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CHILD MENTAL HEALTH AND HUMAN CAPITAL ACCUMULATION: THE CASE OF ADHD

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ABSTRACT

We examine U.S. and Canadian children with symptoms of Attention Deficit Hyperactivity Disorder (ADHD), the most common child mental health problem. ADHD increases the probability of delinquency and grade repetition, reduces future reading and mathematics scores, and increases the probability of special education. The estimated effects are remarkably similar in the two countries, and are robust to many specification changes.Moreover, even moderate symptoms have large negative effects relative to the effects of poor physical health.

The probability of treatment increases with income in the U.S., but not in Canada. However, in models of outcomes, interactions between income and ADHD scores are statistically insignificant in the U.S. (except for delinquency), while in Canada these interactions indicate that higher income is protective. The U.S. results are consistent with a growing psychological literature which suggests that conventional treatments for ADHD improve behavior, but have inconsistent effects on cognitive performance.

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Adult mental health problems are a major cause of lost work time and health care costs. For example, Ettner, Frank and Kessler (1997) show that psychiatric disorders reduce employment and earnings among both men and women. Currie and Madrian (1999) conclude that the labor market consequences of mental health problems are large relative to the consequences of physical health problems, since the former are more likely than the latter to afflict those of working age. Many adult mental health conditions have their origins in childhood, so that in addition to direct effects, mental health problems may reduce adult earnings and employment indirectly by inhibiting the child's accumulation of human capital. While the economics literature recognizes that physical health problems can impede children's human capital accumulation (c.f. Grossman and Kaestner, 1997), the link between mental health problems and human capital accumulation has received little attention.

This paper examines the experience of North American children who score highly on a screener for Attention Deficit Hyperactivity Disorder (ADHD), the most common chronic mental health problem among young children. It is estimated that approximately 5 percent of young American children suffer from ADHD (Jensen et al, 1999) and ADHD has been linked to problems such as peer rejection and school failure. However, poor children are more likely to suffer symptoms of ADHD than non-poor children: In the U.S., rates are almost twice as high in families with income less than $20,000 compared to families of higher income (Cuffe et al. 2003). It is possible then that poorer outcomes reflect the other problems suffered by poor children, rather than being primarily a consequence of ADHD itself. It is also possible that poor children with ADHD receive less effective treatment than other children, and thus are at "double jeopardy" for ill effects.

We investigate these issues using data from the Canadian National Longitudinal Survey of Children and Youth, and the American National Longitudinal Survey of Youth. We show that among young children ADHD symptoms increase the probability of delinquency and grade repetition, reduce future reading and mathematics test scores, and increase the probability of being placed in special education. The estimated effects are remarkably similar in the U.S. and Canada, and are robust to many changes in specification, including instrumenting teacher reports of ADHD with parental reports (in the Canadian data) in order to control for measurement error, and including maternal AFQT (the Armed Forces Qualification Test score, which is available in the U.S. data). Moreover, even moderate levels of symptoms have large negative effects, suggesting that ADHD can harm children who are unlikely to be formally diagnosed with the syndrome.

We show using Canadian data that the effects are large relative to the longer-term effects of being in poor health, or of having been diagnosed with a chronic condition. A score of 5 out of 16 in the hyperactivity distribution decreases future mathematics scores by 12.5 percent relative to the mean score, compared to a 5 percent reduction in future scores among children who were in poor or fair health, and an insignificant effect of having been diagnosed with a chronic condition such as asthma.

We find that on average, both drug and psychiatric treatment for ADHD are much less common in Canada than in the U.S., though rates have been increasing in Canada. However, in the U.S., a high income child with a given ADHD score is much more likely to receive treatment than a low income child, while the same is not true in Canada. On the other hand, in the U.S. there is little interaction between income and ADHD scores in models of test scores and schooling attainment, while there is an interaction for delinquency. In contrast, in Canada,

interactions between income and ADHD scores in models of test scores and grade repetition suggest that higher income also offers protection against the negative academic consequences of ADHD.

A possible explanation for this pattern of results is that drug and psychiatric treatment affects behavior, but does little by itself to mitigate the negative consequences of ADHD for children's human capital attainment. Given the large negative effects of ADHD symptoms on children's human capital attainment, it is important to find out what does work to promote schooling attainment, and why income appears to be protective in Canada but not in the United States.

The rest of the paper proceeds as follows: Section II provides some background information about ADHD. Section III describes the data. Section IV discusses methods and Section V shows the results. Finally, Section VI concludes.

II. Background and Previous Literature

The prevalence and importance of child mental health problems have been increasingly recognized in recent years. For example, the 1999 U.S. Surgeon General's Report states that approximately one in five children and adolescents in the U.S. exhibit the signs or symptoms of mental or behavioral disorders. ADHD is the most common chronic mental health problem among young children.[1] It is characterized by an inability to pay attention (inattention) and/or hyperactivity (though we will sometimes follow common parlance below and refer to the syndrome as hyperactivity).

[1] The description of ADHD in this section comes from the American Academy of Pediatrics Practice Guideline (AAP, 2000).

The main diagnostic criteria for ADHD are laid out in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994). They are: that six or more symptoms of inattention, or six or more symptoms of hyperactivity have persisted for at least six months "to a degree that is maladaptive and inconsistent with developmental level" (AAP, 2000, Table 1); that some of the symptoms were present before seven years of age; and that impairment from the symptom is present in two or more settings (such as home and school). The symptoms are laid out in Appendix Table 1.

The measures available in our surveys, as in most surveys, correspond to the first diagnostic criteria. That is, parents and/or teachers are asked questions about symptoms. We do not have direct information about whether the symptoms are causing impairment in various settings, and we do not know if children have actually been diagnosed with ADHD. In recent years, concern has been expressed about the over-diagnosis of ADHD, and about the increasing use of stimulants such as Ritalin to regulate the behavior of these children. Given that the diagnosis of ADHD depends on a subjective evaluation of whether or not the child's symptoms are causing impairment, we believe that it is preferable to examine the extent to which children exhibit symptoms, as we do below.[2]

What is known about the causes of ADHD suggests that it is strongly heritable—children with ADHD usually have at least one close relative with the disorder, and most identical twins share (or do not share) the trait. Environmental causes including birth injury, diet, and lead poisoning have been investigated and explain a small number of cases at most, though it is possible that a combination of environmental factors could account for a significant fraction of

[2]Most of the literature focuses on children who have been diagnosed with ADHD. However, Merrell and Tymms (2001) show that symptomatic children who have not been diagnosed suffer from similar problems.

cases. According to the National Institutes of Mental Health (1996), ADHD is not usually caused by poor home life, poor schools, excess sugar, food allergies, or too much television, though smoking, alcohol and illicit drug use during pregnancy may have some causal role. The fact that most ADHD children appear to have been born with the disorder makes ADHD a good candidate for examining the longer-term causal effects of mental illness.

Treatment for ADHD generally consists of drug treatment (with stimulants such as methylphenidate or amphetamine), psychiatric counseling for parents and children aimed at behavioral modification, or both. Drug therapy is effective in improving behavior for approximately 70 to 80 percent of children, though in some cases side effects (such as insomnia and loss of appetite) can make drugs difficult to use. However, in their review of the literature, Swanson et al. (1991) indicate that the evidence that treatment affects academic performance is much less conclusive than the evidence regarding effects on behavior.

They point to two reasons for mixed results of drug therapy. First, drug doses that are too high may impair academic performance. They discuss evidence that for simple cognitive tasks, the performance of ADHD children improves linearly with dose, while for "effortful" tasks, performance improves at low doses and then declines. Thus, they conclude that the doses that are administered to control behavior may be higher than optimal for improving academic performance.[3] Second, there are children whose performance on cognitive tests does not improve with drug therapy, and may even be impaired. Some studies suggest that up to 40 percent of children treated with stimulant drugs do not have a favorable cognitive response.

[3] A large-scale controlled trial compared four treatments for ADHD: 1) Medication alone, where dose was carefully calibrated to achieve optimal results; 2) Behavioral therapy alone; 3) A combination of the first two; 4) A group which received the normal treatments available in the community—two thirds of this group got drug treatment. Results of 1) and 3) were similar and superior to the other treatments in terms of effects on behavior,

A third possibility is related to the fact that children with ADHD also suffer from a higher than normal incidence of learning disorders, conduct disorders, and anxiety/depression. It is possible that conventional ADHD treatment often addresses behavioral problems, without addressing other, related, learning disabilities. It is even possible in principal that successful treatment of behavioral symptoms makes it less likely that children with other learning problems will receive help for those problems (though we are not aware of any evidence on this point).

There is a large literature in medicine and psychology that examines the long-term cognitive outcomes of children with ADHD. For example, Barkley et al. (1990) conduct an eight year follow-up of 158 children with ADHD and a matched (on age and grade) group of 81 "normal" children, and find that the ADHD children continue to perform relatively badly on cognitive tests well into adolescence. This literature has, however, paid relatively little attention to the question of whether it is ADHD per se that causes the bad outcomes. Also the literature focuses on performance on standardized tests rather than actual measures of schooling achievement. To the extent that children are able to adapt to their cognitive limitations, schooling attainment could be better than the results of cognitive tests suggest. Finally, there appears to be virtually no research examining the longer-term effects of treatment on achievement (Wigal et al., 1999).

