The Effects of Childhood ADHD on Adult Labor Market Outcomes[*]

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Abstract

While several types of mental illness, including substance abuse disorders, have been linked with poor labor market outcomes, no current research has been able to examine the effects of childhood ADHD. As ADHD has become one of the most prevalent childhood mental conditions, it is useful to understand the full set of consequences of the illness. This paper uses a longitudinal national sample, including sibling pairs, to show important labor market outcome consequences of ADHD. The employment reduction is between 10-14 percentage points, the earnings reduction is approximately 33%, and the increase in social assistance is 15 points, which are larger than many estimates of the black-white earnings gap and the gender earnings gap. A small share of the link is explained by education attainments and co-morbid health conditions and behaviors. The results also show important differences in labor market consequences by family background and age of onset. These findings, along with similar research showing that ADHD is linked with poor education outcomes and adult crime, suggest the importance of treating childhood ADHD to foster human capital.

[*] I thank Lisa Kahn, Dave Marcotte, Matthew Neidell, Joesph Price, Erdal Tekin, Barbara Wolfe and participants at the 2010 Yale Health Economics Workshop for helpful comments.
This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

Introduction

While there is a relatively large literature linking mental illness, including substance dependence, with poor labor market outcomes, few studies have examined the potential long term consequences of childhood mental health on adult outcomes. Those studies that have attempted to link childhood mental illness with adult labor market outcomes have typically focused on measures of adolescent mental health such as depression and substance dependence (Fletcher 2009a, Ettner et al., 1997, Marcotte and Wilcox-Gok 2003). In contrast, no studies have been able to examine long term links between other highly prevalent childhood mental health conditions, such as Attention Deficit/Hyperactivity Disorder (ADHD), and adult labor market outcomes. Indeed, ADHD is one of the most prevalent and fasting growing mental health problems facing children in the US. The prevalence is typically estimated to be between 2-10% of school-aged children, with 7.4 percent of parents with children between the age of 3-17 reporting a doctor has told them their child has ADHD (Bloom and Cohen 2007).

There are many pathways that could reduce the labor market outcomes of adults with childhood ADHD symptoms. There are several recent studies that show that childhood ADHD is associated with early education outcomes, such as grade repetition and special education placement (Currie and Stabile 2006) as well as longer term education outcomes, including high school performance (Fletcher and Wolfe 2008, Currie et al. in press). Currie et al. (in press) also show evidence that ADHD is associated with welfare receipt as a young adult. Further there is evidence that the presence of childhood ADHD symptoms is correlated with criminal activities as a young adult (Fletcher and Wolfe 2009). While this research is strongly suggestive of potential

labor market consequences of ADHD, to date no research has been able to examine this question (Currie et al. in press).

This paper provides the first evidence of links between childhood ADHD symptoms and adult labor market outcomes. The data come from the national, prospective Add Health, which tracks individuals between 7-12th grades and outcomes around age 30. Importantly, to match previous research, this paper is able to examine sibling differences in outcomes based on childhood ADHD diagnoses and focuses on employment, earnings, and social assistance receipt for young adults. The consequences of ADHD on labor market outcomes are large. For example, the findings suggest labor market participation reductions of approximately 10 percentage points, which are robust to including controls for co-occurring health conditions and behaviors, years of schooling as well as family fixed effects. Earnings reductions are estimated to be approximately 30% and social assistance increases are estimated to be 15 percentage points for those with childhood ADHD. The paper also provides evidence of differences in the effects based on family background and age at diagnosis.

Background Literature

ADHD is a neurobehavioral developmental disorder characterized by the co-existence of both chronic attentional problems and hyperactivity. In particular, individuals with ADHD are characterized by lags in impulse control development of approximately 5 years (Shaw et al. 2007), which can cause impairment in a variety of domains including problem solving, planning ahead, and understanding the actions of

others (AACAP 2009).[1] Symptoms typically begin before age seven but often persist into adulthood (Nair et al. 2006).

Although a controversial diagnosis because of the potential for subjectivity in evaluation, the American Medical Association has been a proponent of its usefulness as a disorder.[2] Further, in order to be diagnosed, an individual must show persistent symptoms in at least two different settings (home, school, etc) for more than six months and to a degree that is greater than children of the same age.

While much is known about the family and individual level predictors of childhood ADHD, there are still many open questions about its specific causes. It is an illness with high prevalence, with four and a half million children ages 3-17 reported to have ADHD according to data from the 2006 National Health Interview Study. Briefly, ADHD is more likely to occur in males and children in families with low socioeconomic status. A genetic link has been suggested based on the higher prevalence among close relatives than the general population and some molecular genetic ties to ADHD status (Biederman et al. 1990).

Treatments for ADHD also are somewhat controversial. On one hand, there is evidence that approximately 70% of the patients with ADHD respond to treatment with stimulant medications in the short term and over periods of up to 18 months (Olfson et al. 2003). However, pharmacotherapy alone has not yet been shown to improve the long-term outcome for any domain of functioning (Goldman et al. 1998). While the explosion

[1] ADHD is also separated into subtypes (attention deficit and hyperactivity); inattentive symptoms include being easily distracted, having difficulty focusing, not listening when spoken to, struggling to follow instructions; hyperactive symptoms include talking nonstop, fidgeting, not being able to sit still, having difficulty doing quiet tasks, and having difficulty waiting for things, among others.

[2] For example, a Council on Scientific Affairs concluded, "diagnostic criteria for ADHD are based on extensive empirical research and, if applied appropriately, lead to the diagnosis of a syndrome with high interrater reliability, good face validity, and high predictability of course and medication responsiveness' in 1998 (Goldman et al. 1998)

in pharmacological therapy occurred in 1991, as yet there are no studies of the consequences of long term use (Davey 2006).

Much of the work that has linked childhood ADHD or hyperactivity symptoms to labor market outcomes has used samples from outside the United States and/or used aggregated measures of early childhood mental health, such as behavioral problem indices rather than information on diagnoses. For example, Gregg and Machin (1998) use the British National Child Development Survey (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.[3] A 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 (Caspi et al., 1998).[4] Importantly, neither study used specific measures of ADHD and neither was able to use sibling comparisons, so the relationships could be biased from neighborhood or family factors.

Other research has focused on educational and other long term consequences of ADHD, often using sibling fixed effects specifications. Currie and Stabile (2006) was the first such study, using NLSY data with sibling fixed effects to show associations

[3] The behavioural problems variables were defined from the following eight "syndrome" scores given in NCDS: unforthcomingness, withdrawal, depression, anxiety, hostility towards adults, anxiety for acceptance by children, restlessness and "inconsequential" behaviour. They were entered into the empirical models as 0-1 dummies indicating positive scores on 1, 2/3 and 4 or more of the 8 measures (with no positive scores being the reference group).

