

PERSPECTIVES

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Mistaking immature classroom behaviour with ADHD *Original analyses on the connections between school entry age and ADHD diagnoses for children in Quebec*

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In Quebec, children must be 5 years old before October 1st to be admitted to kindergarten. In the same class, the youngest students are therefore up to one year younger than the oldest. In a CIRANO study (Haeck et al., 2023), the authors show that children born in September have 35% higher rates of ADHD diagnosis and medication than those born in October. ADHD could be confused with immature or unruly behaviours. Based on unpublished data from the RAMQ, including the medical service records of nearly 800,000 young people born between 1996 and 2005, the authors draw unequivocal conclusions about the extent of the phenomenon and sound the alarm on an issue of great concern.

Quebec's status as a province saddled with a high rate of children with attention deficit disorder (with or without hyperactivity) (ADHD) is sadly quite well established. Does this reflect an objective fact or something else? Several researchers, among them doctors, child psychiatrists and neuropsychologists, have for many years been sounding the alarm concerning the phenomenon of overdiagnosis and overmedication, alerting parents and school personnel to the fact that "not everything that moves is afflicted by ADHD".

Recent studies have shed new light on the medicalization during childhood for ADHD and the incorrect psychiatric diagnoses of ADHD, and show that school is a critically important environment for determining such diagnoses. Worth noting are the results of a comparative study carried out in Quebec and the Belgian region of Flanders, which demonstrate that ADHD diagnoses and medicalization are primarily initiated by teachers, prompted by immature behaviour on the part of the class's youngest pupils (Brault et al., 2022a, 2022b).

Apart from teachers, school administrators and various intervenors such as school counselors and a panoply of external consultants specializing in different types of behaviours probably also have an influence on the overall prevalence and incidence of children diagnosed or medicated for ADHD.

Medical service records for nearly 800,000 youths in Quebec

Our study is the first in Quebec to examine and document the extent of the potential for overdiagnosis and overmedication of ADHD through the lens of age requirements for kindergarten or grade school admission. Our econometric analyses on the impact of a child's birth month on the probability of being diagnosed or medicated for ADHD are based on information drawn from records of consultations with a physician found in the medical records of the Régie de l'assurance maladie du Québec (RAMQ) and purchases of prescription drugs in the records of the Régime public d'assurance médicaments du Québec (RPAM) (the Quebec health insurance and drug plans).

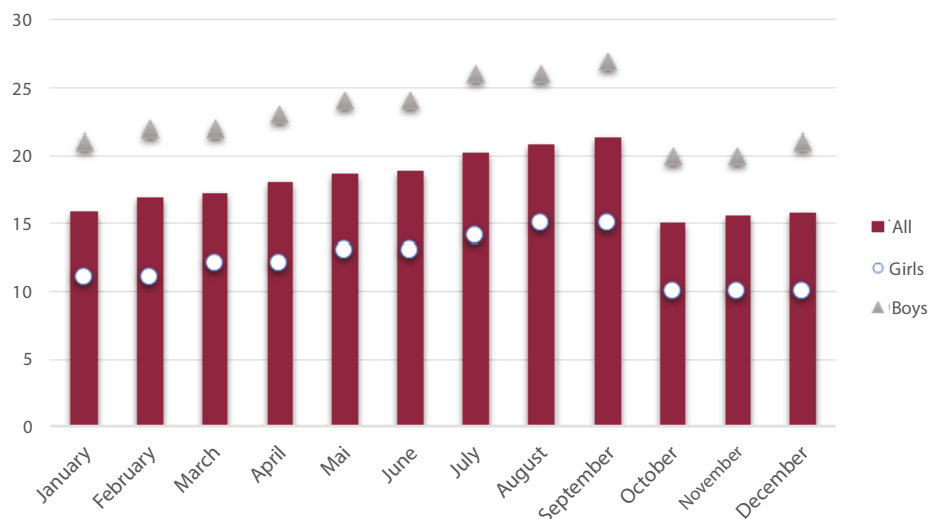
For research purposes, and with the anonymity of the subjects preserved, we were thus able to access the longitudinal medical service records of 794,460 children living in Quebec, born between January 1, 1996, and December 31, 2005. The files covered a period that ran from 2000 to 2018. For each child, medical service records were available from the date of their fourth birthday up to either December 31, 2018, or their 18th birthday (whichever occurred first). For each child

of the 1996 to 2000 birth cohorts, we thus have 14 years of data at our disposal. For those born after the year 2000, the data cover a shorter period of their lives, but at the very least, up to the age of 13, and therefore after their entry into high school.

