learning Difficulties (SHSMLD). In this article, for purposes of concision, we use the acronym SHSMLD or simply use the term special needs students, which is widely used in the English language education system in the province.

9. GOUVERNEMENT DU QUÉBEC. MINISTÈRE DE L'ÉDUCATION, DU LOISIR ET DU SPORT (2007), *Guide de la déclaration de l'effectif scolaire des jeunes en formation générale (DCS)*, Québec, MELS, [Online]: [www.bibliotheque.assnat.qc.ca/01/PER/909154/2007\\_08.pdf](http://www.bibliotheque.assnat.qc.ca/01/PER/909154/2007_08.pdf) (page accessed April 14, 2011).

To document associations between the trajectories obtained and the various characteristics under study, tests of proportion differences and analyses of variance (ANOVA) were conducted. The models included an imputation procedure providing a means of taking into account the probabilities of belonging to the estimated trajectories and the uncertainty associated with these probabilities.

All the data presented here have been weighted to allow for a generalization of the results to the target population of the QLSCD. In addition, the complex sample design of the survey was incorporated in the production of statistical tests. The results cover a cohort of children born in Québec in the late 1990s. Therefore, excluded from this analysis are children who arrived in Québec after being born elsewhere – approximately 9% of children 8 years of age in 2006.<sup>10</sup>

## Results

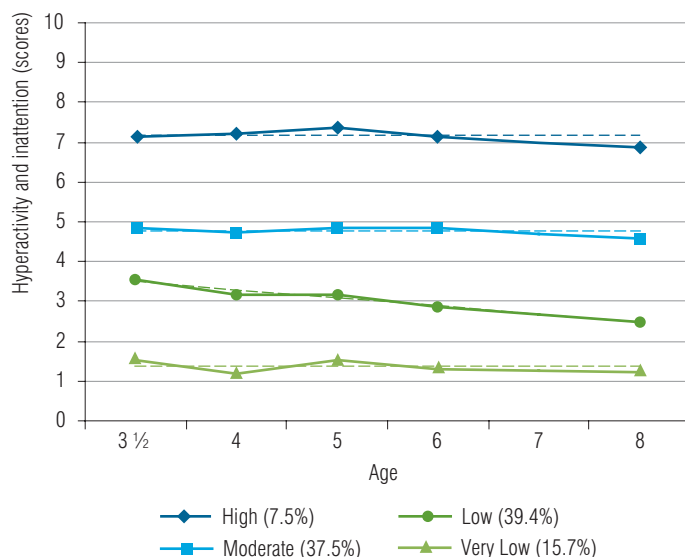
### Hyperactivity and inattention symptoms between 3½ and 8 years of age

Figure 1 presents the HI trajectories of children between 3½ and 8 years of age as assessed by the parent, generally the mother.

Nearly 8% of children were likely to present a High score on the HI symptoms scale between 3½ and 8 years of age. The children in this group obtained a score of approximately 7 out of 10 on the HI scale. At the other end of the spectrum, those who scored Low and Very Low comprised 39% and 16% respectively of the children.

Figure 1

### Hyperactivity and inattention (HI) symptoms trajectories in children from 3½ to 8 years of age, Québec, 2001-2004 and 2006



Note: The solid lines represent actual values, and the dashed lines represent predicted values. Since the SAS "traj" procedure used in this analysis did not take into account the complex sample design of the survey in estimating the variance, confidence intervals are not presented.

Source: Institut de la statistique du Québec, QLSCD 1998-2010.

## Box 2

### Analysis of developmental trajectories

Group-based trajectory modeling was conducted using the "traj" procedure in the SAS software program. The trajectory method can identify distinct trajectories in a given population and estimate the proportion of the population following each one.<sup>11,12,13</sup> The estimated group of children in a given trajectory is based on a probabilistic method and represents the *approximate* proportion of the population following the same developmental trajectory.