[4] Behavior problems were assessed with independent parent and teacher ratings of each child's behavior. The ratings used items from the "antisocial" and "hyperactivity" subscales of the Rutter Child Scales (Rutter, Tizard, and Whitmore 1970). Items were scored 0 = does not apply, 1 = applies somewhat, 2 = certainly applies. The authors combined the parent and teacher ratings into a single score to improve the reliability and validity of this measure.

between behavioral symptoms consistent with ADHD[5] and grade repetition, test scores, and special education placement. Fletcher and Wolfe (2008) followed this work using the Add Health data with sibling comparisons to show some associations between ADHD and later education outcomes, such as high school grade point average. Additionally, Aizer (2009) shows evidence that ADHD "spills over" on classmate test score performance in elementary school. Currie and Stabile (2009) extend this work further by using the Canadian and US NLSY datasets and show that hyperactive symptoms reported by parents are associated with educational outcomes as well as delinquency, and Fletcher and Wolfe (2009) show associations between childhood ADHD symptoms and criminal activities as a young adult using sibling fixed effects models. While these papers are suggestive that childhood ADHD may also have labor market implications, they do not provide direct evidence.

The most similar paper to the current study is Currie et al. (2009), who use a combined ADHD/Conduct disorder category of "externalizing disorders" and show that this grouping is related to welfare receipt by age 19, grade retention and lower literacy scores, even using sibling fixed effects; the findings also suggest that later diagnosis may be associated with worse outcomes. Their data is somewhat limited because it is based on administrative records from one Canadian province and thus lacks typical social science measures such as socioeconomic status, etc and does not contain labor market outcomes. This paper will build from the research base by using national data from the

[5] The authors were only able to concentrate on hyperactivity questions from the Behavior Problems Index: 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 thoughts
(has obsessions)
5. He/she is restless or overly active, cannot sit still.

US that tracks individuals and sibling pairs though age 30 and thus has labor market outcome information as well as histories of ADHD status.

Data and Empirical Methods

The Add Health is a school-based, longitudinal study of the health-related behaviors of adolescents and their outcomes in young adulthood. Beginning with an in-school questionnaire administered to a nationally representative sample of students in grades 7 through 12 in 1994-95 (Wave 1), the study follows up with a series of in-home interviews of respondents approximately one year (Wave 2; 1996), six years (Wave 3; 2001-2002), and thirteen years later (Wave 4; 2008). By design, the Add Health survey included a sample stratified by region, urbanicity, school type, ethnic mix, and size.[6]

While the original wave 1 sample collected information on over 20,000 respondents, approximately 15,000 were followed longitudinally at wave 4. At the same time, the data contain a sub-sample of siblings who have been followed over time; this sample originally numbered approximately 5,400, over half of whom were followed (along with their co-sibling) longitudinally into wave 4, leaving a sample size for the sibling analyses of nearly 3,500.[7] In order to maximize available sample sizes for the analysis, missing family income during high school and maternal education was imputed and a dummy variable is controlled. Likewise, in some of the auxiliary regressions, missing birth weight and childhood mistreatment information is imputed in order to retain sample size.

[6] See Udry 2003 for full description of the Add Health data set.
[7] The reason sample attrition appears more pronounced in the sibling sub-sample than the main sample is that if *either* sibling is missing at follow-up, both siblings are dropped from the sample.

Table 1 reports descriptive statistics for the analysis sample.[8] The earnings data from wave 4 come from the following question and are interval coded[9]: "Now think about your personal earnings. How much income did you receive from personal earnings before taxes—that is, wages."[10] Using this coding procedure, the average earnings for this sample of adults (average age nearly 30) is nearly $35,000. Separately from the earnings question, individuals are also asked to report whether they worked ten or more hours during the previous week, which is the measure of employment available in this study. In additional analysis, I also examine receipt of public assistance, which includes welfare payments and food stamps.

In order to characterize ADHD, this paper uses two measures asked at Wave 4: (1) "Has a doctor, or nurse, or other health care provider ever told you that you have or had attention problems or ADD or ADHD?" and (2) "How old were you when the doctor, nurse, or other health practitioner first told you?" In order to separate "early" and "late" ADHD, I split the sample by the median age of diagnosis (age 12) reported in the sample.[11] While recall bias could be an issue with these measures, the 5% of the sample who reported a diagnosis of ADHD matches closely with the estimated prevalence of the illness. .

[8] Like Currie and Stabile (2006), who use sibling comparisons with other datasets, there is very little difference across sub-samples. Fletcher and Wolfe (2008) also do not find large differences between the full sample and sibling samples using the Add Health data. See Appendix Table 1A.

[9] The midpoint of each interval is used in the analysis. The intervals include: $0, <$5,000, $5,000-9,999, 10,000-14,999, 15,000-19,999, 20,000-24,999, 25,000-29,999, 30,000-39,999, 40,000-49,999, 50,000-74,999, 75,000-99,999, 100,000-149,999, 150,000 or more.

[10] The interval coding does not allow an adequate examination using quantile regression specification, though Marcotte and Wilcox-Gok (2003) use interval-coded earnings data with 23 intervals and assign the midpoint.

[11] Interestingly, there appears to be no pronounced "clumping" of the age of diagnosis measure in the sample, say at ages 5 and 10.

The data also contains rich information on health conditions and (endogenous) health behaviors. Individuals report behaviors such as tobacco use (25%), sexual activity (39%), alcohol use (41%), obese status (7%), and marijuana use (14%) as well as completed a diagnostic tool for depression (8%) at wave 1 of the survey (during junior high or high school). In Wave 4 of the survey, respondents report whether they have ever been diagnosed with asthma (15%) or diabetes (3%), and in Wave 3 the respondents completed an assessment of childhood mistreatment which is combined into a "mistreatment index" using principal component analysis.[12] Finally, in order to control for skill accumulation (apart from years of schooling information), the analysis uses scores on the Peabody Picture Vocabulary Test (PPVT), which was administered at waves 1 and 3.[13]

In Table 2, descriptive statistics are presented based on ADHD status. The differences foreshadow both some of the results in the paper and empirical issues with comparing individuals with ADHD vs. individuals without a diagnosis. There are large differences in employment outcomes between individuals with an ADHD diagnosis and those with no diagnosis. Individuals with ADHD are 9 percentage points less likely to be currently working and earn incomes that are $4,000 less than those with no ADHD diagnosis. Individual with ADHD are also 10 percentage points more likely to receive public assistance. However, there are also differences in the family background of individuals with ADHD. On one hand, these individuals come from more advantaged

[12] See Fletcher (2008, in press) for details on the depression measure, Fletcher, Green, and Neidell (2010) for details on the asthma questions, and Fletcher (2009b) for details on the mistreatment data

