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THE EFFECTS OF CHILDHOOD ADHD ON ADULT LABOR MARKET OUTCOMES

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Abstract

Although 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 attention deficit/hyperactivity disorder (ADHD). Because 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 article uses a longitudinal national sample, including sibling pairs, to show the important labor market outcome consequences of ADHD. The employment reduction is between 10 and 14 percentage points, the earnings reduction is approximately 33%, and the increase in social assistance is 15 points, figures that are larger than many estimates of the Black people/White people earnings gap and the gender earnings gap. A small share of the link is explained by educational 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.

Keywords

ADHD; labor market outcomes; sibling fixed effects

1. INTRODUCTION

Although there is a relatively large amount of 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 the 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 fastest growing mental health problems facing children in the United States. The prevalence is typically estimated to be between 2% and 10% of school-aged children,

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with 7.4% of parents with children between the ages of 3 and 17 reporting that a doctor has told them their child has ADHD (Bloom *et al.*, 2007).

There are many pathways that could reduce the labor market outcomes of adults with symptoms of childhood ADHD. There are several recent studies showing 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.* 2010). Currie *et al.* (2010) also show evidence that ADHD is associated with welfare receipt as a young adult. Furthermore, there is evidence that the presence of the symptoms of childhood ADHD is correlated with criminal activities as a young adult (Fletcher and Wolfe, 2009). Although this research is strongly suggestive of the potential labor market consequences of ADHD, to date, no research has been able to examine this question (Currie *et al.*, 2010).

This article provides the first evidence of links between childhood ADHD symptoms and adult labor market outcomes. The data come from the national, prospective Add Health study, which tracks individuals between the 7th and 12th grades and outcomes at approximately age 30. Importantly, to match previous research, this article 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, and 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 article also provides evidence of differences in the effects based on family background and age at diagnosis.

2. BACKGROUND LITERATURE

ADHD is a neurobehavioral developmental disorder characterized by the coexistence 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 7 years of age but often persist into adulthood (Nair *et al.*, 2006). For example, Wilens *et al.* (2002) report the persistence of as much as 60% between childhood/adolescent symptoms and adult symptoms.

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]

[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, the 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).

Furthermore, to be diagnosed, an individual must show persistent symptoms in at least two different settings (home, school, etc.) for more than 6 months and to a degree that is greater than children of the same age.

Although 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 to 17 reported to have ADHD according to data from the 2006 National Health Interview Study. Briefly, the symptoms of ADHD are more likely to occur in males and children in families with low socioeconomic status; however, diagnosis rates could be higher in high-income families due to differences in health care access. A genetic link has been suggested based on the higher prevalence among close relatives compared with the general population and some molecular genetic ties to ADHD status (Biederman *et al.*, 1990).

Treatments for ADHD also are somewhat controversial. On the 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). Although the explosion in pharmacologic therapy occurred in 1991, as yet, there are no studies of the consequences of long-term use (Daley, 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) used the British National Child Development Survey (NCDS) data and found 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 children born between 1971 and 1973 in Dunedin, New Zealand found that those with behavior problems at ages 7 to 9 were more likely to be unemployed at ages 15 to 21 (Caspi *et al.*, 1998).[4] Importantly, neither study used specific measures of ADHD nor were they able to use sibling comparisons, so the relationships could be biased from neighborhood or family factors.

Other research have 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 USA and Canadian National Longitudinal Survey of Youth (NLSY) data with sibling fixed effects to show associations between behavioral symptoms consistent with ADHD[5] and grade repetition, test scores, and special education placement. Fletcher and

[3]The behavioral problems variables were defined from the following eight ‘syndrome’ scores given in NCDS: unforthcomingness, withdrawal, depression, anxiety, hostility toward adults, anxiety for acceptance by children, restlessness, and ‘inconsequential’ behavior. They were entered into the empirical models as 0–1 dummies indicating positive scores on 1, 2/3, and 4 or more of the eight 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 as 0 = does not apply, 1 = applies somewhat, and 2 = certainly applies. The authors combined the parent and teacher ratings into a single score to improve the reliability and validity of this measure.