The hyperactivity and inattention trajectories obtained were based on information provided by parents when the children were 3½, 4, 5, 6 and 8 years of age.<sup>14</sup> Note that the criteria used for the trajectory models involved a minimum of four valid measurement times out of the five possible ones of HI and at least one valid datum among the characteristics under study potentially associated with HI behaviours. Based on the aforementioned, 1,397 children were eligible to be included in the analysis (4 measurement times: 12%; 5 measurement times: 88%). To determine the optimal number of groups, trajectory models between one and five groups were tested. The optimal model for both trajectories of HI and those for hyperactivity and inattention taken separately comprised four groups. This was based on a Bayesian information criterion (BIC). This criterion is often used to select the model which has the best fit to the data, namely the one with the lowest value and least number of groups.

Joint trajectories complete this descriptive portrait by showing associations between hyperactivity and inattention behaviours. They present an easily understood summary of the links between two series of trajectories.<sup>15,16</sup> They also provide a means of estimating the proportions of children in each of the possible combinations of hyperactivity and inattention trajectories.

10. Source: *Fichier d'inscription des personnes assurées de la Régie de l'assurance maladie du Québec* (Register of Insured Persons, Québec Health Insurance Board); compiled by the Institut de la statistique du Québec.

11. D. S. NAGIN (2005), *Group-Based Modeling of Development*, Cambridge, Harvard University Press, 201 p.

12. D. S. NAGIN, and R. E. TREMBLAY (2005), "Developmental trajectory groups: Fact or a useful statistical fiction?," *Criminology*, Vol. 43, No. 4, p. 873-904.

13. D. S. NAGIN, and R. E. TREMBLAY (1999), "Trajectories of Boys' Physical Aggression, Opposition, and Hyperactivity on the Path to Physically Violent and Nonviolent Juvenile Delinquency", *Child Development*, Vol. 70, No. 5, p. 1181-1196.

14. HI behaviours were not covered in the questionnaire when the children were 7 years old, but an adjustment was made in the model to account for this.

15. D. S. NAGIN, *op. cit.*

16. B. L. JONES, and D. S. NAGIN (2007), "Advances in Group-based trajectory modeling and a SAS procedure for estimating them," *Sociological Methods Research*, Vol. 35, No. 4, p. 542-571.

The 38% of children who were in the Moderate trajectory were more likely to obtain a score between 5 and 10 through the timeline under study. This could include children who manifested certain behaviours often or who manifested many behaviours at certain times. However, it should be noted that the trajectories remained relatively stable over time, with the exception of the Low trajectory, in which there was a slight downward trend. Therefore, the findings show that overall, HI symptoms reported by the parent remained relatively stable over time during this period of childhood.