There is also a literature in sociology and economics, looking at longer term consequences of a broader set of behavior problems in larger samples than are typically used in psychology. For example, Farmer (1993, 1995) uses data from the British National Child Development Survey (the NCDS) which follows the cohort of all British children born in a

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though 3) achieved the same effect with lower drug doses (Wigal, 1999). The relatively poor performance of 4) suggests that the drug treatment that many children receive in their communities are suboptimal.

single week in March 1958, to examine the consequences of childhood "externalizing" behavioral problems on men's outcomes at age 23. She finds that children who fell into the top decile of an aggregate behavior problems score at ages 7, 11, or 16 had lower educational attainment, earnings and probabilities of employment at age 23.[4] Gregg and Machin (1998) use the NCDS data and find that behavioral problems at age 7 are related to poorer educational attainment at age 16, which in turn is associated with poor labor market outcomes at ages 23 and 33. A similar study of a cohort of all New Zealand children born between 1971 and 1973 in Dunedin found that those with behavior problems at age 7 to 9 were more likely to be unemployed at age 15 to 21 (Caspe et al., 1998).[5]

Besides our focus on North America, our work differs from the previous work using these cohort data sets in several respects. First, these papers focus on behavior problems as measured by the sum of responses to a wide variety of questions about children's behavior, and do not attempt to focus on any specific syndrome that might be amenable to mental health treatment.[6] Second, the NCDS has no data on family income during childhood, so it is not possible to examine the relationships between mental health problems, treatment, income, and outcomes, and the previous studies have not examined determinants of treatment. Third, while

[4] Her regressions control for parent's aspirations for the child, the type of school attended, the ability group of the child, and whether they are in special education. Hence, her analysis attempts to measure the effects of externalizing behavior over and above its effects on these determinants of educational attainment.

[5] Other psychological studies have examined the longer term impact of different types of behavior, such as aggression (see Richard Tremblay's many studies of a cohort of Montreal school boys). However, a survey of this literature is beyond the scope of this paper.

[6] A limited amount of work has examined the consequences of specific mental health problems in adolescents. Mullahy and Sindelar (1989) examine the impact of adolescent alcoholism on earnings and employment, and conclude that the onset of alcoholism before age 18 reduces earnings and employment through its effect on schooling attainment. Cuellar, Markowitz, and Libby (2003) show that adolescents in the Colorado state foster care program who received treatment for their mental health problems were less likely to engage in crime.

the NCDS also collects scores independently from parents and teachers, no previous attempt has been made to use this information to control for measurement error in the hyperactivity score.

The problems involved in using parental reports of children's mental health disorders are well documented (c.f. Offord et al., 1988; Garrett, 1996; Glied et al, 1997). Socioeconomic characteristics and parents' mental health conditions are correlated with parents' perceptions of the mental health of their children, which suggests that there may be systematic measurement error in these reports. Since the Canadian data contains identical sets of questions asked to both teacher and parent regarding the mental health of the child, we check our Ordinary Least Squares (OLS) results by using the parents' reports as instruments for the teachers' reports.

The identifying assumption is that conditional on the teacher report, the parent report has no independent effect on the child's test scores and other outcomes. We believe that this is a reasonable assumption when examining academic outcomes, though it may be less so for our models of delinquency. Note that the results are very similar if we reverse the procedure and instrument parent's reports using teacher reports. Comparison of OLS and Instrumental Variables (IV) estimates shown below suggests that OLS is biased downwards to some extent by measurement error, though the qualitative pattern of the estimates is similar.

Previous research using Canadian data has established that the incidence of ADHD is similar in Canada and the U.S. For example, Willms (2002) find that approximately 14 percent of children in the NLSCY are hyperactive. Researchers have also found strong evidence that the prevalence of ADHD is related to income in both the NLSY (Korenman, Miller and Sjaastad , 1995; McLeod and Shanahan, 1993) and the NLSCY (Dooley et al., 1998; Dooley and Stewart, 2003; Phipps and Curtis, 2003) and in other data sets. For example, Lipman et al. (1994) find that the incidence of hyperactivity is three times higher for poor children than for non-poor

children in Ontario, Canada. Phipps and Curtis (2003) use NLSY data to compare the effect of income on the prevalence of one ADHD symptom in the two countries.[7] However, Dooley et al. (1998) argue using the NLSCY data that lone motherhood is actually a more important predictor of ADHD than poverty, suggesting that it is important to control for family structure when investigating the effect of income on ADHD. Offord et al. (1989) report that the relationship between income and hyperactivity is stronger for teacher reports, than for parent reports.

3. Data

We use data from the Canadian National Longitudinal Survey of Children and Youth (NLSCY) and from the American NLSY. The NLSCY is a national longitudinal data set which surveyed children ages 0-11 and their families beginning in 1994.[8] Follow up surveys were conducted in 1996 and 1998. The initial sample consisted of approximately 22,831 children in 1994. We restrict our sample to those children who were between the ages of 4 and 11 in 1994, and who were surveyed in both 1994 and 1998. We keep only those children who were given the hyperactivity screener in 1994 which yields a sample of just under 4000 children. For our analyses that use math and reading test scores we have a smaller sample (not all children's test scores were recorded and we discuss this further below) of approximately 2200. We use the NLSCY data to ask how hyperactivity in 1994 affects treatment in 1994 and outcomes in 1998.

The NLSY began in 1979 with a survey of approximately 6000 young men and 6000 young women between the ages of 14 and 21. These young people have been followed up every

[7] Rather than using the hyperactivity scales, Phipps and Curtis focus on a single question: "How often would you say that (your child) can't sit still, is restless, or hyperactive". They treat a second question about trouble concentrating as an additional domain of child well being.

year up to the present. In 1986, the NLSY began assessing the children of the female NLSY respondents at two year intervals. Given the differences in the design of the two studies, and the large amounts of missing data in the NLSY, we use the NLSY data to see how the average hyperactivity score measured over the 1990 to 1994 period affects the average outcomes of children in the 1998 and 2000 waves. This procedure yields a maximum sample of 5348 children.

The measurement of hyperactivity is key for our analysis. In the NLSCY data, the teachers and parents of all children aged 4 through 11 in 1994 were asked a series of 8 questions taken from both the Montreal Longitudinal Survey and the Ontario Child Health Study (we list the questions in the data appendix). The responses to these questions were added together to determine a hyperactivity score for the child. Since the hyperactivity score is generated from a set of questions asked of all respondents, our measure captures a set of hyperactivity symptoms and is not dependent on whether the child has been diagnosed with a hyperactivity disorder. This avoids criticisms of mental health measures based on the set of children who seek treatment for their illness (Frank and Gertler, 1991).

The NLSY Behavior Problems Index is asked to parents of children 4 to 14. There are 26 questions asked to all children, and 2 questions asked only to children who have been to school. Five of the questions can be used to create a hyperactivity subscale.[9] This score is standardized by the child's sex and age. We convert this standardized score to one that has the

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[8] Both surveys included siblings, though we have not used this feature of the data in our analyses.

[9] In addition to hyperactivity, there are also NLSY subscales for: antisocial, anxious, depressed, headstrong, dependent, peer conflict, and withdrawal. The questions used to form the hyperactivity subscale were selected by doing a factor analysis of more complete scales to select those questions most strongly related to the disorder. Still, a five question scale is rather limited as a screener, and one question on obsessions is perhaps inappropriately included in this subscale. A second limitation is that the screener focuses on hyperactivity and cannot be used to identify the "predominantly inattentive" ADHD subtype, which is thought by some to be a separate disorder.

same range as the score in the Canadian data. More information about how these scores are computed in both samples is available in the data appendix.

Means of the hyperactivity scores are shown for poor and non-poor children in Table 1.[10] These means confirm that hyperactivity symptoms are more prevalent among poor children. A comparison of the distribution of NLSCY teacher reports, NLSCY parent reports, and NLSY parent reports is shown in Table 1c. The first two columns suggest that the teacher and parent reports do contain independent information–parents are much more likely to report low levels of symptoms than teachers. Half of the children receive scores of two or less from teachers, while only 34 percent of children receive such low scores from their parents. On the other hand, the 75th percentiles are very similar in the two distributions.[11] The U.S. distribution suggests lower fractions of children with very low scores, and higher numbers of children with high scores.

Scores exceeding 8 (approximately the 75th percentile of these distributions) have been shown in previous research to be associated with diagnosed ADHD (Baillargeon et al, 1999). In a survey of students in three Ontario school districts, Sgro et al. (2000) use a cutoff of 9 or higher as a "diagnosis" of ADHD and find rates around 5 percent. In our data, a cutoff of 9 yields prevalence rates of about 14 percent. However, response rates to the survey instrument used in Sgro et al, were less than 29 percent, suggesting that perhaps the NLSCY numbers are more accurate.

These distributions raise an important issue, which is whether we expect the effect of hyperactivity symptoms to be roughly linear, or whether we expect scores above some threshold

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[10] In the NLSY, we define a child as poor if their family income was below the federal poverty line in any year between 1990 and 1994.

[11] Note that the correlation between teacher and parent reports is very similar for rich and poor children.

to have much more deleterious effects? We will compare results obtained using the 90th percentile of the U.S. and Canadian distributions as a cutoff, to those obtained using the linear score. A second reason to examine this alternative measure is that the distribution of U.S. scores displays some heaping at scores of four and nine, as shown in Table 1c.

We focus on a set of outcomes that are intended to capture the child's human capital accumulation, broadly defined. These include: Grade repetition, mathematics scores, reading scores, and special education. We also look at delinquency, which may be more closely related to the child's behaviour problems. Further details about the construction of these variables are available in the data appendix, but some discussion is warranted here.

Grade repetition is an important outcome, in that it is predictive of eventual schooling attainment. Since whether or not someone has ever repeated a grade is a cumulative measure, we ask whether the child repeated a grade between 1994 (when hyperactivity is measured) and 1998 (2000 in the NLSY). Mathematics and reading scores are two more immediate measures of schooling attainment. The NLSY assesses children using the Peabody Individual Achievement Tests (PIATs) for mathematics and reading recognition. These tests are administered in the home.

In the NLSCY, mathematics and reading tests were administered in schools to children in grades two through ten.[12] The math test was a shortened version of the Canadian Achievement

[12] Of the 9,542 children eligible to receive the tests, 86 percent of parents consented to have the school board administer the tests and 97 percent of school boards consented to conduct the tests. However, due to administrative problems, only 65 percent of the administered tests were returned to Statistics Canada in 1998. Therefore, of the original 9,542 children eligible to take the test, we have test scores for only 5,153 children (this number represents all children in the sample, including those outside the age range we investigate). The response rate for the 1996 was significantly higher (closer to 75 percent). Using the 1996 test scores rather than the 1998 test scores yields results that are qualitatively similar to those reported below. Statistics Canada has conducted an analysis of the nonresponse, and finds that there is very little difference between responders and nonresponders along observable dimensions (such as gender, type of school, whether the children had ever repeated a grade, or the

Test Center's Mathematical Operations test, second edition. It measures the student's ability to do addition, subtraction, multiplication and division on whole numbers, decimals, fractions, negatives, and exponents. Problem solving using percentages and the order of operations was also measured. A separate version of the test was constructed for each grade level (except for 9 and 10 which received the same test). The 1998 test included 20 questions at each level (except for level 9-10 which had 15 questions) plus 5 questions selected from the test of the next higher level. The reading comprehension test is also from the Canadian Achievement Test, second edition. Each test consists of questions about two passages, which are designed to test the student's ability to recall information, identify the main idea, and analyze the passage. In order to avoid problems with test "ceilings", children were given a short assessment at home before they took the school tests. Children who scored perfectly on the home test, were given the test of the next highest grade level.