In our study, as in all scientific studies on the issue, a diagnosis of ADHD is established in accordance with the internationally recognized diagnostic code, that is, 314-ICD 9, which designates one or more "simple disturbance[s] of activity and attention." This code characterizes in our data roughly 1.4 million medical acts with an ADHD diagnosis for the grouping of individuals registered in the records of persons insured with the RAMQ. Data that is ADHD specific and prescribed to children are drawn from RPAM administrative files.

There is a clear discontinuity between the diagnosis rate among the younger children and that for older children in the same class

Simply from descriptive statistics, we observe that the percentage of children having been diagnosed at least once with ADHD in our files varies according to the birth month. Among all children in the 10 birth cohorts studied, 17.9% were diagnosed with ADHD one or more times (13.2% were diagnosed at least twice). We see that 21.4% of children born in September were diagnosed at least once for ADHD, while only 15% were diagnosed in October.



Percentage of children having been diagnosed at least once with ADHD

The relationship between relative age in class and the probability of being diagnosed with ADHD is almost perfectly linear. The closer we get to September as a birth month, the greater the likelihood of a diagnosis. The decrease we observe for children born in October is striking.

This relationship between ADHD diagnosis and birth month is found for the 10 cohorts taken as a whole, as well as for each birth cohort taken individually, and this is true for boys and for girls. We find the same discontinuity when we examine the relationship between medication prescribed for ADHD and birth month.

Various studies have examined the possibility of over-diagnosis or over-treatment of ADHD related to the age of children. Differences in ADHD rates between children born before and after the cut-off date are quite large with estimates ranging from 20% to 55%, except in Denmark where effects are zero.

With a difference of 35%, Quebec is among the regions where this phenomenon is most pronounced.

Studies	Region	Month of birth effect %	Years	Age
Dalsgaard et al., 2012	Denmark	0	1997-2010	7-13
Morrow et al., 2012	British Columbia	30	1997-2008	6-12
Elder, 2010	United States	55	1988-2008	6-14
Zoëga et al., 2012	Island	45	2003-2009	9-12
Schwandt and Wupperman, 2016	Germany	20	2008-2011	7-17
Haeck et al., 2023	Québec	35	2000-2018	4-17
Evans et al., 2010	United States	28	1996-2006	7-17
Layton et al., 2018	United States	34	2007-2015	4-7

Children born in September are not diagnosed for common illnesses more often than children born in October

We explored the possibility that the relationship between the month of birth and a diagnosis of ADHD might differ depending on whether the child has been diagnosed one, two or even three times with ADHD during the period studied. We also wanted to test the hypothesis that the youngest ones in a class are, in general, more prone to suffer from various illnesses, including ADHD.

We therefore estimated the month of birth effect with respect to the number of ADHD diagnoses, and for 10 other major illness diagnoses.

Our estimates are based on statistical regressions, using each of the 12 birth months as an explanatory variable. Since the month of October was the reference month for each estimate, the October effect was set to zero in the regression. The impacts of the birth month were estimated for each of the other 11 months and were measured in percentage points. The following table shows the birth month impacts for September as compared to October.