[13]The Add Health Picture Vocabulary Test (AHPVT) is a computerized, abridged version of the Peabody Picture Vocabulary Test-Revised (PPVT-R). The AHPVT is a test of hearing vocabulary, designed for persons aged 2 1/2 to 40 years old who can see and hear reasonably well and who understand standard English to some degree. The test scores are standardized by age. Some psychologists interpret PVT scores as a measure of verbal IQ. Information on the test is provided online at http://www.cpc.unc.edu/projects/addhealth/files/w3cdbk/w3doc.zip.

backgrounds, as measured by maternal education and family income. On the other hand, individuals with ADHD are also more likely to have other health problems, such as asthma, and are also more likely to be exposed to childhood mistreatment. These differences in family background as well as unobserved family factors will be controlled in the analysis. Individuals with ADHD also have several co-occurring illnesses and unhealthy behaviors—they are more likely to smoke marijuana and tobacco, drink alcohol, and be sexually active (p-value<0.16). The empirical analysis will be able to control for these important sources of heterogeneity.

Empirical Models

Following much of the literature examining the associations between health and labor market outcomes, I begin the analysis using baseline OLS regression specifications:

$$Employment_{i,t} = \beta_0 + \beta_1 ADHD_{it-1} + X_i \beta_2 + \varepsilon_{it} \qquad (1)$$

Likewise, traditional Mincer models are used to link log(earnings) with ADHD and other individual and family-level characteristics (X) (following Marcotte and Wilcox-Gok 2003, among others in examinations of the labor market effects of poor mental health):

$$\log(earnings)_{i,t} = \beta_0 + \beta_1 ADHD_{it-1} + X_i \beta_2 + \varepsilon_{it} \qquad (2)$$

where outcomes are measured at time *t* (wave 4) and ADHD is reported for time periods prior to wave 4. This temporal structure reduces concerns with reverse causality in the estimated effects. In order to examine the potential biases from either community (*c*) or family (*f*) level unobserved heterogeneity, the empirical models are expanded to allow for school-of- origin fixed effects or family fixed effects for each outcome, Y_i (employment, earnings, and public assistance receipt):

$$Y_{ict} = \beta_0 + \beta_1 ADHD_{it-1} + X_i \beta_2 + \tau_c + \varepsilon_{ict} \quad (3)$$

$$Y_{ift} = \beta_0 + \beta_1 ADHD_{it-1} + Z_i \beta_2 + \mu_f + \varepsilon_{ift} \quad (4)$$

where the *Z* vector in equation (4) is limited to individual level variables that vary within families (e.g. gender). Estimates from equation (3) will allow common environmental factors at the school/neighborhood level to be controlled, such as labor market opportunities, health care options, and other factors. Then, in order to further control for family-level factors that could affect both labor market opportunities and health status (e.g. parental health), family fixed effects will be controlled. A comparison of (2) and (4) will indicate whether baseline methods are driven by omitted variable bias at the family level (Currie and Stabile, 2006; Fletcher and Wolfe, 2008).[14] Further examinations will include additional individual level variables, including educational outcomes and co-occurring illnesses and health behaviors to further examine potential pathways linking ADHD and labor market outcomes as well as reduce the chances of bias due to individual-level heterogeneity. In addition to these measures, auxiliary specifications were estimated that included measures of hours worked per week as well as criminal activities; neither set of measures changed the main results presented below and are available upon request.

Results

Results for Employment

Table 3 presents baseline OLS estimates of the effects of childhood ADHD on employment at Wave 4. Column 1 shows evidence that ADHD is associated with a 10

[14] It is important to note that if the ADHD diagnosis is measured with error, the use of sibling fixed effects may exacerbate the bias associated with the measurement error.

percentage point decrease in employment. Separating the results by gender (columns 2 and 3) suggest no differences. Separating the results by race suggests that blacks (14 points) and Hispanics (17 points) are affected to a greater extent than whites (9.5 points) and columns 7 and 8 show that the effect is more heavily concentrated in children from poor (below median income) families (13 points) in comparison to children from rich (above median income) families (4.5 points).[15]

In order to control for measures of environmental factors (e.g. local unemployment rates) during adolescence as well as narrow the comparison groups, controls were included for high school of origin fixed effects in column 2 in Table 4; however these controls do not alter the estimates from column 1. Column 3 shows the baseline results for the sibling subsample and column 4 controls for high school fixed effects, again suggesting no changes in the coefficients. Next, family fixed effects are controlled in column 5, which slightly reduces the effect on employment to 12.6 percentage points. In order to examine potential pathways through which ADHD might affect employment, columns 6-8 add controls for health behaviors (6), years of schooling and wave 3 test scores (7), and occupation fixed effects at wave 3 (8)—the results are surprisingly stable[16], indicating between a 12-14 percentage point reduction in employment for individuals with ADHD, compared with their sibling. As noted above, these results are unchanged if controls for wave 3 criminal behavior or hours worked are used. Overall, the effects of ADHD on adult employment appear concentrated in disadvantaged children, are only partially explained by education and health behaviors,

[15] Controlling for birth order did not change any results and was not statistically significant.
[16] All individuals with no stated occupation at wave 3 are given a separate (common) value for their occupation code for this analysis.

and the magnitude of the coefficient is quite robust to controls for several sources of heterogeneity.

Results for Earnings

Results for log(earnings) are presented in Tables 5 and 6. It is important to note that these empirical models are conditional on non-zero earnings.[17] Baseline OLS results in column 1 of Table 5 indicate a nearly 30% earnings reduction for those with childhood ADHD. The magnitude is nearly twice the black-white earnings gap and similar to the gender gap. Splitting the sample by gender in columns 2 and 3 shows very little difference in effects. As before, the earnings effects of ADHD are also concentrated among racial minorities and children from poor families.

Again, in order to control for measures of environmental factors during adolescence as well as narrow the comparison groups, controls were included for high school of origin fixed effects in column 2 in Table 6; however these controls do not alter the estimates from column 1. Column 3 shows the baseline results for the sibling subsample and column 4 controls for high school fixed effects, again suggesting no changes in the coefficients. Next, family fixed effects are controlled in column 5, which slightly *increases* the effect on earnings to 40% from 36% (Smith 2009 shows larger effects of poor childhood health on income after using family fixed effects). In order to examine potential pathways through which ADHD might affect earnings, columns 6-8 add controls for health behaviors (6), years of schooling and wave 3 test scores (7), and occupation fixed effects at wave 3 (8)—the results are again surprisingly stable,

[17] Results imputing zero earnings for individuals with missing earnings are larger than those presented and are available upon request.

indicating between a 34-36% reduction in earnings for individuals with ADHD, compared with their sibling. Overall, like employment, the effects of ADHD on adult earnings appear concentrated in disadvantaged children, are only partially explained by education and health behaviors, and the magnitude of the coefficient is quite robust to controls for several sources of heterogeneity.