The special education variable in the NLSY, corresponds to a parental report that the child was in a special education class in 2000. In the NLSCY, the teacher is asked whether the child received special education because of a physical, emotional, and behavioural or other problem that limited their ability to do school work. We count only students who received special education because of a mental health condition. Although this might appear to be a more restrictive protocol than in the U.S., Table 1 indicates that the prevalence of positive responses is actually higher in Canada than in the U.S. Special education is an important variable to consider, because of evidence that special education children lag behind their peers throughout their schooling and are more likely to drop out.

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importance that the parent respondent attaches to education).

Our definition of delinquency in the NLSY corresponds closely to that used by the U.S. Department of Justice (DIJ) for this age group. The DIJ definition includes illegal drug use or sales, "destroyed property", "stolen something worth more than $50", "committed assault", and whether they have ever been arrested (Puzzanchera, 2000). The NLSCY measure is slightly broader in that it also includes questions about whether children have been questioned by police, or have run away from home. Questions about drug use and delinquency are answered by the child in both surveys.

Means of all these outcome variables are shown in Table 1. The table illustrates that poor outcomes are more prevalent among poor children, just as the prevalence of hyperactivity is. For example, in the NLSY, children who were poor in 1994 score 16 points lower on average on the reading test in 1998 than children who were not poor. There are also some differences between the two surveys–the incidence of delinquent behavior and of grade repetition is much lower in Canada than in the U.S. (despite the somewhat broader measure of delinquency for Canada), while the fraction in special education is higher. The math and reading scores are scaled out of 15 and 20 respectively in Canada, and are reported as percentiles of a standardized score in the United States, so this difference in scaling should be kept in mind when comparing these means.[13]

Both the NLSY and the NLSCY have information about drug and psychiatric treatment for mental health conditions, as shown in Table 1. In 1994, only 1.4 percent of the Canadian children reported drug treatment compared to 3.3 percent of the American children.[14] The

[13] In the U.S., the scores are standardized using national norms for children of the same sex and age. Such norms are not available for these Canadian tests. However, we control for the child's sex and age in our regressions.

[14]In comparison, the Centre for Addiction and Mental Health in Ontario, which conducts a student drug use survey in 2001, found 4.2 percent of seventh and eighth graders in Ontario reported using Ritalin within the past 12

Canadian children were also less likely to have seen a psychiatrist, resulting in overall treatment rates of 4.9 percent compared to 8.5 percent for the American children. It is striking that in the U.S. poor children were much more likely to have been treated for ADHD then non-poor children (11.5 percent compared to 6.5 percent). The gap in treatment rates was much smaller in Canada, suggesting that the main discrepancy between the two countries in terms of treatment rates is that poor U.S. children are much more likely to be treated than poor Canadian children.

These differences in mean rates of treatment are perhaps surprising in view of differences in the insurance regimes in the two countries: In Canada, psychiatric treatment is covered under public health insurance, and all of the provinces have drug plans for low-income families. In the U.S., many private insurance plans severely restrict the coverage of mental health treatment, and Medicaid (the public system of health insurance for low income children) offers only limited coverage of psychiatric treatment.

Both studies collect detailed information on the family backgrounds of the study children. Means of these variables are also compared in Table 1, for the sample of children with non-missing reading and mathematics test scores (For grade repetition we have a larger sample, and for special education, we have a smaller sample. Also, the delinquency question is asked to a sample that is somewhat older.) Table 1 shows that our selection criteria yield a sample that is quite comparable in terms of age–the average age being 7.8 in Canada and 7.4 in the U.S. in 1994. On the other hand, the U.S. children have mothers who are more likely to have completed a high school degree, and are also more likely to have a mother who is depressed or has an condition that limits her ability to work.

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months (Adlaf and Paglia, 2001). However, in the NLSCY reported use of Ritalin has increased significantly since 1994. For example, among 10 year olds the incidence of Ritalin use increased from 2.5 to 4.1%, while among 11 year olds, it increased from 1.3 to 3.9% between 1994 and 1998.

Table 1 highlights some important differences in the design of the two surveys. The NLSCY has both parental and teacher reports of hyperactivity, while the NLSY has only maternal reports. And while the Canadian survey has very good physical health information, the health information on the NLSY is limited, and difficult to use. For example, in the NLSY, questions about chronic conditions are asked only about children who have an activity limitation, and the "poor health" question is not asked in all waves of the survey. Therefore, we limit our IV analysis, and our comparison of the effects of hyperactivity and physical health conditions to the Canadian data. The NLSCY respondent is asked to rate the health of the child on a scale of 1 to 5, with 1 being poor and 5 being excellent. We define poor health as the bottom three measures on this scale. Information is also collected on chronic conditions (these include allergies, asthma, heart disease, bronchitis, epilepsy, cerebral palsy, kidney troubles, and a category for other chronic conditions) for all children. We excluded learning disabilities, and psychological disabilities from this list for the list of chronic conditions in order to focus on physical health problems.

We use total *permanent* household income as our measure of income. This variable is constructed in the NLSCY by taking the mean income for all waves between 1994 and 1998. In the NLSY, we take mean income (in $1998) over all of the years in which the mother is observed. Child outcomes are likely to be more strongly affected by permanent than by transitory income. The impact of random measurement error in the OLS estimates also will be attenuated by averaging.[15]

[15] In cases where the household income is not reported, the NLSCY imputes it. We include a dummy variable for the imputation of household income in all of our analyses. We also re-estimated all our analyses omitting individuals for whom income had been imputed in order to be sure that there was nothing peculiar about the income imputation process. Our analyses are robust to these checks.

4. Methods

We begin by estimating OLS models of the relationship between ADHD scores in 1994 and outcomes in 1998, controlling for a wide range of other potentially confounding variables, including permanent income; maternal health status, education and family structure (in 1994); child age (single year of age dummies), whether the child is first born, and sex.

These models have the following form:

$$(1) outcome98_i = \alpha + \beta ADHD94_i + \lambda X94_i + \varepsilon_i$$

where *outcome98* is one of the outcomes described above, ADHD94 is the child's hyperactivity score, and X is the vector of covariates described above. We also estimate variants of this model excluding children who were being treated in 1994, using the 90th percentile of the hyperactivity score as the independent variable, and including a spline at the 90th percentile of income. Finally, in the NLSY data we estimate model (1) including maternal AFQT score (in the NLSY) as an independent variable. AFQT has been found to be predictive of many child outcomes. In the NLSCY data, we can also instrument the hyperactivity score based on teacher reports with the score based on parent reports, in order to control for measurement error. These various models allow us to investigate the robustness of the estimated effects of ADHD on future outcomes to alternative assumptions about functional form, and to compare the estimated effects in the U.S. and Canada.

We next turn to an investigation of the extent to which the effects of ADHD are mediated by income. To do this we estimate models of the following form:

$$(2) outcome98_i = \alpha + \beta(income)_i + \phi income * ADHD94_i + \chi ADHD94_i + \lambda X94_i + \varepsilon_i$$

where now income has been broken out of the X vector, and interacted with the hyperactivity score. We also estimate models of treatment probabilities that take the form (2). It is difficult to investigate the efficacy of treatment directly, given the high probability that the children with the worst difficulties will be the ones most likely to receive treatment. However, it is interesting to examine the probability of receiving treatment in its own right.

We expect that there may be substantial differences between the U.S. and Canada in this regard, given the differences in health insurance regimes. A comparison of the extent to which treatment probabilities are mediated by income, and the extent to which the effects of ADHD on outcomes are mediated by income may shed some light on the global efficacy of treatment as currently practiced.

5. Results

5.1 Educational and Behavioral Outcomes

Table 2 presents our baseline OLS estimates of the effects of hyperactivity on child outcomes in the U.S. and Canada. Table 2 indicates that children with higher hyperactivity scores have outcomes that are worse in all of the measured dimensions. The estimated effects of hyperactivity are generally somewhat lower for the U.S. than for Canada, though for reading scores, they are somewhat larger (recall that to compare effects, one needs to multiply the Canadian coefficients on reading and math by 5 and 6.67, respectively.)

One way to think about the size of these effects is to compare them with the effect of income, which has consistently significant effects, and generally has larger effects in the U.S. than in Canada. For example, in Canada, each $100,000 worth of permanent income is associated with a 3.8 percentage point decrease in the probability that a child repeats a grade

between 1994 and 1998. But a Canadian child with a score of 5 out of 16 on the hyperactivity index would be 3.5 percentage points more likely to have repeated a grade. Thus, in Canada, the effect of hyperactivity is large relative to the effect of income. The same comparison in the U.S. data suggests that each $100,000 increase in permanent income would decrease the probability of grade repetition by 5.1 percentage points, compared to a 2 percentage point increase in the probability for a child with a hyperactivity score of 5. Alternatively, we can note that if we used a score of 8 as a proxy for "diagnosis" of ADHD, then on average, the ADHD children would have math and reading scores more than a quarter of a standard deviation below the scores of children without ADHD symptoms.

Having a mother with at least a high school education is also consistently related to positive outcomes, especially in the U.S., with the effect being generally similar to that of $100,000 worth of income. Other variables with consistently significant effects are the indicator for Hispanic ethnicity, which has negative effects (in the NLSY data), and having two parents in 1994, which has positive effects in the NLSY data, though in Canada it is only statistically significant in the model of delinquency. Males are more likely to be delinquent, more likely to repeat grades, and (in the U.S.) more likely to be in special education, consistent with other studies.