	All %	Born in September %	Born in October %	Month of birth effect in p.p.
ADHD diagnosis				
At least one diagnosis	17.9	21.4	15.0	+6.5***
At least two diagnosis	13.8	16.8	11.3	+5.5***
At least three diagnosis	11.6	14.1	9.3	+4.9***
Other diagnosis				
Respiratory infections	56.4	56.1	56.9	-0.8***
Asthma	22.3	22.0	22.6	-0.6**
Allergies	13.6	12.9	13.4	-0.5**
Obesity	5.4	5.2	5.6	-0.4**
Otitis	51.9	51.8	52.0	-0.2
Diabetes	0.8	0.8	0.8	-
Pneumonia	1.2	1.2	1.2	-
Bronchitis	9.1	9.1	9.2	-
Anorexia	0.9	1.0	0.9	+0.1*
Depression	3.7	3.9	3.4	+0.6**
Number of children	794460	68680	64750	133430

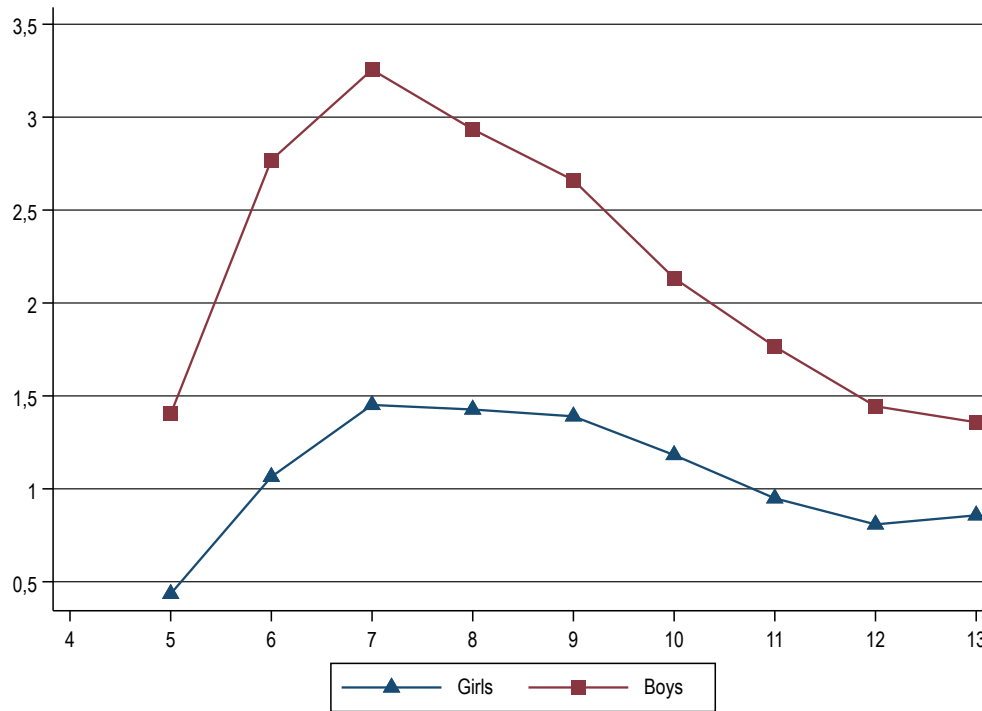
Our econometric analyses show that the impact of the birth month is between 4.9 and 6.5 percentage points higher in September than October. The birth month effects are all statistically significant at (at least) the 1% level, and the standard errors are very low.

Are the youngest in a class more prone to suffer from other illnesses? Our findings are unequivocal: ADHD month of birth effects are much larger than for other illnesses. By using the same methodology, and estimating the impact of the birth month in percentage points, we found that a greater proportion of children born in October were diagnosed with respiratory infections, asthma, obesity or allergies, compared to those born in September, and that these differences are statistically significant. With regards to diagnoses of anorexia or depression, the opposite is true: a smaller proportion of children born in October were diagnosed with anorexia or depression compared to those born in September. These differences are statistically significant, but the differences are very small. Therefore, the positive September effect stands out only for ADHD.

Elementary school is the key

Given that a diagnosis of ADHD often implies that children whose brains are still developing must take medication on a daily basis, properly understanding the practices surrounding this diagnosis is a matter of urgency. Knowing exactly when the diagnosis is made is therefore crucial.