Results for Public Assistance

Results for public assistance receipt between waves 3 and 4 are presented in Tables 7 and 8. Baseline OLS results in column 1 of Table 7 indicate a 13 percentage point increase in public assistance for those with childhood ADHD. Splitting the sample by gender in columns 2 and 3 shows larger effects for females (16 points) than males (11 points). As before, the effects of ADHD are also concentrated among racial minorities and children from poor families (15 points) versus children from rich families (8 points).

Again, in order to control for measures of environmental factors (e.g. local unemployment rates) during adolescence as well as narrow the comparison groups, controls were included for high school of origin fixed effects in column 2 in Table 8; however these controls do not alter the estimates from column 1. Column 3 shows the baseline results for the sibling subsample and column 4 controls for high school fixed effects, again suggesting no changes in the coefficients. Next, family fixed effects are controlled in column 5, which slightly reduces the effect on public assistance from 19 points to 17 points. In order to examine potential pathways through which ADHD might affect earnings, columns 6-8 add controls for health behaviors (6), years of schooling and wave 3 test scores (7), and occupation fixed effects at wave 3 (8)—the results are again

surprisingly stable, indicating between a 15-17 point reduction in social assistance for individuals with ADHD, compared with their sibling. Overall, like employment, the effects of ADHD on adult social assistance appear concentrated in disadvantaged children, are only partially explained by education and health behaviors, and the magnitude of the coefficient is quite robust to controls for several sources of heterogeneity.

Examination by Age of Onset

Tables 9-11 examine the differential effects based on whether the respondent reported an "early" or "late" diagnosis, where the variables are defined based on the median age of reported diagnosis in the sample—age 12. Table 9 shows evidence that early ADHD reduces employment by 12-15 percentage points and that late ADHD reduces employment by approximately 5 percentage points.

Table 10 shows evidence that early ADHD reduces earnings by 35-45% and late ADHD reduces earnings by 15-25% compared to individuals with no diagnosis, and the results are relatively robust to family fixed effects and additional controls. Finally, Table 11 shows that early ADHD increases social assistance receipt by 15-20 percentage points and late ADHD increases social assistance by 8-14 points in young adulthood. Again, the results are relatively robust to family fixed effects and controls for individual heterogeneity. These results are consistent with Currie et al. (in press) and suggest that early interventions that are able to reduce ADHD symptoms may be particularly compelling.

Suggestive Robustness Checks

Finally, in order to examine the robustness of the primary results, this paper uses the "selecton on unobservables" methods outlined in Altonji, Elder, and Taber (2005) (AET). AET focuses on bounding the associations in the analysis under alternative assumptions about the selection on unobservables in the analysis. In the bivariate probit case (i.e. outcomes are employment and social program participation), the following equations are estimated

$$Y_{it} = \gamma_0 + \gamma_1 ADHD_{i,t-1} + \gamma_2 X_i + \upsilon_{it} \ ,$$

$$ADHD_{it-1} = \phi_0 + \phi_1 X_i + \zeta_{it} \text{, and} \qquad (5)$$

$$\begin{bmatrix} \upsilon \\ \zeta \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right).$$

The covariance between the errors terms, ρ, determines the amount of selection on unobservables and measures the extent of the relationship between the unobserved determinants of employment outcomes and the unobserved determinants of ADHD diagnosis. As shown by AET, reasonable guidelines for the extent of selection on unobservables can be determined by estimating equation (5) under the assumption that there is no selection on unobservables, or that ρ=0, and under the assumption that the amount of selection on unobservables equals the amount of selection on observables. Although the extent of selection on unobservables is not likely to be as great as the selection on observables, given the individual and family characteristics included in the model, the estimates from these values of ρ will provide guidance on the degree to which concerns about the potential bias from selection on unobservables are likely to be relevant.

For the two binary outcomes in this paper, employment status and social program participation, the results from this analysis suggest *positive* selection (the unobservables related to ADHD status are positively related to the unobservables of a "good" employment outcome). This implies that if selection on unobservables is equal to selection on unobservables, the point estimates would *increase*. For employment status, the estimated ρ is 0.081; at this value of rho, the marginal effect of ADHD diagnosis is estimated to be -0.16 percentage points (compared with the 10 point reduction from OLS and no selection). Likewise, for social program participation, the estimated ρ is -0.12; at this value, the marginal effect of ADHD diagnosis is 21 percentage points (compared with 13 points from OLS with no selection). The analyses are suggestive that the results in this paper are not driven by selection on unobservables and may be lower bound effects.

Conclusions

This paper provides the first evidence in the literature that childhood ADHD diagnosis decreases young adult employment and earnings and increase the likelihood of social assistance. This evidence advances previous literature because it is immune to issues of reverse causality and also allows controls for unobserved heterogeneity at the environmental and family levels as well as many measures of co-occurring health outcomes and behaviors. Overall, the magnitude of the results are robust across specifications and suggest that childhood ADHD reduces adult employment by approximately 10 percentage points, reduces earnings by 33 percent and increases social assistance receipt by 15 points. Further, the employment reductions appear to be

concentrated among children from disadvantaged families. The Add Health data does not contain information on potential ADHD treatment during childhood; a reasonable speculation might therefore place the results in this paper as lower bound estimates if some individuals were diagnosed and successfully treated.

To place the magnitude of the results into perspective, the 30% earnings reduction associated with ADHD are as large as the within-sample, within-family gender earnings gap (29%), the within-sample black-white earning gap (24%), the within sample, within family earnings difference for those who report graduating college versus those who did not (15%) and larger than the effects of low birth weight (table not shown but available upon request). Broadening the comparison, Leigh and Gill (1997) present evidence of an 8-10 percent earnings premium associated with community college completion. Currie and Hyson (1999) report wage reductions of between 2-4 percent associated with low birth weight status. Fletcher (2009a) finds a 15% earnings reduction associated with adolescent onset depression. Smith (2009) finds a 24% increase in household income for siblings reporting good or excellent physical health up to age 16. Based on these comparisons, the within-sibling associations between earnings and childhood ADHD diagnosis are worthy of attention and policy intervention. In particular, these comparisons suggest that interventions that can reduce the effects of ADHD have the potential to be quite cost effective.