Table 3 offers a second way to think about the magnitudes of these effects. In it, we compare the estimated effect of hyperactivity to the effects of physical health problems, using the Canadian data. Table 3 shows that having been diagnosed with a chronic health problem such as asthma (the most common chronic physical condition among children) as of 1994, has no effect on human capital accumulation as of 1998. In contrast, a maternal report that a child is in poor health in 1994 is predictive of poorer outcomes as of 1998. We cannot be certain that

mothers answer this question with only their child's physical health in mind, but the correlation between being in poor health and the hyperactivity score is very small (0.09).

In terms of magnitudes, a moderate hyperactivity score generally has worse effects than being in poor health. For example, among Canadian children, being in poor health in 1994 is associated with a reduction of .43 in 1998 mathematics scores, while a score of 5 out of 16 on the hyperactivity index is associated with reduction of 1.3 (on a mean score of 8.1). Thus, these results indicate that mental health problems may be a more important determinant of future human capital attainment among children than physical health problems.

The robustness of these effects is investigated further in Table 4. The first panel of Table 4 repeats the OLS estimates of the effects of hyperactivity and income from Table 2. The second panel presents IV estimates in which the teacher hyperactivity scores are instrumented using the parent reports (F-statistics for our first-stage are reported in the notes to the table). The IV point estimates are uniformly somewhat higher than the OLS estimates, which confirms our hypothesis that OLS estimates may be lower bounds on the true effects of hyperactivity, which are biased downwards by measurement error. On the other hand, the IV and OLS estimates are not statistically different from each other, suggesting that the OLS estimates are still informative.

The third panel of Table 4 presents estimates in which the continuous hyperactivity score has been replaced by a dichotomous variable equal to one if the child scores higher than the 90^{th} percentile of the hyperactivity score distribution. These estimates are qualitatively similar to those obtained using the linear score variable.

The hypothesis that the effect of the hyperactivity score is non-linear is tested more formally in panel 4 of Table 4, which presents estimates that include a linear spline with a knot point at the 90^{th} percentile. In most cases, we cannot reject the null hypothesis of linearity, and

in those cases where the hypothesis is rejected, the change in the estimated effect of hyperactivity above the 90th percentile is relatively small. (We found similar results in more complicated models with knot points at the 50th, 75th, and 90th percentiles of the ADHD score distribution). This finding is of interest because it suggests that even children below the clinical thresholds for diagnosis with ADHD may suffer ill effects.

Our full sample includes some children who are being treated for ADHD. If these children have a lower hyperactivity score in 1994 because of their treatment, then our results regarding the effects of hyperactivity scores may be biased upwards since we will be finding that even some children with low scores have poor outcomes. In order to be sure that this bias is not large, the 5th panel of Table 4 presents estimates from models excluding all children who were being treated for ADHD from the analysis. The estimates are similar with and without these children, suggesting that any bias of this nature is very small.

Finally, the last panel of Table 4 shows estimates of models using the NLSY data that include the mother's AFQT score. AFQT is a strong predictor of child outcomes in the NLSY, but no comparable measure is available in the NLSCY. These estimates suggest that its inclusion has virtually no impact on the estimated effect of hyperactivity, suggesting that we are in fact capturing the effect of the condition rather than the effect of some omitted background variable.

Table 5 reports estimates of equation (2) which interact hyperactivity and income. Panel 1 shows that in the NLSY, the interactions are of the expected sign (that is, higher income appears to mitigate the effects of hyperactivity) but none of them are statistically significant. In contrast, in Canada all of the interactions are significant, except in the model of delinquency. Panel 2 shows that for Canada, the results are roughly comparable if we instrument teacher

reports of hyperactivity with parent reports, and instrument the interaction term with the interaction between parent reports and income. The point estimates in Panel 1 suggest, for example, that a child with a score of 5 on the hyperactivity score would have a mathematics score 1.3 points lower than another similar child. The interaction term indicates that an additional $50,000 of income would reduce this effect to 1.0 point, a reduction of approximately 25 percent.

Panel 3 shows estimates using the zero-one measure of hyperactivity, which is set equal to one if people are over the 90^{th} percentile of the hyperactivity score distribution. There is one interesting difference between Panel 1 and Panel 3, which is that the interaction between income and being in the highest decile of the hyperactivity score distribution is large and significantly negative in both data sets. Apparently, among the most hyperactive children, income has a strong negative effect on the probability that they will be delinquent, in both Canada and the U.S.

In sum, we find that both rich and poor children suffer large negative effects of even moderate levels of hyperactivity symptoms in terms of test scores, schooling attainment, and delinquency. Moreover, the impacts of hyperactivity are large relative to those of the physical health problems that have been the focus of most previous research about the effects of health on children's human capital attainments. In both Canada and the United States, higher income reduces the probability that the most hyperactive children will be delinquent. However, in the U.S., interactions between income and hyperactivity are otherwise insignificant, while in Canada, income appears to be strongly protective. We have estimated similar models interacting hyperactivity scores and maternal education, but did not find statistically significant effects in either country.

5.2 Who Gets Treated?

Table 6 investigates the relationship between hyperactivity scores, income, and treatment. Note that since one would expect effective treatment to reduce the hyperactivity score, the causal effect of scores on the probability of seeking treatment may be over-estimated. (As discussed above, we might find that even people with relatively low scores, because they were receiving treatment, had poorer outcomes. This would tend to inflate the estimated effect of scores). However, we can still examine the relationship between treatment and income conditional on the hyperactivity score.

The estimates indicate that income has no effect on the probability of treatment in Canada, while in the U.S., income has large effects on the probability of receiving drug, and especially psychiatric treatment. These results are what one would expect given the differences in health insurance regimes in the two countries. The estimates in column (10) suggest that in the U.S., an additional $50,000 of income would increase the probability of seeking psychiatric treatment by more than seven percentage points for each one point increase in the hyperactivity score. In the U.S., maternal education also increases the probability of treatment as does having a mother who is depressed or has an activity limitation. Children of younger mothers and Hispanic children are much less likely to be treated, as are children in two parent families.

A comparison of Table 5 and Table 6 presents a puzzle since we find that in the U.S., rich children are much more likely to be treated (conditional on their level of symptoms) than poor children, but that rich and poor children suffer equally in terms of the effects of hyperactivity on test scores and schooling attainment. In contrast, rich and poor Canadian children are equally (un)likely to receive treatment for ADHD, but in Canada, income appears to offer some protection against negative academic outcomes.

6. Discussion and Conclusions

Our estimates suggest that both rich and poor children with symptoms of hyperactivity suffer large negative consequences in terms of their achievement test scores and schooling attainment and that hyperactivity is a more important determinant of reduced human capital accumulation than physical health problems. Moreover, the results suggest that even children whose hyperactivity symptoms would not normally lead to a diagnosis of ADHD are at risk for poorer outcomes. These results are qualitatively similar in the U.S. and Canada, and are robust to many changes in specification, including an IV strategy designed to overcome potential error in the measurement of hyperactivity (implemented in models using the Canadian data).

Perhaps surprisingly, income appears to be more protective in Canada than in the U.S. in terms of academic outcomes, even though higher income U.S. children are much more likely to be treated conditional on their ADHD scores. It is possible, for example, that in the United States the parents of many high income children erroneously believe that conventional ADHD therapy will improve cognitive performance as well as behavior, while in Canada, wealthy parents are more likely to address cognitive problems as a separate (albeit related) issue.

The psychological literature suggests that conventional drug and psychiatric treatment for ADHD improves behavior but has inconsistent effects on cognitive performance. Our results are consistent with this literature, in that they suggest that while high income U.S. children are much more likely than low income children to be treated, ADHD has roughly similar effects on the test scores and schooling attainments of high and low income American children. Given the large negative effects of ADHD symptoms on children's achievement test scores and schooling

attainment, it is important to find out what does work to improve these outcomes, and why income appears to be more protective in Canada than in the United States.

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Data Appendix

Appendix Table 1: Symptoms of Inattention and Hyperactivity (Source: AAP, 2000).

Inattention:
A) Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities.
B) Often has difficulty sustaining attention in tasks or play activities.
C) Often does not seem to listen when spoken to directly.
D) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions).
E) Often has difficulty organizing tasks and activities.
F) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
G) Often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books, or tools.
H) Is often easily distracted by extraneous stimuli.
I) Is often forgetful in daily activities.

Hyperactivity:
A) Often fidgets with hands or feet or squirms in seat.
B) Often leaves seat in classroom or in other situations in which remaining seated is expected.
C) Often runs about or climbs excessively in situations in which it is inappropriate.
D) Often has difficulty playing or engaging in leisure activities quietly.
E) Is often "on the go" or often acts as if "driven by a motor".
F) Often talks excessively.
G) Often blurts out answers before questions have been completed.
H) Often has difficulty awaiting turn.
I) Often interrupts or intrudes on others (e.g. butts into conversations or games).

2. Variable Definitions in the NLSCY

Respondent: In the NLSCY the respondent is the "person most knowledgeable about the child" which is usually, but not always the mother (it is the mother 92% of the time). Because of this potential complication, we determine the education level of the mother using information about the PMK and the spouse of the PMK in all three survey years. We measure mother's education as follows: when the child's mother is also the PMK or the child's mother is the spouse of the PMK we use this information to calculate the mother's education. When no biological mother is present in the family in any of the three survey years we use the next closest female parent figure as the basis for calculating the mother's education. We then include dummy variables for the female parent figure being other than the biological mother, and/or for the PMK being other than the biological mother in all our analyses.

Parent Reported Hyperactivity - Inattention Score variables (variables ABECS06, BBECS06 and CBECS06 in cycles 1, 2 and 3 respectively) are derived using the PMK's responses to the following questions:

How often would you say that -- can't sit still, is restless or hyperactive?
How often would you say that – is distractible, has trouble sticking to an activity?
How often would you say that – fidgets?
How often would you say that – can't concentrate, can't pay attention for long?
How often would you say that – is impulsive, acts without thinking?
How often would you say that – has difficulty awaiting turn in games or groups?
How often would you say that – cannot settle to anything for more than a few moments?
How often would you say that – is inattentive?