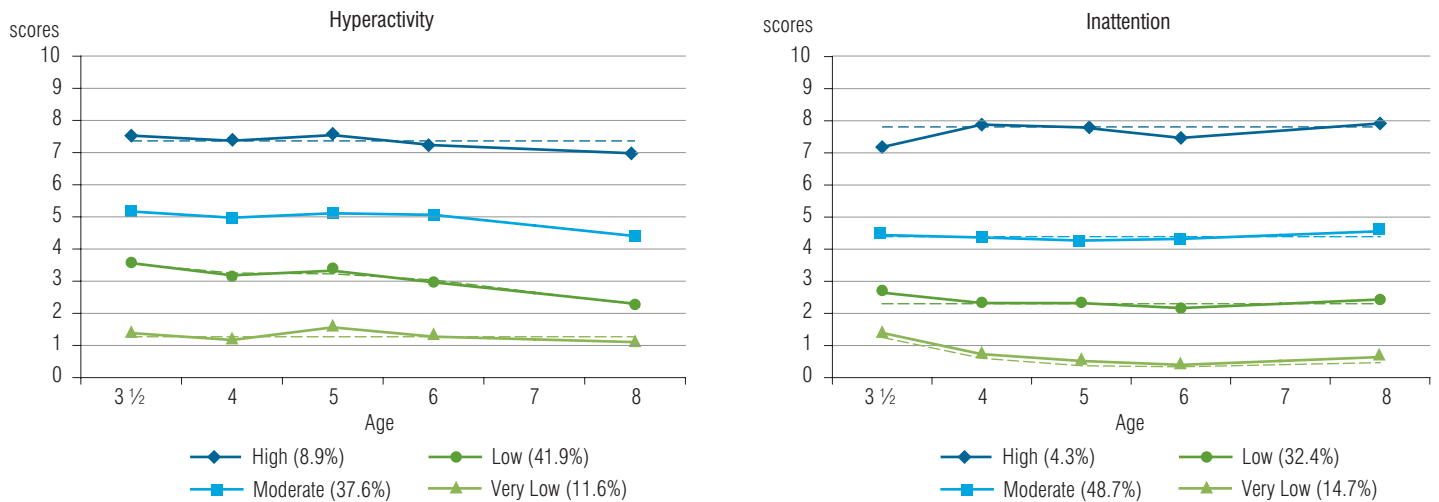
A similar portrait emerged when HI trajectories were analyzed by sex. Indeed, in both boys and girls, the same number of trajectories and trends were obtained as shown in Figure 1. However, more boys than girls presented a chronically High score of HI symptoms (10% vs. 5%) or a Moderate score of HI symptoms (43% vs. 33%) (data not shown). These results are similar to those of other studies which show that a higher proportion of boys compared to girls present hyperactivity and inattention problems.<sup>17,18,19</sup>

### A distinction between hyperactivity and inattention behaviours

The results presented above refer to the HI scale based on combined symptoms of hyperactivity and inattention. However, it is also relevant to assess these two categories of symptoms separately. Indeed, combined trajectories can camouflage differences in the frequency and trends of each category of symptoms.

As we can see, the children were grouped into four trajectories for both hyperactivity and inattention behaviours. Overall, the trajectories appear to be relatively stable over the period studied. Only a small decrease in reported hyperactivity symptoms was observed from when the children were 5 years of age. We can also see that the proportion of children in each trajectory varied with the type of symptoms under study. For example, 9% of children were in the High trajectory of hyperactivity while only 4.3% were in the High trajectory of inattention. The Moderate trajectory of inattention, however, contained a larger proportion of children compared to the corresponding trajectory of hyperactivity (49% vs. 38%).

Figure 2  
Hyperactivity trajectories and inattention trajectories in children from 3½ to 8 years of age, Québec, 2001-2004 and 2006



Note: The solid lines represent actual values, and the dashed lines represent predicted values. Since the SAS “traj” procedure used in this analysis did not take into account the complex sample design of the survey in estimating the variance, confidence intervals are not presented.  
Source: Institut de la statistique du Québec, QLSCD 1998-2010.

17. A. CHARACH (2010), “Children with attention deficit hyperactivity disorder: Epidemiology, comorbidity and assessment,” in: R. E. TREMBLAY, R. G. BARR, RdeV. PETERS and M. BOIVIN (ed.), *Encyclopedia on Early Childhood Development* [Online], Montréal, Québec, Centre of Excellence for Early Childhood Development, p. 1-12, [Online]: [www.child-encyclopedia.com/pages/PDF/CharachANGxp.pdf](http://www.child-encyclopedia.com/pages/PDF/CharachANGxp.pdf) (page accessed March 9, 2010).  
18. R. E. TREMBLAY, B. BOULERICE, H. FOSTER, E. ROMANO, J. HAGAN and R. SWISHER (2001), *Multi-Level Effects on Behaviour Outcomes in Canadian Children*, Ottawa, Applied Research Branch, Strategic Policy, Human Resources Development Canada, Catalogue No. SP-458-09-01E (W-01-2E), 93 p.  
19. HÔPITAL RIVIÈRE-DES-PRAIRIES (2007), *Troubles et maladies : Trouble déficitaire de l’attention avec ou sans hyperactivité (TDAH)*, Québec, [Online]: [www.hrdp.qc.ca/webconcepteur/web/hrdp/fr/maladies/nav/pedo.html?page=details.jsp&idoc=102929](http://www.hrdp.qc.ca/webconcepteur/web/hrdp/fr/maladies/nav/pedo.html?page=details.jsp&idoc=102929) (page accessed March 25, 2010).