The results could be policy relevant along several dimensions. First, the results suggest that childhood ADHD may be an important determinant of labor market outcomes, with potentially important differences in effects by family background. Increasing our understanding of labor market outcomes may allow additional policies to

be suggested to increase labor force participation and productivity, which could have long term implications for important life outcomes such as income and wealth accumulation, occupation, and adult population health. Second, the results suggest that interventions that successfully reduce ADHD symptoms during childhood may have downstream benefits that may not be comprehensively measured in many cost-benefit analyses and suggest that further interventions may be desirable. Increases in treatment options, particularly during early childhood, may provide substantial long term benefits in terms of future labor productivity.

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Tables

Table 1
National Longitudinal Study of Adolescent Health (Add Health)
Descriptive Statistics

Variable	Obs	Mean	Std Dev	Min	Max
Currently Working (10+ hours week)	12229	0.77	0.42	0	1
Earnings last year ($)	14436	34137.57	37521.63	0	920000
Social Program Participation	14414	0.24	0.43	0	1
Diagnosed ADHD	14436	0.05	0.22	0	1
Early Diagnosis	14426	0.023	0.15	0	1
Late Diagnosis	14426	0.027	0.16	0	1
Years of Schooling	14433	14.28	2.06	8	21
Ever Married	14428	0.50	0.50	0	1
Test Score (Wave 3)	14436	101.06	14.09	9	123
Test score Missing	14436	0.19	0.39	0	1
Age (Wave 4)	14436	28.96	1.74	24.25	34.66667
Female	14436	0.54	0.50	0	1
Hispanic	14436	0.16	0.37	0	1
Black	14436	0.22	0.41	0	1
Maternal Years of Education	14436	13.21	2.24	0	17
Family Income as Adolescent ($1000s)	14436	46.12	42.27	0	990
Married Parents	14436	0.71	0.42	0	1
Test Score (Wave 1)	14436	100.74	14.47	13	146
Rural Status	14436	0.26	0.44	0	1
Missing Family Information	14436	0.30	0.46	0	1
Childhood Mistreatment Scale	14436	0.00	0.58	-0.46231	4.545121
Ever Diagnosed Asthma	14436	0.15	0.36	0	1
Low Birth Weight	14436	0.11	0.28	0	1
Ever Diagnosed Diabetes	14436	0.03	0.16	0	1
Mistreatment Missing	14436	0.25	0.43	0	1
Low Birth Weight Missing	14436	0.17	0.38	0	1
Marijuana Use (Wave 1)	14436	0.14	0.35	0	1
Obese (Wave 1)	14436	0.07	0.26	0	1
Depressed (Wave 1)	14436	0.08	0.27	0	1
Sexual Initiation (Wave 1)	14436	0.39	0.49	0	1
Smoke (Wave 1)	14436	0.25	0.43	0	1
Drink (Wave 1)	14436	0.41	0.49	0	1

Table 2
Descriptive Statistics
Comparison Between Ever ADHD vs. Never ADHD

Variable	Obs	Mean Never ADHD	Obs	Mean Ever ADHD	Difference
Currently Working (10+ hours week)	11576	0.77	653	0.68	<0.001***
Earnings last year ($)	13710	34346.04	726	30200.77	0.003***
Social Program Participation	13690	0.23	724	0.33	<0.001***
Diagnosed ADHD	13710	0.00	726	1.00	
Early Diagnosis	13710	0.00	716	0.47	
Late Diagnosis	13710	0.00	716	0.53	
Years of Schooling	13708	14.30	725	13.88	<0.001***
Ever Married	13702	0.50	726	0.47	<0.001***
Test Score (Wave 3)	13710	100.97	726	102.68	<0.001***
Test score Missing	13710	0.19	726	0.23	<0.001***
Age (Wave 4)	13710	28.97	726	28.80	0.009***
Female	13710	0.55	726	0.37	<0.001***
Hispanic	13710	0.16	726	0.08	<0.001***
Black	13710	0.22	726	0.10	<0.001***
Maternal Years of Education	13710	13.19	726	13.64	<0.001***
Family Income as Adolescent ($1000s)	13710	45.79	726	52.50	<0.001***
Married Parents	13710	0.71	726	0.72	0.60
Test Score (Wave 1)	13710	100.62	726	103.09	<0.001***
Rural Status	13710	0.26	726	0.27	0.48
Missing Family Information	13710	0.30	726	0.26	0.03**
Childhood Mistreatment Scale	13710	0.00	726	0.09	<0.001***
Ever Diagnosed Asthma	13710	0.14	726	0.25	<0.001***
Low Birth Weight	13710	0.11	726	0.11	0.74
Ever Diagnosed Diabetes	13710	0.03	726	0.02	0.59
Mistreatment Missing	13710	0.25	726	0.31	<0.001***
Low Birth Weight Missing	13710	0.17	726	0.17	0.60
Marijuana Use (Wave 1)	13710	0.14	726	0.20	<0.001***
Obese (Wave 1)	13710	0.07	726	0.07	0.49
Depressed (Wave 1)	13710	0.08	726	0.10	0.02**
Sexual Initiation (Wave 1)	13710	0.39	726	0.37	0.15
Smoke (Wave 1)	13710	0.25	726	0.35	<0.001***
Drink (Wave 1)	13710	0.41	726	0.45	0.02**

Table 3
Effects of ADHD on Adult Employment Status: Baseline Results

Outcome	Employed	Employed	Employed	Employed	Employed	Employed	Employed	Employed
Sample	Full	Males	Females	Whites	Blacks	Hispanics	Rich	Poor
Fixed Effects	None	None	None	None	None	None	None	None
Ever Diagnosed with ADHD	-0.100***	-0.100***	-0.110***	-0.094***	-0.141**	-0.169**	-0.045*	-0.131***
	(0.018)	(0.025)	(0.032)	(0.022)	(0.062)	(0.075)	(0.027)	(0.031)
Age	-0.029***	-0.017**	-0.040***	-0.029***	-0.043***	-0.010	-0.016	-0.032***
	(0.006)	(0.007)	(0.008)	(0.009)	(0.011)	(0.012)	(0.012)	(0.007)
Female	-0.087***			-0.134***	0.015	-0.089***	-0.100***	-0.086***
	(0.011)			(0.013)	(0.017)	(0.019)	(0.014)	(0.014)
Maternal Education	0.006***	0.002	0.011***	0.008**	0.012***	0.003	-0.007*	0.008***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Family Income								
During High School	0.000	0.000	-0.000	0.000	-0.000	-0.000	-0.000	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Parents Married								
During High School	0.029***	0.053***	0.009	0.020	0.029	0.059***	0.008	0.017
	(0.009)	(0.015)	(0.012)	(0.014)	(0.019)	(0.022)	(0.022)	(0.012)
Hispanic	0.043***	0.017	0.068***				0.007	0.074***
	(0.012)	(0.016)	(0.016)				(0.025)	(0.020)
Black	-0.006	-0.084***	0.055***				-0.013	0.021
	(0.011)	(0.018)	(0.014)				(0.022)	(0.014)
Test Score								
During High School	0.029***	0.016**	0.039***	0.020**	0.034***	0.045***	0.016	0.030***
	(0.006)	(0.008)	(0.007)	(0.008)	(0.011)	(0.011)	(0.011)	(0.007)
Rural Status								
During High School	-0.020*	-0.006	-0.031**	-0.019	0.014	-0.093***	0.001	-0.019
	(0.011)	(0.013)	(0.014)	(0.013)	(0.019)	(0.034)	(0.015)	(0.016)
Missing Family Information	-0.003	-0.016	0.008	-0.001	-0.023	0.005	-0.040	0.016
	(0.009)	(0.011)	(0.013)	(0.014)	(0.017)	(0.019)	(0.030)	(0.020)
Constant	1.424***	1.176***	1.576***	1.451***	1.661***	1.017***	1.313***	1.437***
	(0.162)	(0.192)	(0.228)	(0.249)	(0.294)	(0.339)	(0.324)	(0.181)
Observations	12515	5823	6692	6950	2865	1891	3707	5896
R-squared	0.031	0.033	0.028	0.041	0.039	0.042	0.026	0.040