The possible responses to these questions were: Never/Not True, Sometimes/Somewhat True or Often/Very True. The total score varies from 1-16 where a high score represents the presence of hyperactive or inattentive behaviour.

The Teacher Hyperactivity - Inattention Score variables (variables AETCS28B, BETCS28B and CETCS28B in cycles 1, 2 and 3 respectively) are derived using the respondent's teacher's responses to the same questions.

The Delinquency Variable is derived using the responses to the following questions.

I physically attack people. (cfbcq1aa)
I vandalize. (cfbcq1dd)
I steal outside my home. (cfbcq1pp)

The possible responses to these questions were Never or not true, Sometimes or somewhat true or Often of very true.

In the past 12 months, about how many times were you questioned by the police about anything that they thought you did? (cfbcbq2e)

In the past 12 months, about how many times have you run away from home? (cfbcbq2f)

The possible responses to these questions were Never, Once or Twice, Three or Four times or Five times or more.

Ages 10-11: Have you ever tried drugs or sniffed glue or solvents? (cdrcq10)The possible responses to this question are yes or no.

Ages 12-15: Have you ever tried marijuana and cannabis products (also known as joint, pot, grass, hash)? (cdrcc10a)

Have you ever tried glue or solvents (such as paint thinner, gasoline etc)? (cdrcb10b)

Ages 14-15: Have you ever tried Hallucinogens (like LSD, acid, magic mushrooms, "mesc" or PCP, "Angel dust" etc)? (cdrcb10c)

Ages 12-13: Have you ever tried other drugs (heroin, speed, PCP, crack/cocaine, LSD, acid ecstasy etc)? (cdrcc10f)

The possible responses to these questions are yes, no or I don't know what that drug is.

The variable delinquency takes on the value 1 if any of the above questions indicate delinquent behaviour, takes on the value 0 only if the answers to all these questions is no or 'I don't know what that drug is', and is a missing value if any of the questions were not answered.

The above questions were asked to children 10-15 in 1998, and hence the sample available to study delinquency is somewhat older than that available to study test scores. For younger children, there are a similar set of delinquency questions that are asked to the adult respondant. However, for a two year age range in which we have both self reports and adult reports (ages 10 and 11) we found that there were considerable differences in the reporting of delinquent behavior between parent and child. Given that the child's answers to these questions were recorded in writing confidentially[16] and the adult answers were recorded orally, we decided to use child self-reports as the more accurate reflect of true delinquency [17].

Special Education:

The special education variable is derived from a subset of respondents (the teacher in this case) who answer yes to the following question:

Does this student receive special education because a physical, emotional, behavioural, or some other problem limits the kind or amount of school work he/she can do? (cetcq21)

Respondents who answer yes are then asked a series of questions about why the student receives special education. We categorize the student as receiving special education for a mental health problem if they answered yes to any of the following reasons:

a) A learning disability.
b) An emotional or behavioural problem.
c) A mental disability or limitation.
d) Home environment.

[16]Children are asked to respond to a written questionnaire for these questions and then to return the answers in a sealed envelope, much like the sampling procedures used in the NLSY.

[17]For the delinquency analysis we restrict the sample to those children who do not have missing information for any of the questions used.

Child Treatment

Children are classified as taking drugs for mental health treatment if the PMK answers yes to one of the following questions:

DOES HE/SHE TAKE THE FOLLOWING PRESCRIBED MEDICATION ON A REGULAR BASIS: Ritalin? (ahlcq51b)
DOES HE/SHE TAKE THE FOLLOWING PRESCRIBED MEDICATION ON A REGULAR BASIS: Tranquilizers or nerve pills? (ahlcq51c)

Children are classified as visiting a doctor for mental health treatment based on the following question:

IN THE PAST YEAR, HOW MANY TIMES HAVE YOU SEEN OR TALKED ON THE TELEPHONE ABOUT CHILD'S PHYSICAL OR MENTAL HEALTH WITH: A psychiatrist or psychologist? (ahlcq48g)

PMK Activity Limitations

The PMK is asked if he/she are restricted in their daily activities. (variable ARSSD01).

The PMK Depression Score variable (variables ADPPS01, BDPPS01 and CDPPS01 in cycles 1, 2 and 3 respectively) is derived using the responses to the following questions.

How often have you felt this way during the past week: I did not feel like eating, my appetite was poor?
How often have you felt this way during the past week: I felt like I could not shake off the blues even with help from family or friends?
How often have you felt this way during the past week: I had trouble keeping my mind on what I was doing?
How often have you felt this way during the past week: I felt depressed.
How often have you felt this way during the past week: I felt that everything I did was an effort?
How often have you felt this way during the past week: I felt hopeful about the future.
How often have you felt this way during the past week: My sleep was restless.
How often have you felt this way during the past week: I was happy.
How often have you felt this way during the past week: I felt lonely.
How often have you felt this way during the past week: I enjoyed life.
How often have you felt this way during the past week: I had crying spells.
How often have you felt this way during the past week: I felt that people disliked me.

The possible responses to these questions were Rarely or none of the time (less than 1 day), Some or a little of the time (1-2 days), Occasionally or a moderate amount of the time (3-4 days) or Most or all of the time (5-7 days). The total score varies between 0 – 36, where a high score represents the presence of symptoms of depression.

We used the chose a cutoff such that 10 percent of the mothers in the survey were classified as depressed.

3. Variables in the NLSY: (Note: Question numbers are from the 2000 survey).

Hyperactivity: The Behavior Problems Index is asked to parents of children 4-14. There are 26 questions asked to all children, and 2 questions asked only to children who have been to school. For each question, parents reply that the statement is often true, sometimes, true, or not true. To convert into an index, they take not true to be zero and often true or sometimes true to be a one, and then sum up the answers to the questions (so the maximum score is either 26 or 28). In addition to hyperactivity, there are also subscales for: antisocial, anxious, depressed, headstrong, hyperactive, dependent, peer conflict, and withdrawal.

The hyperactivity subscore has 5 questions:

1. He/she has difficulty concentrating, cannot pay attention for long
2. He/she is easily confused, seems to be in a fog
3. He/she is impulsive, acts without thinking
4. He/she has a lot of difficulty getting his/her mind off certain though (has obsessions)
5. He/she is restless or overly active, cannot sit still.

This score is standardized by the child's sex and age. We convert this standardized score to one that has the same range as the score in the Canadian data.

Delinquency

Children 10-14 were consistently asked the following questions as part of the child self-administered questionnaire (Question 40 on the 2000 questionnaire):

In the last year, about how many times have you:

Hurt someone badly enough to need bandages or a doctor?
Taken something from a store without paying for it?
Damaged school property on purpose?

Children were asked additional questions, but they are not comparable with those asked to children 15+, so we do not use them. Also, we recode the answers as zero if the answer is never, and 1 otherwise.

For children 15 and older, the questions which are asked consistently from 94 to 2000 (as part of the young adult survey) are:

YASR-61B In the last year (last 12 months), have you ever gotten into a fight at school or work?

YASR-61C In the last year (last 12 months), have you ever taken something not belonging to you that was worth $50 or more?

YASR-61D In the last year (last 12 months) have you ever hit or seriously threatened to hit someone?

Note, prior to 2000, additional questions were asked but we do not use them, in order to maintain comparability across years..

These questionnaires also ask whether the respondent has ever used marijuana, cocaine, LSDs, uppers, downers, amphetamines, or sniffed or huffed substances to get high. We code a one if the respondent answers yes to any of these questions.

Special Education

BKGN-29C Has he/she participated in special education or a program for handicapped children in the past year? (yes/no).

This question was only asked in 2000. Previous surveys ask about remedial education in various subjects, but we do not use these questions.

Child Treatment

HLTH-17 During the past 12 months has (child) seen a psychiatrist, psychologist, or counselor about any behavioral emotional, or mental problem?

HLTH-20 Does (child) regularly take any medicines or prescription drugs to help control his/her activity level or behavior?

Maternal Activity Limitations

Question Q11-5A is coded as 1 if the mother has any health problem that limits her ability to work, and zero otherwise.

Maternal Depression:

The mother was asked the following questions (Q11-H40CESD1B-1G in the 2000 questionnaire):

During the past week...

I had trouble keeping my mind on what I was doing.
I felt depressed.
I felt that everything I did was an effort.

My sleep was restless.
I felt sad.
I could not get going.

Possible responses were: Rarely/None of the time/1 Day; Some/A little of the time/1-2 Days/Occasionally/Moderate Amount of the Time/3-4 Days/Most/All of the Time/5-7 Days. These responses were given values 0, 1, 2, or 3.

To create a depression score, we summed the responses for each question, and chose a cutoff so that 10% of the mothers were depressed.