To illustrate the associations that can exist between the trajectories of hyperactivity and inattention symptoms, the joint trajectory procedure was employed (see Box 2). Table 1 presents the joint probabilities of belonging to a specific trajectory of hyperactivity and a specific trajectory of inattention. It shows all the dyadic possibilities of associations between the two groups of trajectories. The sum of these probabilities is therefore 1.

A strong association between the manifestations of the two types of symptoms emerged from our analysis. Indeed, it is estimated that 81% of the children in a specific hyperactivity trajectory were found in the corresponding inattention trajectory (as derived from the sum of the proportions of the diagonal starting from the upper left corner of the table to the lower right one). The other children (19%) were in the adjacent trajectories. In fact, the probability of a child being a little or not inattentive and of presenting a High level of hyperactivity, as well as the probability of a child having a High level of inattention and being a little or not hyperactive, was nearly zero. Overall, it is estimated that 5% of children 8 years of age were likely to present a High score of both inattention and hyperactivity throughout the period of time under study. It should be noted that the estimated prevalence of ADHD in school-aged children considerably varies among studies, ranging from 2% to 12%.<sup>20,21,22,23</sup> However, meta-analyses of studies based on combined methods (e.g. assessments by parents and teachers, measurements of functional deficits) obtain estimates of the prevalence of ADHD closer to 5%.<sup>24,25,26</sup>

**Table 1**  
**Joint probabilities of hyperactivity and inattention trajectories in children from 3½ to 8 years of age, Québec, 2001-2004 and 2006**

	Hyperactivity trajectories			
	Very Low	Low	Moderate	High
<b>Inattention trajectories</b>				
Very Low	0.12	0.03	0.00	0.00
Low	0.02	0.30	0.04	0.00
Moderate	0.00	0.06	0.34	0.04
High	0.00	0.00	0.00	0.05

Source: Institut de la statistique du Québec, QLSCD 1998-2010.

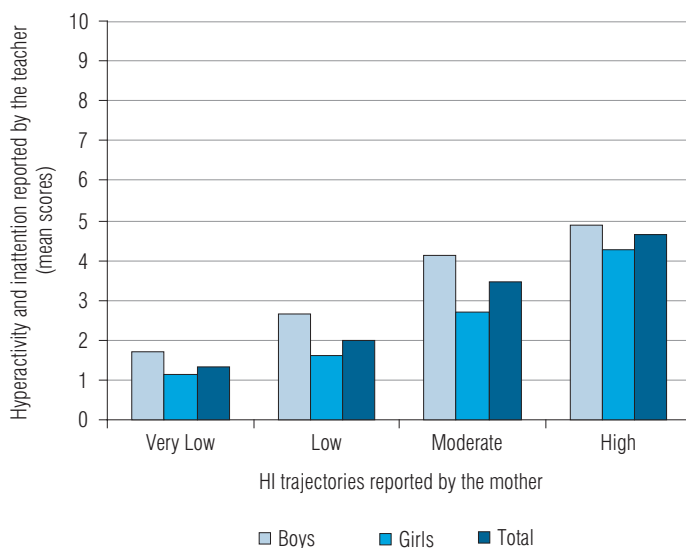
### What do the teachers say?

Figure 3 illustrates the comparison of the trajectories of HI symptoms in the children from 3½ to 8 years of age as reported by the mothers, and the teachers' assessment of these symptoms when the children were 8 years of age.

As we can see, the teachers' assessments in Grade 2 match those of the mothers. Indeed, the results form a gradient – children in the High trajectory presented more HI behaviours according to their teacher than children in the Moderate trajectory, and this follows for the Low and Very Low trajectories.