Robust standard errors in parentheses, clustered at school. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: wave 1 grade-level fixed effects

Table 4
Effects of ADHD on Adult Employment Status: Extended Results

Outcome	Employment	Employment	Employment	Employment	Employment	Employment	Employment	Employment
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls						Health	Plus Education	Health/Education
Ever Diagnosed with ADHD	-0.100***	-0.104***	-0.133***	-0.130***	-0.126**	-0.116**	-0.116**	-0.143**
	(0.018)	(0.018)	(0.038)	(0.041)	(0.058)	(0.057)	(0.057)	(0.059)
Age	-0.029***	-0.030***	-0.020**	-0.019**	-0.009	-0.005	-0.001	0.006
	(0.006)	(0.006)	(0.009)	(0.009)	(0.017)	(0.017)	(0.017)	(0.018)
Female	-0.087***	-0.086***	-0.114***	-0.115***	-0.076***	-0.072***	-0.088***	-0.077**
	(0.011)	(0.011)	(0.018)	(0.019)	(0.027)	(0.028)	(0.027)	(0.031)
Test Score During High School	0.029***	0.021***	0.021**	0.014	0.035*	0.035*	0.027	0.033*
	(0.006)	(0.006)	(0.010)	(0.011)	(0.019)	(0.019)	(0.019)	(0.019)
Constant	1.424***	1.483***	1.193***	1.214***	0.958***	0.862**	0.505	0.708*
	(0.162)	(0.167)	(0.249)	(0.251)	(0.341)	(0.354)	(0.386)	(0.425)
Observations	12515	12515	2955	2955	2958	2958	2958	2888
R-squared	0.031	0.052	0.041	0.112	0.015	0.032	0.044	0.081

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Table 5
Effects of ADHD on Adult Earnings: Baseline Results

Outcome								
Sample	Full	Males	Females	Whites	Blacks	Hispanics	Rich	Poor
Fixed Effects	None	None	None	None	None	None	None	None
Ever Diagnosed with ADHD	-0.290***	-0.296***	-0.312***	-0.263***	-0.466***	-0.379***	-0.252***	-0.338***
	(0.045)	(0.055)	(0.068)	(0.047)	(0.145)	(0.144)	(0.073)	(0.079)
Age	-0.074***	-0.035*	-0.116***	-0.084***	-0.078***	-0.056	-0.027	-0.063***
	(0.018)	(0.019)	(0.028)	(0.019)	(0.029)	(0.042)	(0.026)	(0.019)
Female	-0.322***			-0.445***	-0.143***	-0.188***	-0.317***	-0.323***
	(0.029)			(0.024)	(0.045)	(0.066)	(0.037)	(0.039)
Test Score During High School	0.110***	0.095***	0.124***	0.103***	0.168***	0.104***	0.084***	0.109***
	(0.012)	(0.018)	(0.015)	(0.013)	(0.025)	(0.025)	(0.019)	(0.016)
Maternal Education	0.027***	0.018***	0.035***	0.038***	0.053***	-0.013	0.021***	0.011
	(0.006)	(0.006)	(0.008)	(0.008)	(0.010)	(0.012)	(0.008)	(0.008)
Family Income During High School	0.001***	0.002***	0.001***	0.002***	0.001	0.001	0.001**	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Parents Married During High School	0.087***	0.082***	0.092***	0.045	0.108**	0.079*	-0.061	0.012
	(0.022)	(0.031)	(0.029)	(0.031)	(0.047)	(0.046)	(0.051)	(0.029)
Hispanic	0.056*	-0.071*	0.178***				-0.003	0.150***
	(0.030)	(0.042)	(0.048)				(0.055)	(0.046)
Black	-0.166***	-0.317***	-0.044				-0.147**	-0.103**
	(0.034)	(0.042)	(0.041)				(0.065)	(0.045)
Rural Status During High School	-0.078**	-0.034	-0.119***	-0.054	-0.040	-0.045	-0.072	-0.060
	(0.032)	(0.035)	(0.042)	(0.034)	(0.083)	(0.087)	(0.044)	(0.041)
Missing Family Information	0.001	0.020	-0.015	0.012	-0.002	-0.115***	-0.176**	-0.100**
	(0.020)	(0.025)	(0.029)	(0.025)	(0.041)	(0.042)	(0.068)	(0.044)
Constant	11.640***	10.792***	12.243***	11.815***	11.169***	11.673***	10.785***	11.397***
	(0.505)	(0.514)	(0.770)	(0.545)	(0.806)	(1.161)	(0.707)	(0.541)
Observations	13434	6467	6967	7433	2947	2134	4166	6158
R-squared	0.090	0.073	0.075	0.110	0.087	0.038	0.061	0.084

Robust standard errors in parentheses, clustered at school. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: wave 1 grade-level fixed effects

Table 6
Effects of ADHD on Adult Earnings: Extended Results

Outcome	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls						Health	Education	
Ever Diagnosed with ADHD	-0.290***	-0.299***	-0.345***	-0.363***	-0.403***	-0.367***	-0.336***	-0.362***
	(0.045)	(0.045)	(0.080)	(0.089)	(0.119)	(0.118)	(0.116)	(0.114)
Age	-0.074***	-0.066***	-0.015	-0.003	0.071*	0.080**	0.092**	0.078**
	(0.018)	(0.018)	(0.031)	(0.031)	(0.038)	(0.039)	(0.037)	(0.038)
Female	-0.322***	-0.328***	-0.346***	-0.349***	-0.314***	-0.287***	-0.353***	-0.240***
	(0.029)	(0.031)	(0.047)	(0.049)	(0.060)	(0.061)	(0.062)	(0.069)
Test Score								
During High School	0.110***	0.097***	0.100***	0.116***	0.155***	0.146***	0.102**	0.102**
	(0.012)	(0.011)	(0.027)	(0.026)	(0.041)	(0.040)	(0.043)	(0.043)
Constant	11.640***	11.557***	10.067***	9.876***	8.225***	8.150***	6.624***	7.978***
	(0.505)	(0.501)	(0.840)	(0.869)	(0.786)	(0.794)	(0.827)	(0.869)
Observations	13434	13434	3202	3202	3205	3205	3205	3146
R-squared	0.090	0.121	0.091	0.147	0.060	0.079	0.100	0.155