Table 1: Means of Key Variables in Sample with Reading and Math Scores

	Canada All	Canada Poor in 94	Canada, Not Poor in 94	U.S. All	U.S. Poor in 94	U.S. Not Poor in 94
Hyperactivity Score 1994 reported by teacher	3.785 [4.062]	4.614 [4.428]	3.599 [3.954]	.	.	.
Hyperactivity Score reported by parent	4.447 [3.434]	5.05 [3.50]	4.310 [3.400]	5.876 [3.820]	6.569 [3.899]	5.373 [3.671]
Child Outcomes						
Delinquent Behaviour 1998	0.289	0.361	0.273	0.421	0.466	0.376
Grade Repetition 1998	0.032	0.062	0.025	0.068	0.117	0.032
Mathematics score 1998 (/15 in Canada, /100 in US)	8.094 [3.472]	7.391 [3.515]	8.252 [3.44]	51.79 [26.88]	42.52 [25.70]	58.59 [25.52]
Reading score 1998 (/20 in Canada, /100 in US)	11.130 [3.645]	10.361 [3.662]	11.302 [3.620]	56.38 [28.81]	46.54 [29.62]	63.50 [25.97]
Special Education 1998/2000	0.094	0.150	0.080	0.069	0.099	0.049
Alternative Health Indicators						
Poor Health 1994	0.132	0.151	0.127	.	.	.
Chronic Condition Indicator 1994	0.350	0.347	0.351	.	.	.
Treatment						
Drug Treatment 1994	0.014	0.015	0.013	0.033	0.047	0.024
Psychiatrist 1994 (or Psychologist in NLSCY)	0.038	0.044	0.037	0.069	0.094	0.053
Any Treatment 1994	0.049	0.055	0.047	0.085	0.115	0.065
Covariates						
Child Age 1994	7.841 [2.098]	7.589 [2.075]	7.898 [2.099]	7.368 [1.872]	7.778 [1.808]	7.087 [1.866]
Male Child	0.497	0.500	0.496	0.515	0.515	0.515
First Born Child	0.453	0.433	0.457	0.353	0.240	0.434
Average Income 1994-1998	55259 [34657]	24047 [12560]	62244 [34174]	43623 [26699]	27573 [18532]	55248 [25684]
Mother High School or More	0.578	0.324	0.634	0.785	0.620	0.903
Mother AFQT score	.	.	.	36.170 [27.13]	21.820 [20.53]	46.710 [26.43]
Two Parent Family 1994	0.872	0.574	0.939	0.594	0.330	0.785
Family Size 1994	4.338 [1.048]	4.205 [1.312]	4.367 [0.977]	4.359 [1.206]	4.584 [1.476]	4.186 [0.929]
Mother Teen at Child Birth	0.040	0.090	0.030	0.007	0.013	0.003
Mother's Age at Birth	27.223 [4.678]	25.998 [5.252]	27.497 [4.495]	25.501 [2.817]	24.750 [2.800]	26.041 [2.717]
Mother depressed or activity limitation	0.154	0.222	0.139	0.222	0.313	0.159
Number of Observations	2209	404	1805	2352	969	1350

Notes: Canadian data from the 1994-95, 1996-97 and 1998-99 cycles of the NLSCY. Standard deviations in brackets.

U.S. data is means for 1990-1994 and for 1998 and 2000, see text. Sample includes those with non-missing test scores.

Table 1b: Means of Outcomes for Children Above and Below the Median Hyperactivity Score

	Canada: Above Median	Canada: Below Median	U.S.: Above Median	U.S.: Below Median
Grade repetition	0.056	0.008	0.083	0.050
Delinquent	0.368	0.213	0.478	0.342
Mathematics Score	7.32	8.84	47.96	56.32
Reading Score	10.38	11.85	51.60	62.01
Special Education	0.156	0.029	0.100	0.038
Drug Treatment 1994	0.024	0.004	0.053	0.010
Psychiatric Treatment 1994	0.052	0.026	0.102	0.030
Any Treatment 1994	0.069	0.029	0.126	0.036

Table 1c: Hyperactivity Score Distribution

Score	Canada Teacher Report % with score	Canada Parent Report % with score	U.S.
0	29.2	10.4	11.44
1	12.2	11.9	5.74
2	9.2	11.5	5.91
3	7	10.3	4
4	6.5	9.5	14.12
5	5.6	9.3	6.12
6	6.4	8.6	10.5
7	5.3	7.5	8.97
8	5.4	6.9	6.16
9	2.7	4.8	11.14
10	1.9	3.1	3.83
11	2	2	4.34
12	1.4	1.4	3.02
13	1.6	1.1	1.79
14	1.1	0.9	1.19
15	1.2	0.7	0.98
16	1.1	0.3	0.77

Correlation between teacher score and parent score	0.46
Correlation between teacher score and poor health	0.09

Table 2: Effects of Hyperactivity on Future Outcomes

	[1] Canada Delinq.	[2] U.S. Delinq.	[3] Canada Grade Rep.	[4] U.S. Grade Rep.	[5] Canada Math	[6] U.S. Math	[7] Canada Reading	[8] U.S. Reading	[9] Canada Special Ed.	[10] U.S. Special Ed.
Hyperactivity Score 1994	0.015	0.012	0.007	0.004	-0.206	-0.868	-0.170	-1.176	0.023	0.008
	[6.00]**	[4.28]**	[6.99]**	[3.23]**	[10.85]**	[6.57]**	[8.18]**	[8.14]**	[8.79]**	[3.85]**
Average Income	0.008	-0.024	-0.038	-0.051	1.067	15.382	1.044	13.977	-0.031	-0.024
(in 100,000)	[0.33]	[0.52]	[4.28]**	[3.60]**	[4.72]**	[6.87]**	[4.69]**	[5.51]**	[1.44]	[0.73]
Adult Respondent	-0.040		-0.009		0.077		0.166		0.078	
Immigrant	[1.23]		[0.94]		[0.28]		[0.56]		[2.00]*	
Black		-0.017		0.011		-8.787		-2.835		-0.023
		[0.68]		[1.12]		[6.13]**		[1.76]		[1.13]
Hispanic		-0.059		0.025		-12.485		-9.391		0.004
		[2.47]*		[2.63]**		[8.58]**		[5.69]**		[0.16]
Male	0.099	0.103	0.005	0.019	0.258	4.539	-0.042	-0.444	0.023	0.034
	[5.34]**	[5.82]**	[0.79]	[2.83]**	[1.78]	[4.65]**	[0.27]	[0.41]	[1.43]	[2.46]*
First Born Child	-0.032	-0.070	-0.003	-0.003	0.464	2.221	1.037	5.375	-0.003	-0.015
	[1.55]	[3.60]**	[0.49]	[0.40]	[2.89]**	[1.94]	[6.06]**	[4.42]**	[0.19]	[0.85]
Log Family Size 1994	0.059	-0.050	0.007	0.001	0.104	-8.366	0.432	-9.785	0.014	0.035
	[1.23]	[1.51]	[0.41]	[0.06]	[0.27]	[3.61]**	[1.10]	[3.63]**	[0.34]	[0.90]
Two Parent Family 1994	-0.111	-0.046	0.000	-0.024	0.020	2.128	-0.042	1.773	-0.048	-0.027
	[3.31]**	[2.16]*	[0.04]	[2.86]**	[0.08]	[1.74]	[0.27]	[1.25]	[1.45]	[1.45]
Mother's Age at Birth	-0.001	-0.010	0.000	0.001	0.039	0.543	0.081	0.477	-0.001	0.002
	[0.61]	[1.82]	[0.12]	[0.71]	[2.16]*	[2.21]*	[4.17]**	[1.76]	[0.49]	[0.78]
Teen Mother	0.035	-0.074	-0.007	-0.031	-0.806	2.062	-0.964	6.905	0.065	0.000
	[0.70]	[2.62]**	[0.40]	[2.62]**	[2.26]*	[0.43]	[2.68]**	[0.95]	[1.27]	[.]
Mother High School plus	-0.021	-0.042	-0.015	-0.048	0.348	8.487	0.636	11.635	-0.017	-0.005
	[1.08]	[1.98]*	[2.25]*	[4.75]**	[2.21]*	[6.19]**	[3.84]**	[7.23]**	[1.02]	[0.22]
PMK depressed or	0.034	0.028	0.004	0.001	-0.101	-2.499	-0.140	-0.491	0.024	0.025
activity limit in 1994	[1.29]	[1.37]	[0.41]	[0.07]	[0.49]	[1.87]	[0.67]	[0.33]	[0.97]	[1.19]
Age 4 (in 1994)			-0.036	0.066	0.967	-2.306	0.229	-2.062	0.000	0.006
			[3.11]**	[3.05]**	[2.42]*	[0.58]	[0.49]	[0.50]	[0.00]	[0.16]
Age 5	-0.730	0.000	0.005	0.024	0.776	-0.533	-0.310	-4.554	0.032	0.005
	[16.02]**	[.]	[0.37]	[1.23]	[2.92]**	[0.13]	[1.12]	[1.10]	[0.58]	[0.12]

Age 6	-0.216	0.000	-0.010	-0.017	0.813	-0.621	-0.597	-3.063	0.009	-0.017
	[6.88]**	[.]	[0.83]	[1.21]	[3.13]**	[0.16]	[2.22]*	[0.75]	[0.16]	[0.46]
Age 7	-0.244	0.000	-0.017	-0.008	0.809	-1.412	-0.997	-4.855	0.022	0.009
	[7.95]**	[.]	[1.43]	[0.56]	[3.02]**	[0.36]	[3.44]**	[1.17]	[0.40]	[0.23]
Age 8	-0.224	-0.204	-0.019	0.016	-0.828	-3.178	-0.891	-3.991	-0.013	0.068
	[7.22]**	[4.41]**	[1.69]	[1.10]	[3.33]**	[0.80]	[3.27]**	[0.95]	[0.22]	[1.64]
Age 9	-0.127	-0.147	-0.004	0.037	-0.552	-3.866	-1.409	-3.917	0.077	0.000
	[3.92]**	[4.75]**	[0.32]	[2.55]*	[2.11]*	[0.95]	[5.20]**	[0.93]	[1.26]	[.]
Age 10	-0.016	-0.103	-0.024	0.052	-0.961	-1.725	-0.746	-2.429	0.079	0.000
	[0.46]	[3.49]**	[2.23]*	[3.33]**	[3.70]**	[0.40]	[2.80]**	[0.55]	[1.03]	[.]
Constant	0.359	0.889	0.040	0.047	6.938	45.458	8.805	54.236	0.063	-0.080
	[3.54]**	[6.51]**	[1.15]	[0.97]	[8.06]**	[5.38]**	[9.91]**	[5.88]**	[0.62]	[0.75]
Observations	2516	3283	3925	5348	2209	2501.000	2209	2501	1357	1401
R-squared	0.090	0.05	0.040	0.04	0.150	0.230	0.120	0.2	0.14	0.05

Notes: Canadian data are from the 1994-95, 1996-97 and 1998-99 cycles of the NLSCY. Robust t-statistics are in brackets. A * is significant at the 95% level. A ** indicates significants at 99%. Standard errors clustered at the household level.
In the U.S. data, the "1994" variables are means over the period 1988-1994, while the 1998 values are means for 1998 and 2000. Regressions for Canada also included indicators for whether the PMK was female, and for whether income was imputed.