We examined the issue by comparing the rates of ADHD diagnoses by birth month and the age at which the first diagnosis was made. The diagnosis rates expressed in percentages for each age shown in the following figure correspond to the number of new cases – that is, the number of children who had not been diagnosed at a younger age – divided by the total number of children of that age.



Rates of ADHD diagnoses (in %) by age at which the first diagnosis was made, 1996-2005

The first observation we can make is the following: a majority of children are first diagnosed between the ages of 6 and 8. Our second observation: it is also between the ages of 6 and 8 that we find the largest gaps between children born in September and those born in October. Among 7-year-olds born in September, 3% receive a first diagnosis of ADHD versus 1.75% for those born in October. As of age 11, the birth month effect starts to fade, and after age 13, the rates are very similar.

What happens in elementary school is therefore the key to understanding the month of birth effects. Our findings also suggest a course of action. It might, indeed, be desirable to delay making a diagnosis involving the taking of medication, particularly among children who are youngest in class. When it comes to children in elementary school, such a diagnosis should only be considered for the minority of children who are truly unable to function in a classroom.

Regression discontinuity analysis

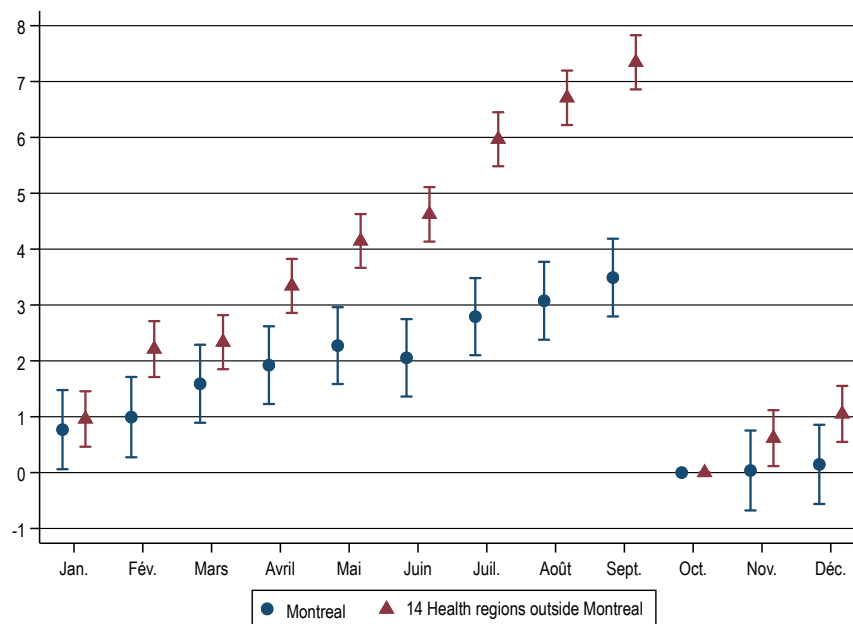
We used several methodologies in order to confirm and validate our results. In particular, we used one of the most sophisticated methods, namely regression discontinuity analysis, developed by Calonico et al. (2017, 2019) to determine whether there is a significant statistical discontinuity effect, in other words, "a jump in the relationship". Using this method essentially means assuming that birth during the first three days of October, rather than during the last three days in September, is the result of chance, similar to a randomized controlled experiment where the allocation of subjects between the treatment group and the control group is done in a random fashion. The results we obtained using this method confirm the results we obtained by other means, but are even more reliable, since regression discontinuity analysis is more credible in attenuating any bias resulting from unobserved differences between children born in late September and early October.

There is a different “medical culture of ADHD” outside of Montreal

The differences between boys and girls pertaining to ADHD diagnoses are well known, and our findings are consistent with that fact. For the full sample, the probability of being diagnosed with ADHD at least once is 23% among boys and 12% among girls. The probability of receiving at least two diagnoses of ADHD among boys is 18%, and 9% among girls. The fact of being born in September rather than October corresponds to an increase of 8 percentage points in the probability of an ADHD diagnosis for boys, and 5 percentage points for girls.