Noteworthy is that boys in the Very Low, Low and Moderate hyperactivity and inattention trajectories had higher scores than girls as reported by their teachers. In contrast, among children in the High trajectory, no significant difference was observed in hyperactivity and inattention by sex as reported by the teachers.

**Figure 3**  
**Mean scores of children on the hyperactivity and inattention scale based on teachers' assessments in Grade 2, by HI trajectories based on mothers' assessments between 3½ and 8 years of age, and sex, Québec, 2001-2004 and 2006**



Source: Institut de la statistique du Québec, QLSCD 1998-2010.

20. N. ROMMELSE (2010), "Attention Deficit Hyperactivity Disorder and Cognition," in: R. E. TREMBLAY, R. G. BARR, R. DE V. PETERS and M. BOIVIN (ed.), *Encyclopedia on Early Childhood Development* [Online], Montréal, Québec, Centre of Excellence for Early Childhood Development, p. 1-7, [Online]: [www.child-encyclopedia.com/documents/RommelseANGxp.pdf](http://www.child-encyclopedia.com/documents/RommelseANGxp.pdf) (page accessed February 8, 2010).

21. A. CHARACH, *op. cit.*

22. A. CHARACH, E. LIN and T. TO (2010), "Evaluating the Hyperactivity/Inattention Subscale of the National Longitudinal Survey of Children and Youth," Ottawa, Statistics Canada, *Health Reports*, Catalogue No. 82-003-X, Vol. 21, No. 2, p. 51-58.

23. HÔPITAL RIVIÈRE-DES-PRAIRIES, *op. cit.*

24. S. FARAONE, J. BIEDERMAN and E. MICK (2006), "The age dependent decline of attention-deficit/hyperactivity disorder: a meta-analysis of follow-up studies," *Psychological Medicine*, Vol. 36, No. 2, p. 159-165.

25. C. WADDELL, D. R. OFFORD, C. A. SHEPHERD, J. M. HUA and K. MCEWAN (2002), "Child psychiatric epidemiology and Canadian public policy-making: the state of the science and the art of the possible," *Canadian Journal of Psychiatry*, Vol. 47, No. 9, p. 825-832.

26. G. POLANCZYK, M. S. DE LIMA, B. L. HORTA, J. BIEDERMAN and L. A. ROHDE (2007), "The worldwide prevalence of ADHD: a systematic review and meta-regression analysis," *American Journal of Psychiatry*, Vol. 164, No. 6, p. 942-948.



## Hyperactivity and inattention trajectories by academic performance reported by the teachers in Grade 2 of elementary school

As shown in Figure 4, children in the High trajectory of HI presented lower academic performance, as reported by the teacher, compared to the three other groups. The results form a gradient wherein each group of children present a level of academic performance significantly lower than the group presenting fewer symptoms of hyperactivity and inattention.

It should be noted that no significant difference was observed by sex among children with regards to reported academic performance in Grade 2, except for the Low trajectory, in which girls had better scores in academic performance compared to boys.