Table 3: Comparing Effects of Hyperactivity, Poor Health, & Chronic Conditions, Canada
Ordinary Least Squares Regressions

Panel 1	**Delinq.**	**Grade Rep.**	**Math**	**Reading**	**Special Ed.**
Hyper Score -OLS	0.015	0.007	-0.206	-0.170	0.023
	[6.00]**	[6.99]**	[10.85]**	[8.18]**	[8.79]**
Income (100,000)	0.008	-0.038	1.067	1.044	-0.031
	[0.33]	[4.28]**	[4.72]**	[4.69]**	[1.44]
N	2516	3925	2209	2209	1357
R-squared	0.090	0.040	0.150	0.120	0.140
Panel 2					
Poor Health	0.051	0.020	-0.427	-0.474	0.081
	[1.86]	[1.89]	[1.92]	[1.98]*	[2.78]**
Income (100,000)	0.003	-0.041	1.122	1.091	-0.031
	[0.11]	[4.61]**	[5.05]**	[4.94]**	[1.49]
N	2513	3922	2207	2207	1356
R-squared	0.080	0.02	0.090	0.09	0.060
Panel 3					
Chronic Conditions	-0.018	0.002	0.116	0.143	0.017
	[0.96]	[0.31]	[0.76]	[0.87]	[0.94]
Income (100,000)	-0.002	-0.042	1.164	1.128	-0.036
	[0.09]	[4.64]**	[5.20]**	[5.11]**	[1.71]
N	2516	3925	2209	2209	1356
R-squared	0.080	0.02	0.1	0.100	0.060

Notes: Canadian data are from the 1994-95, 1996-97 and 1998-99 cycles of the NLSCY. Robust t-statistics are in brackets. A * is significant at the 95% level. A ** indicates significants at 99%. Standard errors clustered at the household level. In the U.S. data, the "1994" variables are means over the period 1988-1994, while the 1998 values are means for 1998 and 2000. Regressions for Canada also included indicators for whether the PMK was female, and for whether income was imputed.

Table 4: Robustness of Effects of Hyperactivity on Future Outcomes

	[1] Canada	[2] U.S.	[3] Canada	[4] U.S.	[5] Canada	[6] U.S.	[7] Canada	[8] U.S.	[9] Canada	[10] U.S.
1. OLS from Table 2	**Delinq.**	**Delinq.**	**Grade Rep.**	**Grade Rep.**	**Math**	**Math**	**Reading**	**Reading**	**Special Ed.**	**Special Ed.**
Hyperactivity Score 1994	0.015	0.012	0.007	0.004	-0.206	-0.868	-0.170	-1.176	0.023	0.008
	[6.00]**	[4.28]**	[6.99]**	[3.30]**	[10.85]**	[6.57]**	[8.18]**	[8.14]**	[8.79]**	[3.85]**
Average Income (100,000)	0.008	-0.024	-0.038	-0.055	1.067	15.382	1.044	13.977	-0.031	-0.024
	[0.33]	[0.52]	[4.28]**	[3.86]**	[4.72]**	[6.87]**	[4.69]**	[5.51]**	[1.44]	[0.73]
Observations	2516	3283	3925	5348	2209	2501	2209	2501	1357	1401
R-squared	0.090	0.050	0.040	0.040	0.150	0.23	0.120	0.2	0.140	0.050
2. Instrumenting with Parent Hyperactivity Score										
Hyperactivity Score 1994	0.019		0.016		-0.270		-0.207		0.047	
	[3.23]**		[6.54]**		[5.60]**		[4.17]**		[8.03]**	
Average Income (100,000)	0.011		-0.033		1.029		1.026		-0.025	
	[0.46]		[3.64]**		[4.50]**		[4.56]**		[1.01]	
Observations	2508		3909		2198		2198		1352	
R-squared	0.09		0.07		0.14		0.12		0.050	
3. Dummy Variable for Hyperactivity Above 90th Percentile										
Hperactivity Score 1994	0.094	0.013	0.079	0.039	-1.468	-5.799	-1.487	-10.087	0.285	0.064
Above 90th percentile	[2.90]**	[0.43]	[4.97]**	[2.63]**	[5.93]**	[3.46]**	[5.52]**	[5.41]**	[7.13]**	[1.95]
Average Income (100,000)	0.003	-0.044	-0.038	-0.054	1.117	16.077	1.078	14.717	-0.032	-0.028
	[0.12]	[0.96]	[4.42]**	[3.80]**	[4.99]**	[7.14]**	[4.88]**	[5.75]**	[1.52]	[0.83]
Observations	2516	3283	3925	5348	2209	2501	2209	2501	1357	1401
R-squared	0.08	0.05	0.03	0.04	0.11	0.22	0.1	0.19	0.14	0.04
4. Include Spline at the 90th Percentile of the Hyperactivity Score										
Hyperactivity Score, 1994	0.019	0.015	0.007	0.002	-0.245	-0.905	-0.195	-1.131	0.016	0.008
	[6.25]**	[4.70]**	[6.53]**	[1.96]	[10.28]**	[5.87]**	[7.46]**	[6.74]**	[5.32]**	[3.47]**
Spline at 90th	-0.028	-0.003	-0.001	0.001	0.232	0.026	0.148	-0.031	0.040	0.000
	[2.22]*	[1.85]	[0.21]	[1.64]	[2.27]*	[0.49]	[1.33]	[0.57]	[2.64]**	[0.35]
Average Income (100,000)	0.008	-0.024	-0.038	-0.051	1.065	15.383	1.043	13.976	-0.032	-0.024
	[0.32]	[0.54]	[4.27]**	[3.59]**	[4.71]**	[6.87]**	[4.68]**	[5.51]**	[1.52]	[0.72]
Observations	2516	3283	3925	5348	2209	2501	2209	2501	1357	1401
R-squared	0.1	0.05	0.04	0.04	0.15	0.23	0.13	0.2	0.15	0.05

Table 4, continued

	[1] Canada Delinq.	[2] U.S. Delinq.	[3] Canada Grade Rep.	[4] U.S. Grade Rep.	[5] Canada Math	[6] U.S. Math	[7] Canada Reading	[8] U.S. Reading	[9] Canada Special Ed.	[10] U.S. Special Ed.
5. Excluding Children Treated in 1994										
Hyperactivity Score, 1994	0.014	0.012	0.007	0.004	-0.203	-0.741	-0.164	-1.003	0.021	0.003
	[5.16]**	[4.17]**	[6.43]**	[3.22]**	[10.04]**	[5.30]**	[7.47]**	[6.38]**	[7.82]**	[1.88]
Average Income (100,000)	-0.003	-0.020	-0.034	-0.06	1.010	16.178	1.049	14.926	-0.027	-0.047
	[0.13]	[0.44]	[4.05]**	[4.97]**	[4.52]**	[7.15]**	[4.63]**	[5.55]**	[1.32]	[2.29]*
Observations	2384	3220	3737	5067	2098	2221	2098	2221	1300	1217
R-squared	0.09	0.06	0.04	0.04	0.14	0.23	0.12	0.2	0.13	0.02
6. Including Maternal AFQT										
Hyperactivity Score 1994		0.012		0.003		-0.823		-1.12		0.008
		[3.99]**		[2.72]**		[6.22]**		[7.64]**		[3.84]**
Average Income (100,000)		-0.034		-0.03		7.831		6.976		-0.007
		[0.69]		[2.04]*		[3.67]**		[2.73]**		[0.20]
AFQT		0		-0.001		0.302		0.294		-0.001
		[0.41]		[4.61]**		[11.13]**		[10.06]**		[3.06]**
Observations		3152		5125		2419		2419		1351
R-squared		0.05		0.05		0.27		0.24		0.06

Notes: See Table 3. The first stage F-statistic for test that the parent score is 0 in our IV models is 687 (t-statistic of 26, R-squared of 0.26).
To compare effects on reading and math scores, multiply the Canadian coefficients by 5 and 6.67 respectively.

Table 5: Interactions of Income With Hyperactivity

	[1] Canada Delinq.	[2] U.S. Delinq.	[3] Canada Grade Rep.	[4] U.S. Grade Rep.	[5] Canada Math	[6] U.S. Math	[7] Canada Reading	[8] U.S. Reading	[9] Canada Special Ed.	[10] U.S. Special Ed.
1. OLS - Income										
Interaction	0.000	-0.012	-0.011	-0.004	0.113	0.069	0.123	0.614	-0.016	-0.003
	[0.01]	[0.95]	[4.16]**	[1.01]	[2.30]*	[0.15]	[2.47]*	[1.25]	[2.72]**	[0.34]
Hyperactivity 1994	0.015	0.016	0.012	0.005	-0.264	-0.896	-0.233	-1.428	0.031	0.009
	[3.37]**	[3.18]**	[6.23]**	[2.29]*	[8.26]**	[3.98]**	[6.79]**	[5.58]**	[7.23]**	[2.16]*
Average Income	0.008	0.041	-0.006	-0.028	0.763	15.039	0.711	10.909	0.013	-0.011
[100,000]	[0.33]	[0.51]	[0.80]	[1.24]	[3.38]**	[5.16]**	[2.79]**	[3.20]**	[0.78]	[0.31]
Observations	2516	3283	3925	5348	2209	2501	2209	2501	1357	1401
R-squared	0.09	0.05	0.04	0.04	0.15	0.23	0.13	0.2	0.15	0.05
2. IV - Income										
Interaction	-0.001		-0.018		0.065		0.072		-0.030	
	[0.07]		[2.88]**		[0.61]		[0.68]		[2.47]*	
Hyperactivity 1994	0.019		0.025		-0.304		-0.245		0.062	
	[2.01]*		[5.66]**		[4.08]**		[3.29]**		[6.91]**	
Average Income	0.014		0.020		0.852		0.829		0.057	
[100,000]	[0.34]		[1.21]		[2.53]*		[2.37]*		[1.62]	
Observations	2508		3909		2198		2198		1352	
R-squared	0.09		0.01		0.14		0.12		0.05	
3. OLS - Indicator for Hyperactivity Score >=90th percentile										
Interaction	-0.207	-0.409	-0.135	-0.023	1.497	-1.115	2.060	0.927	-0.219	-0.034
	[2.01]*	[2.40]*	[3.08]**	[0.23]	[2.32]*	[0.17]	[2.68]**	[0.14]	[2.49]*	[0.29]
Hperactivity Score 1994	0.193	0.130	0.142	0.046	-2.193	-5.411	-2.485	-10.409	0.388	0.076
Above 90th percentile	[3.18]**	[2.31]*	[4.56]**	[1.24]	[5.39]**	[1.85]	[5.36]**	[3.35]**	[6.19]**	[1.30]
Average Income	0.013	-0.028	-0.030	-0.053	1.004	16.139	0.922	14.665	-0.012	-0.026
[100,000]	[0.53]	[0.62]	[3.76]**	[3.98]**	[4.59]**	[6.99]**	[4.11]**	[5.58]**	[0.70]	[0.77]
Observations	2516	3283	3925	5348	2209	2501	2209	2501	1357	1401
R-squared	0.08	0.05	0.04	0.04	0.11	0.22	0.11	0.19	0.14	0.04