Regional differences in diagnoses are less well known, and our analyses reveal some very striking information. The probability of receiving at least one ADHD diagnosis among children mainly residing in the Montreal area is 11%, while it is 20% for children elsewhere in Quebec. The probability of being diagnosed at least twice with ADHD is 8% in Montreal, and 16% elsewhere in the province.

There are also substantial differences in the birth month effect between regions. The most notable disparity is between Montreal and the rest of the province. As illustrated in the following figure, the month of birth effect is twice the size for children residing outside Montreal compared to children residing in Montreal (leaving out the Nord-du-Québec region, Nunavik and the James Bay Cree Lands, for which there are not sufficient data).



Month of birth effect in percentage, 1996-2005 (95% confidence intervals)

Diagnostic practices vary from one region to another. Why? One might look, for instance, at differences in family or schooling environments, or in health systems, numbers of medical staff, or types of medical specializations and practices across regions to find an answer. According to the Institut national de santé publique du Québec (INSPQ) (the institute of public health of Quebec), interregional differences might be connected to disparities in the availability of resources or medical equipment or in care pathways outside urban areas,

which would lead to under- or overdiagnosis of ADHD (INSPQ, 2019).

Except for the type of physician diagnosing the child, the RAMQ administrative data at our disposal does not include any information that would enable us to dig into this question, and no other rigorously conducted study has examined these possible explanations. In our view, there is a blind spot worth investigating on this point.

Children whose parents are income security recipients have much higher ADHD diagnosis rates

In 1997, Quebec implemented a compulsory prescription drug insurance regime. Any individual aged 18 to 64 not having access to private coverage through their employment or professional association, or through their spouse's or relatives' plans, must participate in the prescription insurance drug plan provided by the RPAM. Those who are enrolled in the plan and who are not receiving income security benefits must bear a part of the cost of medication prescribed for ADHD, but this cost is very low (less than \$1 per prescription). Income security recipients are entitled to the medication free of charge.

Type of insurance coverage is a good proxy for the socioeconomic situation in which a young person grows up. We wanted to determine whether insurance status had any impact on diagnoses, and thus determine if there was some sort of link between parents' financial resources and ADHD diagnosis. We also tested to determine whether the birth month effect varies according to the individual's insurance status.

Half of the 794,460 young people in our sample are covered by a private plan, and the other half by Quebec's public scheme. Among the latter, one quarter are income security recipients.

Our findings suggest major differences in diagnosis or prescription rates linked to insurance status. Children whose parents are income security recipients have much higher ADHD rates: 21.9% of children have received at least one ADHD diagnosis. By comparison, the rate for children covered by the public drug insurance plan and whose parents are not income security recipients is 18.4%. The rate for children whose parents are covered by private insurance is 16.7%. However, September vs October effects are very similar across these three groups.

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Mistaking immature behaviour in class for ADHD may have cost the province more than 50 million dollars

We have carried out several analyses, applying a variety of methodologies, and our results have led us to the conclusion that there is a diagnostic bias towards ADHD that works against the "babies" in the class, and that this bias cannot be explained by other underlying conditions. How much does this bias cost us?

Based on our sample of nearly 800,000 youths, we have estimated that the costs incurred due to overdiagnosis and overmedication linked to birth month may reach 17 million dollars for medical services rendered on a fee-for-service basis, and 41 million dollars for medication covered by the RPAM, in 2018 dollars.

The status quo is not acceptable

It is very troubling that the diagnosis of a condition that often entails daily intake of medication by very young children stems from an ordinary and arbitrary administrative rule. The long-term consequences of taking psychostimulants at a young age, particularly if not needed, are not well known. The "disruptive" lives of these children are certainly not in any danger, and their brains are in the midst of their developmental stage.

Making better diagnoses, waiting for children to mature further before making such diagnoses, and improving in-class learning methods for the youngest pupils are a few avenues that could be explored by public authorities. One thing is certain: the status quo is not acceptable.

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