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Table 7
Effects of ADHD on Adult Social Assistance Receipt: Baseline Results

Outcome	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program
Sample	Full	Males	Females	Whites	Blacks	Hispanics	Rich	Poor
Fixed Effects	None	None	None	None	None	None	None	None
Ever Diagnosed with ADHD	0.132***	0.108***	0.164***	0.113***	0.141**	0.191***	0.081***	0.154***
	(0.021)	(0.022)	(0.032)	(0.022)	(0.062)	(0.057)	(0.025)	(0.030)
Age	0.040***	0.042***	0.041***	0.048***	0.051***	0.003	0.014	0.040***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.012)	(0.013)	(0.011)	(0.009)
Female	0.110***			0.082***	0.205***	0.097***	0.061***	0.140***
	(0.010)			(0.012)	(0.020)	(0.021)	(0.011)	(0.015)
Test Score During High School	-0.037***	-0.020***	-0.051***	-0.052***	-0.040***	-0.024***	-0.040***	-0.023***
	(0.005)	(0.006)	(0.007)	(0.007)	(0.010)	(0.008)	(0.007)	(0.007)
Maternal Education	-0.015***	-0.010***	-0.019***	-0.016***	-0.023***	-0.004*	-0.013***	-0.008***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)
Family Income During High School	-0.001***	-0.001***	-0.000***	-0.001***	-0.001***	0.000	-0.000	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Parents Married During High School	-0.077***	-0.050***	-0.099***	-0.055***	-0.086***	-0.099***	-0.021	-0.032***
	(0.010)	(0.014)	(0.014)	(0.013)	(0.018)	(0.029)	(0.019)	(0.012)
Hispanic	-0.043***	-0.039**	-0.044**				-0.006	-0.080***
	(0.014)	(0.018)	(0.019)				(0.018)	(0.018)
Black	0.099***	0.043***	0.143***				0.088***	0.074***
	(0.011)	(0.015)	(0.016)				(0.017)	(0.016)
Rural Status During High School	0.038***	0.030*	0.046***	0.039**	-0.013	0.065**	0.020	0.029*
	(0.014)	(0.017)	(0.017)	(0.017)	(0.025)	(0.030)	(0.014)	(0.017)
Missing Family Information	0.006	0.008	0.005	0.007	0.027	0.014	0.039	0.055***
	(0.008)	(0.011)	(0.012)	(0.011)	(0.020)	(0.019)	(0.027)	(0.020)
Constant	-0.618***	-0.741***	-0.488**	-0.790***	-0.753**	0.185	-0.075	-0.615**
	(0.208)	(0.232)	(0.231)	(0.248)	(0.329)	(0.333)	(0.298)	(0.241)
Observations	14743	6844	7899	8137	3283	2325	4474	6829
R-squared	0.092	0.050	0.107	0.076	0.114	0.050	0.046	0.091

Robust standard errors in parentheses, clustered at school. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: wave 1 grade-level fixed effects

Table 8
Effects of ADHD on Adult Social Assistance: Extended Results

Outcome	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls						Health	Education	
Ever Diagnosed with ADHD	0.132***	0.130***	0.190***	0.193***	0.168***	0.158***	0.153***	0.153***
	(0.021)	(0.020)	(0.034)	(0.034)	(0.045)	(0.044)	(0.044)	(0.045)
Age	0.040***	0.035***	0.029*	0.025*	-0.007	-0.018	-0.020	-0.016
	(0.008)	(0.008)	(0.015)	(0.015)	(0.013)	(0.014)	(0.014)	(0.014)
Female	0.110***	0.110***	0.113***	0.115***	0.128***	0.127***	0.139***	0.147***
	(0.010)	(0.011)	(0.015)	(0.016)	(0.021)	(0.021)	(0.021)	(0.024)
Test Score During High School	-0.037***	-0.034***	-0.041***	-0.043***	-0.017	-0.018	-0.008	-0.012
	(0.005)	(0.004)	(0.010)	(0.009)	(0.014)	(0.013)	(0.014)	(0.014)
Maternal Education	-0.015***	-0.011***	-0.021***	-0.018***				
	(0.002)	(0.002)	(0.004)	(0.004)				
Constant	-0.618***	-0.570***	-0.175	-0.171	0.475*	0.723***	1.063***	0.787**
	(0.208)	(0.201)	(0.403)	(0.388)	(0.269)	(0.276)	(0.303)	(0.326)
Observations	14743	14743	3470	3470	3474	3474	3474	3395
R-squared	0.092	0.130	0.113	0.179	0.036	0.053	0.058	0.081

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Table 9
Effects of Early and Late ADHD on Employment

Outcome	Employed	Employed	Employed	Employed	Employed	Employed	Employed	Employed
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls	None	None	None	None	None	Health	Education	H/E
Diagnosed ADHD (early)	-0.125***	-0.125***	-0.191***	-0.192***	-0.148*	-0.141*	-0.146*	-0.204**
	(0.026)	(0.026)	(0.051)	(0.057)	(0.087)	(0.085)	(0.085)	(0.085)
Diagnosed ADHD (late)	-0.076***	-0.082***	-0.060	-0.057	-0.066	-0.055	-0.051	-0.038
	(0.025)	(0.025)	(0.059)	(0.063)	(0.076)	(0.075)	(0.076)	(0.080)
Age	-0.029***	-0.030***	-0.020**	-0.019**	-0.011	-0.008	-0.003	0.004
	(0.006)	(0.006)	(0.009)	(0.009)	(0.017)	(0.017)	(0.017)	(0.018)
Female	-0.087***	-0.086***	-0.114***	-0.116***	-0.073***	-0.070**	-0.086***	-0.077**
	(0.010)	(0.010)	(0.018)	(0.019)	(0.027)	(0.028)	(0.027)	(0.031)
Test Score	0.028***	0.021***	0.021**	0.014	0.035*	0.035*	0.027	0.033*
	(0.006)	(0.006)	(0.010)	(0.011)	(0.019)	(0.019)	(0.019)	(0.019)
Constant	1.436***	1.495***	1.197***	1.224***	0.988***	0.908**	0.553	0.754*
	(0.163)	(0.169)	(0.250)	(0.252)	(0.342)	(0.355)	(0.386)	(0.429)
Observations	12506	12506	2951	2951	2954	2954	2954	2884
R-squared	0.031	0.052	0.041	0.113	0.014	0.031	0.044	0.082