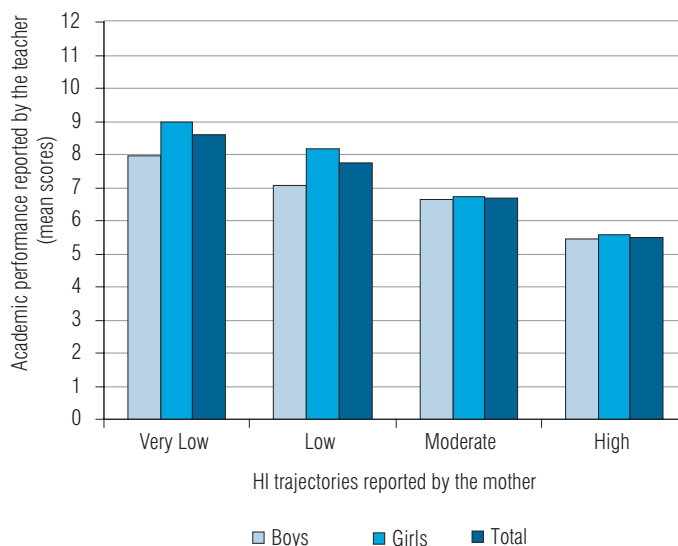
### When a diagnosis is given

Some studies suggest that fewer than half of children presenting ADHD are formally diagnosed.<sup>27</sup> Starting with the 2003 data collection, when the children were approximately 5 years of age, parents were asked whether their child had received a diagnosis of ADD/ADHD from a health professional. According to QLSCD data, approximately 7% of children 8 years of age had been diagnosed at one time or another in the preceding four years (data not shown). Even if the vast majority of diagnosed children (87%) were in the High and Moderate HI trajectories as reported by the parent, only slightly more than a third (35%) of children in the High trajectory had been diagnosed compared to 10% of children in the Moderate trajectory and minute proportions in the other two groups (Table 2).

### Taking Ritalin<sup>®</sup><sup>28</sup>

Ritalin<sup>®</sup> is a drug generally prescribed to treat, among other conditions, ADD/ADHD. The QLSCD data show that 6% of children 8 years of age had taken this or another prescription drug to treat HI in the 12 months preceding the survey round (data not shown). However, this proportion rose to 27% among children 8 years of age who were in the High HI trajectory and 8% in the Moderate trajectory; only minute proportions were observed among children in the Low and Very Low trajectories (Table 2). Similar

Figure 4  
Children’s academic performance reported by the teacher in Grade 2, by HI trajectories based on mothers’ assessments 3½ to 8 years of age, and sex, Québec, 2001-2004 and 2006



Source: Institut de la statistique du Québec, QLSCD 1998-2010.

results were observed for the inattention trajectory alone (data not shown). It should be emphasized that though the proportions of children having received a diagnosis of ADD/ADHD and those taking Ritalin<sup>®</sup> were quite similar (7% and 6%), this does not necessarily mean they refer to the same children. Indeed, 58% of children 8 years of age having received a diagnosis had taken Ritalin<sup>®</sup> or another medication to treat HI in the previous 12 months, while only a small proportion (just over 2%<sup>29</sup>) who had never received a diagnosis had done so (data not shown). The lack of a fit between having received a diagnosis of ADD/ADHD and taking Ritalin<sup>®</sup> is to a certain degree reassuring. Indeed, not all children presenting ADD/ADHD need to take this kind of medication.

Table 2  
Children 8 years of age having been diagnosed with ADD/ADHD and/or having taking Ritalin<sup>®</sup> in the preceding 12 months, by HI trajectories 3½ to 8 years of age, Québec, 2001-2004 and 2006

	Diagnosed children	Proportion of diagnosed children in each trajectory	Proportion of children having taken Ritalin <sup>®</sup> in each trajectory
	%		
<b>Hyperactivity and inattention trajectories</b>			
High	36.0*	35.2*	26.7*
Moderate	51.0	9.5*	8.5*
Low	11.4**	2.1**	1.5**
Very Low	–	–	–

\* Coefficient of variation between 15% and 25%; interpret with caution.

\*\* Coefficient of variation higher than 25%; imprecise estimate for information purposes only.

– Infinitesimal data.

Source: Institut de la statistique du Québec, QLSCD 1998-2010.

27. E. PELLETIER (2009), *Déficit de l'attention sans hyperactivité*, Québec, Les Éditions Québecor, 152 p.

28. See Footnote 4.

29. Coefficient of variation between 15% and 25%; interpret with caution.

## Type of class attended

Even though some students have received a diagnosis of ADD/ADHD, this does not suffice for them to be defined in the Québec education system as SHSMLD (Students with Handicaps, Social Maladjustments or Learning Disabilities in short, special needs students). However, in some children, ADD/ADHD is associated with other diagnoses, such as oppositional (defiant) disorder, pervasive developmental disorder or another disorder. Therefore, students with such diagnoses are more likely to be enrolled in special needs classes. Hence we found it productive to know in which type of class the children were enrolled by HI trajectory, and whether or not they had been diagnosed with ADD/ADHD.