Table 5: Interactions of Income With Hyperactivity

	[1] Canada Delinq.	[2] U.S. Delinq.	[3] Canada Grade Rep.	[4] U.S. Grade Rep.	[5] Canada Math	[6] U.S. Math	[7] Canada Reading	[8] U.S. Reading	[9] Canada Special Ed.	[10] U.S. Special Ed.
4. IV - Hyperactivity Score >=90th percentile										
Interaction	0.088		-0.276		-1.020		-0.201		-0.419	
	[0.25]		[2.03]*		[0.31]		[0.07]		[1.34]	
Hperactivity Score 1994	0.267		0.409		-4.262		-3.539		1.035	
Above 90th percentile	[1.42]		[4.95]**		[2.57]*		[2.33]*		[5.37]**	
Average Income	0.008		-0.012		1.093		1.031		0.015	
[100,000]	[0.32]		[1.36]		[3.37]**		[3.39]**		[0.60]	
Observations	2508		3909		2198		2198		1352	
R-squared	0.06		..		0.03		0.08		..	

Notes: See Table 3.

Table 6: Effects of Hyperactivity in 1994 and Income on Treatment in 1994

	[1] Canada Drug	[2] Canada Drug	[3] Canada Psych.	[4] Canada Psych.	[5] Canada Any	[6] Canada Any	[7] U.S. Drug	[8] U.S. Drug	[9] U.S. Psych.	[10] U.S. Psych.	[11] U.S. Any	[12] U.S. Any
Hyper Score 1994	0.005	0.005	0.005	0.006	0.009	0.009	0.007	0.006	0.018	0.016	0.02	0.018
	[5.85]**	[3.89]**	[5.35]**	[3.49]**	[7.44]**	[4.73]**	[7.95]**	[6.20]**	[12.85]**	[10.22]**	[13.42]**	[10.85]**
Interaction hyper		-0.001		-0.002		-0.002		0.085		0.152		0.135
& income		[0.39]		[0.70]		[0.58]		[1.92]		[2.38]*		[2.07]*
Average Income	-0.005	-0.003	-0.007	-0.002	-0.009	-0.004	0.007	0.002	0.082	0.073	0.082	0.075
[100,000]	[1.26]	[0.61]	[0.81]	[0.16]	[1.01]	[0.39]	[0.49]	[0.17]	[3.38]**	[3.03]**	[3.19]**	[2.89]**
PMK Immigrant	0.005	0.005	-0.014	-0.014	-0.010	-0.009						
	[0.60]	[0.61]	[1.44]	[1.42]	[0.82]	[0.80]						
Black							-0.018	-0.018	-0.018	-0.018	-0.024	-0.024
							[2.30]*	[2.30]*	[1.25]	[1.25]	[1.61]	[1.61]
Hispanic							-0.03	-0.03	-0.096	-0.096	-0.106	-0.105
							[3.90]**	[3.88]**	[6.97]**	[6.96]**	[7.33]**	[7.32]**
Male	0.003	0.003	0.007	0.007	0.011	0.011	0.021	0.021	0.015	0.016	0.025	0.025
	[0.93]	[0.94]	[1.13]	[1.15]	[1.73]	[1.75]	[4.33]**	[4.38]**	[1.86]	[1.91]	[2.84]**	[2.89]**
First Born Child	0.004	0.004	0.021	0.021	0.023	0.023	-0.003	-0.003	-0.012	-0.012	-0.012	-0.012
	[1.05]	[1.05]	[3.02]**	[3.03]**	[3.00]**	[3.01]**	[0.50]	[0.46]	[1.24]	[1.19]	[1.21]	[1.17]
Log Family Size	0.000	0.000	0.001	0.001	0.002	0.002	-0.005	-0.004	-0.028	-0.028	-0.029	-0.029
1994	[0.04]	[0.04]	[0.07]	[0.08]	[0.10]	[0.10]	[0.44]	[0.41]	[1.31]	[1.29]	[1.26]	[1.25]
Two Parent	-0.007	-0.007	-0.028	-0.027	-0.032	-0.032	-0.001	-0.001	-0.01	-0.01	-0.009	-0.009
Family, 1994	[0.92]	[0.89]	[1.99]*	[1.94]	[2.13]*	[2.09]*	[0.37]	[0.37]	[4.10]**	[4.08]**	[3.70]**	[3.68]**
Mother's Age	0.000	0.000	0.001	0.001	0.001	0.001	-0.011	-0.011	-0.062	-0.063	-0.062	-0.063
at Child's Birth	[0.04]	[0.06]	[1.27]	[1.30]	[1.15]	[1.17]	[1.61]	[1.65]	[5.02]**	[5.08]**	[4.84]**	[4.88]**
Teen mother	-0.008	-0.008	0.008	0.008	0.006	0.006	-0.015	-0.015	-0.024	-0.023	-0.022	-0.022
	[0.84]	[0.85]	[0.46]	[0.45]	[0.32]	[0.31]	[1.71]	[1.69]	[1.47]	[1.45]	[1.30]	[1.28]
Mother's HS	0.008	0.008	0.009	0.009	0.013	0.013	-0.001	-0.001	0.034	0.033	0.038	0.038
or more	[1.82]	[1.84]	[1.31]	[1.34]	[1.71]	[1.73]	[0.09]	[0.09]	[2.58]*	[2.57]*	[2.78]**	[2.77]**
PMK Bad Health	0.010	0.010	0.036	0.035	0.043	0.042	0.004	0.004	0.066	0.066	0.067	0.066
	[1.59]	[1.59]	[3.27]**	[3.24]**	[3.62]**	[3.60]**	[0.54]	[0.54]	[4.95]**	[4.95]**	[4.81]**	[4.81]**
Age 4	0.003	0.003	-0.016	-0.016	-0.006	-0.007	-0.032	-0.035	-0.085	-0.091	-0.105	-0.11
	[0.27]	[0.26]	[0.98]	[0.99]	[0.31]	[0.32]	[2.76]**	[3.08]**	[4.54]**	[4.81]**	[5.25]**	[5.47]**
Age 5	-0.018	-0.018	-0.033	-0.033	-0.044	-0.044	-0.011	-0.014	-0.074	-0.08	-0.073	-0.078
	[3.09]**	[3.10]**	[3.28]**	[3.29]**	[4.00]**	[4.01]**	[0.85]	[1.10]	[3.97]**	[4.29]**	[3.54]**	[3.80]**
Age 6	-0.012	-0.012	-0.016	-0.016	-0.021	-0.021	-0.014	-0.014	-0.067	-0.067	-0.069	-0.069
	[1.71]	[1.71]	[1.48]	[1.48]	[1.71]	[1.71]	[1.21]	[1.22]	[3.69]**	[3.71]**	[3.46]**	[3.47]**
Age 7	-0.004	-0.004	-0.008	-0.008	-0.007	-0.007	0.002	0.002	-0.031	-0.031	-0.041	-0.041
	[0.55]	[0.55]	[0.64]	[0.65]	[0.53]	[0.54]	[0.16]	[0.14]	[1.59]	[1.62]	[2.07]*	[2.10]*
Age 8	-0.004	-0.004	-0.003	-0.003	-0.006	-0.006	0.005	0.004	-0.053	-0.053	-0.044	-0.044
	[0.52]	[0.53]	[0.27]	[0.28]	[0.45]	[0.46]	[0.36]	[0.34]	[3.09]**	[3.11]**	[2.36]*	[2.39]*

Age 9	0.007	0.007	0.010	0.010	0.013	0.013	-0.011	-0.011	-0.028	-0.028	-0.03	-0.03
	[0.78]	[0.78]	[0.79]	[0.78]	[0.93]	[0.93]	[1.13]	[1.13]	[1.63]	[1.63]	[1.67]	[1.67]
Age 10	-0.008	-0.008	-0.019	-0.019	-0.022	-0.022	0.015	0.015	-0.016	-0.014	-0.004	-0.003
	[1.08]	[1.08]	[1.71]	[1.71]	[1.76]	[1.76]	[1.25]	[1.31]	[0.86]	[0.78]	[0.23]	[0.17]
Constant	0.002	0.000	-0.011	-0.015	-0.013	-0.017	0.022	0.03	0.289	0.303	0.286	0.298
	[0.10]	[0.01]	[0.35]	[0.48]	[0.37]	[0.48]	[0.61]	[0.81]	[4.30]**	[4.47]**	[3.98]**	[4.11]**
# Observations	3925	3925	3920	3920	3920	3920	5347	5347	5343	5343	5343	5343
R-squared	0.04	0.04	0.03	0.03	0.05	0.05	0.03	0.04	0.1	0.1	0.11	0.11

2. IV

Hyper Score 1994	0.013	0.015	0.017	0.022	0.025	0.030
	[6.13]**	[4.38]**	[6.62]**	[5.02]**	[8.66]**	[6.23]**
Interaction hyper & income		-0.004		-0.010		-0.010
		[0.75]		[1.61]		[1.36]
Average Income	0.00004	0.011	-0.00012	0.029	0.001	0.029
	[0.01]	[0.86]	[0.01]	[1.61]	[0.07]	[1.46]
# Observations	3909	3909	3908	3908	3908	3908

Notes: Sample is the group of children with non-missing grade repetition information.