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Table 10
Effects of Early and Late ADHD on Earnings

Outcome	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)	Log(Earnings)
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls	None	None	None	None	None	Health	Education	H/E
Diagnosed ADHD (early)	-0.364***	-0.363***	-0.519***	-0.535***	-0.480***	-0.453***	-0.426***	-0.423***
	(0.064)	(0.063)	(0.119)	(0.135)	(0.152)	(0.153)	(0.152)	(0.148)
Diagnosed ADHD (late)	-0.212***	-0.229***	-0.141	-0.149	-0.284*	-0.242	-0.209	-0.257
	(0.062)	(0.063)	(0.117)	(0.127)	(0.171)	(0.171)	(0.166)	(0.163)
Age	-0.074***	-0.066***	-0.013	-0.001	0.072*	0.082**	0.094**	0.080**
	(0.018)	(0.018)	(0.030)	(0.031)	(0.038)	(0.039)	(0.037)	(0.038)
Female	-0.323***	-0.329***	-0.349***	-0.353***	-0.319***	-0.293***	-0.359***	-0.247***
	(0.029)	(0.031)	(0.046)	(0.049)	(0.060)	(0.061)	(0.062)	(0.069)
Test Score	0.110***	0.097***	0.101***	0.117***	0.157***	0.148***	0.104**	0.104**
	(0.012)	(0.011)	(0.027)	(0.026)	(0.041)	(0.040)	(0.043)	(0.043)
Constant	11.637***	11.557***	10.022***	9.849***	8.190***	8.113***	6.582***	7.927***
	(0.505)	(0.502)	(0.828)	(0.859)	(0.786)	(0.793)	(0.826)	(0.869)
Observations	13426	13426	3200	3200	3203	3203	3203	3144
R-squared	0.090	0.121	0.092	0.149	0.061	0.080	0.101	0.156

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Table 11
Effects of Early and Late ADHD on Social Assistance

Outcome	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program	Social Program
Sample	Full	Full	Family	Family	Family	Family	Family	Family
Fixed Effects	None	School	None	School	Family	Family	Family	Family/Occupation
Additional Controls	None	None	None	None	None	Health	Education	H/E
Diagnosed ADHD (early)	0.179***	0.168***	0.274***	0.230***	0.230***	0.217***	0.215***	0.216***
	(0.029)	(0.028)	(0.055)	(0.056)	(0.067)	(0.067)	(0.067)	(0.068)
Diagnosed ADHD (late)	0.083***	0.089***	0.101*	0.146***	0.085	0.080	0.071	0.071
	(0.028)	(0.026)	(0.051)	(0.052)	(0.058)	(0.058)	(0.058)	(0.059)
Age	0.040***	0.035***	0.028*	0.025*	-0.006	-0.016	-0.019	-0.015
	(0.008)	(0.008)	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
Female	0.111***	0.110***	0.113***	0.115***	0.128***	0.126***	0.139***	0.147***
	(0.010)	(0.010)	(0.015)	(0.016)	(0.021)	(0.021)	(0.021)	(0.025)
Test Score	-0.037***	-0.034***	-0.042***	-0.043***	-0.018	-0.019	-0.009	-0.012
	(0.005)	(0.004)	(0.009)	(0.009)	(0.014)	(0.014)	(0.014)	(0.014)
Constant	-0.621***	-0.575***	-0.166	-0.185	0.456*	0.696**	1.041***	0.766**
	(0.210)	(0.203)	(0.398)	(0.390)	(0.270)	(0.277)	(0.304)	(0.327)
Observations	14733	14733	3466	3466	3470	3470	3470	3391
R-squared	0.093	0.130	0.114	0.179	0.035	0.052	0.057	0.080

Robust standard errors in parentheses, clustered at school./family. *** p<0.01, ** p<0.05, * p<0.1.
Additional Controls: Table 3 controls. Health Controls: Asthma, Low Birth Weight, Diabetes, Childhood Mistreatment, H.S. Marijuana, Tobacco, and Alcohol Use, H.S. Obesity, Depression, and Sexual Activity and Missing Information Dummies. Education Controls: Test Score at Wave 3, Completed Schooling at Wave 4

Appendix Table

Table A1
Add Health Descriptive Statistics: Sibling Sample

Variable	Obs	Mean	Std.	Dev.	Min
Currently Working (10+ hours week)	2948	0.75	0.43	0	1
Earnings last year ($)	3468	31908.40	34372.17	0	920000
Social Program Participation	3462	0.26	0.44	0	1
Diagnosed ADHD	3468	0.05	0.21	0	1
Early Diagnosis	3464	0.02	0.15	0	1
Late Diagnosis	3464	0.02	0.15	0	1
Years of Schooling	3468	14.14	2.07	8	21
Ever Married	3467	0.50	0.50	0	1
Test Score (Wave 3)	3468	99.97	14.59	9	123
Test score Missing	3468	0.16	0.37	0	1
Age (Wave 4)	3468	28.87	1.76	24.41667	33.58333
Female	3468	0.53	0.50	0	1
Hispanic	3468	0.14	0.35	0	1
Black	3468	0.24	0.42	0	1
Maternal Years of Education	3468	13.14	2.22	0	17
Family Income as Adolescent ($1000s)	3468	45.24	41.13	0	800
Married Parents	3468	0.70	0.43	0	1
Test Score (Wave 1)	3468	99.25	14.23	15	146
Rural Status	3468	0.27	0.44	0	1
Missing Family Information	3468	0.28	0.45	0	1
Childhood Mistreatment Scale	3468	0.02	0.61	-0.46231	4.035326
Ever Diagnosed Asthma	3468	0.15	0.36	0	1
Low Birth Weight	3468	0.19	0.37	0	1
Ever Diagnosed Diabetes	3468	0.03	0.16	0	1
Mistreatment Missing	3468	0.23	0.42	0	1
Low Birth Weight Missing	3468	0.17	0.38	0	1
Marijuana Use (Wave 1)	3468	0.14	0.34	0	1
Obese (Wave 1)	3468	0.07	0.25	0	1
Depressed (Wave 1)	3468	0.09	0.28	0	1
Sexual Initiation (Wave 1)	3468	0.37	0.48	0	1
Smoke (Wave 1)	3468	0.27	0.44	0	1
Drink (Wave 1)	3468	0.40	0.49	0	1