As shown in Table 3, irrespective of the score of HI symptoms, the vast majority of children were not judged to be handicapped or socially maladjusted or to have learning disabilities, and were attending regular classes in Grade 2 of elementary school (90%). Among children in the High HI trajectory, 20% were defined as SHSMLD (special needs) and were integrated into a regular class with support for the teacher or the children or with participation in a resource class. The remaining children in this trajectory (approximately 7%) were attending a special needs class or school comprising students with the same or other type of problem. Table 3 also shows that the proportion of children in a special needs class or school among those in the other trajectories was infinitesimal. These data correspond to the intentions of the specific education policy entitled *Une école adaptée à tous ses élèves*<sup>30</sup> (Schools Adapted to All Students),

which put an emphasis on academic achievement for all students, including, among other things in its action plan,<sup>31</sup> integration into regular classes. Also of note is that among children who had been diagnosed with ADD/ADHD, approximately half were not defined as handicapped or socially maladjusted or to have learning disabilities, and were integrated into regular classes (data not shown).

## Conclusion

A number of conclusions can be drawn from the results presented here, in terms of both prevention and support for students who face certain difficulties.

First, based on a continuum of data on the children between 3½ and 8 years of age, this analysis revealed the early onset and relative stability over time of hyperactivity and inattention symptoms. These results could be used to support the hypothesis that a neurological component, linked to heredity or environmental factors, may play a role in the onset of these types of symptoms.<sup>32,33,34</sup> In addition, given the continuity of HI symptoms over time and the fact that they are associated with more difficult life trajectories,<sup>35</sup> it would be very productive to intervene early in the life of a child and to provide him/her and the parents with tools to foster his/her development. In this regard, it is important to emphasize that the parent, usually the mother, seems to occupy a privileged position in terms of early identification of hyperactivity and inattention symptoms in her children.<sup>36</sup>

Table 3

### Distribution of children by type of class attended in Grade 2 and HI trajectories 3½ to 8 years of age, Québec, 2001-2004 and 2006

	Students with no handicaps, social maladjustments or learning disabilities in regular classes	Special needs students (SHSMLD) in regular classes with support	Special needs students (SHSMLD) in a special needs class / school
	%		
<b>Hyperactivity and inattention trajectories</b>			
High	72.7	19.9*	7.4**
Moderate	88.1	10.8*	1.1**
Low	92.9	6.8*	–
Very Low	95.8	3.2**	–
<b>All children</b>	<b>90.0</b>	<b>8.7</b>	<b>1.2**</b>

\* Coefficient of variation between 15% and 25%; interpret with caution.

\*\* Coefficient of variation higher than 25%; imprecise estimate for information purposes only.

– Infinitesimal data.

Sources: Institut de la statistique du Québec, QLSCD 1998-2010.

*Fichier de déclaration des clientèles scolaires* (Declaration of School Enrolment), Ministère de l'Éducation, du Loisir et du Sport du Québec (MELS) (Ministry of Education, Leisure and Sport).

30. GOUVERNEMENT DU QUÉBEC. MINISTÈRE DE L'ÉDUCATION (1999), *Une école adaptée à tous ses élèves. Politique de l'adaptation scolaire*, Québec, Ministère de l'Éducation, 37 p. and annexes.

31. GOUVERNEMENT DU QUÉBEC, MINISTÈRE DE L'ÉDUCATION, DU LOISIR ET DU SPORT (2008), *Conditions for Greater Success. Action Plan to Promote Success for Students With Handicaps, Social Maladjustments or Learning Disabilities*, 5 p.

32. E. PELLETIER, *op. cit.*

33. D. MARES, A. MCLUCKIE, M. SCHWARTZ and M. SAINI (2007), "Executive Function Impairments in Children With Attention-Deficit Hyperactivity Disorder: Do They Differ Between School and Home Environments?," *Canadian Journal of Psychiatry*, Vol. 52, No. 8, p. 527-534.

34. S. STES (2003), "Déficit de l'attention/hyperactivité chez l'adulte: qu'en est-il?," *Neurone*, Vol. 8, No. 5, p. 20-25.

35. T. E. MOFFITT, L. ARSENEAULT, D. BELSKY, N. DICKSON, R. J. HANCOX, H. HARRINGTON, R. HOUTS, R. POULTON, B. W. ROBERTS, S. ROSS, M. R. SEARS, W. M. THOMSON and A. CASPI (2011), "A gradient of childhood self-control predicts health, wealth, and public safety," *PNAS*, Vol. 108, No. 7, p. 2693-2698.

36. N. LEBLANC, M. BOIVIN, G. DIONNE, M. BRENDGEN, F. VITARO, R. E. TREMBLAY and D. PÉRUSSE (2008), "The development of hyperactive/impulsive behaviors during the preschool years: The predictive validity of parental assessments," *Journal of Abnormal Child Psychology*, Vol. 36, No. 7, p. 977-987.

This analysis focused mainly on hyperactivity and inattention symptoms, whether or not there had been a formal diagnosis of ADD/ADHD. The results demonstrate that children with a high level of HI symptoms as reported by their parent (High trajectory: 8%) had not necessarily received a formal diagnosis. However, diagnosed or not, these children were assessed by their teacher as manifesting a higher level of HI symptoms and lower academic performance compared to other children in Grade 2 of elementary school. This result indicates that it would be of great interest to use a simple questionnaire for parents to screen children at risk of facing difficulties in school. Validation of such a tool would constitute a viable research path in public health. As an indication of increased focus on this issue, the Québec government has added the label "Students at Risk" to the category of SHSMLD (special needs). The concept has now received particular attention and therefore is of current concern to stakeholders in the education system.<sup>37</sup>

Finally, we also conclude that the majority of children in the High HI trajectory were enrolled in regular classes, whether they were defined as SHSMLD or not. Given the difficulties experienced by these students in terms of academic performance, further research would be recommended to assess the support needed for these children and/or their teachers. The ultimate goal would be to afford these children with a high level of HI symptoms a better chance of achieving success in school.

37. GOUVERNEMENT DU QUÉBEC. MINISTÈRE DE L'ÉDUCATION, DU LOISIR ET DU SPORT (2007), *L'organisation des services éducatifs aux élèves à risque et aux élèves handicapés ou en difficulté d'adaptation ou d'apprentissage (EHDA)*, Québec, Ministère de l'Éducation, du Loisir et du Sport, 24 p.

#### About the QLSCD

The *Québec Longitudinal Study of Child Development* (QLSCD) is being conducted by the Institut de la statistique du Québec (ISQ) (Québec Institute of Statistics) in collaboration with various partners. The main goal of this study is to gain a better understanding of the life trajectories and factors in early childhood that contribute to social adjustment and academic achievement. Since 2004, the QLSCD has received funding from the Ministère de la Santé et des Services sociaux du Québec (MSSS) (Ministry of Health and Social Services), the Ministère de la Famille et des Aînés (MFA) (Ministry of the Family and the Elderly), the Fondation Lucie et André Chagnon (Lucie and André Chagnon Foundation), and the ISQ. The Ministère de l'Éducation, du Loisir et du Sport du Québec (MELS) (Ministry of Education, Leisure and Sport) provided administrative data that could be matched with those of the QLSCD.

For more information on the study, also known as "I am, I'll be", you can access the QLSCD website at: [www.iamillbe.stat.gouv.qc.ca/default\\_an.htm](http://www.iamillbe.stat.gouv.qc.ca/default_an.htm).

To access the study microdata, please contact the *Centre d'accès aux données de recherche de l'ISQ (CADRISQ)* on the following website ([www.stat.gouv.qc.ca/sad/acces\\_microdonnees\\_an.htm](http://www.stat.gouv.qc.ca/sad/acces_microdonnees_an.htm)) or by telephone at 514-343-2299.

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