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 USA NLSY data sets to show that the hyperactive symptoms reported by parents are associated with educational outcomes as well as delinquency, and Fletcher and Wolfe (2009), using sibling fixed effects models, show associations between childhood ADHD symptoms and criminal activities as young adults. Although these articles are suggestive that childhood ADHD may also have labor market implications, they do not provide direct evidence.

The most similar article to the current study is that of Currie *et al.* (2010), 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 are somewhat limited because it is based on administrative records from one Canadian province and thus lacks typical social science measures such as socioeconomic status, and does not contain labor market outcomes. This article will build from the research base by using national data from the United States, which tracks individuals and sibling pairs though age 30 and thus has labor market outcome information as well as histories of ADHD status.

3. DATA AND EMPIRICAL METHODS

The Add Health study 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 to 1995 (wave 1), the study follows up with a series of in-home interviews of respondents approximately 1 year (wave 2; 1996), 6 years (wave 3; 2001–2002), and 13 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]

Although the original wave 1 sample collected information on more than 20,000 respondents, approximately 15,000 were followed longitudinally at wave 4. At the same time, the data contained a subsample of siblings who were followed over time; this sample originally numbered approximately 5,400, more than 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] To maximize available sample sizes for the analysis, missing family income during high school and maternal education was imputed and a dummy

[5]The authors were only able to concentrate on hyperactivity questions from the behavior problems index: the hyperactivity subscore has five questions:1. He/she has difficulty concentrating, cannot pay attention for long2. He/she is easily confused, seems to be in a fog3. He/she is impulsive, acts without thinking4. 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

[6]See Udry, 2003 for full description of the Add Health data set. The sample may not be representative of the more general population in that it is a school-based survey and, as such, those individuals originally interviewed at grade 12 in wave 1 will be very likely to graduate high school. Grade level at wave 1 is controlled to reduce this issue.

[7]The reason sample attrition seems more pronounced in the sibling subsample than the main sample is that if either sibling is missing at follow-up, both siblings are dropped from the sample.

variable was controlled. Likewise, in some of the auxiliary regressions, missing birth weight and childhood mistreatment information were imputed to retain sample size.

Table I reports descriptive statistics for the analysis sample.[8] The earnings data from wave 4 came 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 were also asked to report whether they worked 10 h or more during the previous week, which is the measure of employment available in this study. In additional analyses, I also examine receipt of public assistance, which includes welfare payments and food stamps.

To characterize ADHD, this article 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?' To separate 'early' and 'late' ADHD, I split the sample by the median age of diagnosis (age 12) reported in the sample.[11] Although recall bias could be an issue with these measures, the 5% of the sample that reported a diagnosis of ADHD matches closely with the estimated prevalence of the illness.[12]

The data also contains rich information on health conditions and (endogenous) health behaviors. Individuals reported behaviors at wave 1 such as tobacco use (25%), sexual activity (39%), alcohol use (41%), obese status (7%), and marijuana use (14%) and also 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 reported whether they had 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.[13] Finally, to control for skill accumulation (apart from years of schooling information), the analysis uses scores on the Peabody picture vocabulary test, which was administered during waves 1 and 3.[14]

[8]Like Currie and Stabile (2006), who use sibling comparisons with other data sets, there is very little difference across subsamples. 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 IA.

[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, and 150,000 or more.

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

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

[12]Appendix Table IIA compares the prevalence rate for Add Health with surveyed children from the NHIS 2009 survey. Overall, the rates are similar; however, because these are different cohorts of individuals and the prevalence rates have risen over time, it is not surprising that the NHIS rates are higher. Also of note is that the differences in rates for Black people between the two samples are larger than those of the other groups. It could be that reports of ADHD may be differentially stigmatized by race and this stigma could be falling over time. This difference should be considered when viewing the results in this article.

[13]See Fletcher (2008, 2010) for details on the depression measure, Fletcher, Green, and Neidell (2010) for details on the asthma questions, and Fletcher (in press2009b) for details on the mistreatment data.

[14]The Add Health picture vocabulary test is a computerized, abridged version of the revised Peabody picture vocabulary test. The Add Health picture vocabulary test is a test of hearing vocabulary, designed for persons 2 and a half to 40 years of age 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 picture vocabulary test 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.

In Table II, descriptive statistics are presented based on ADHD status. The differences foreshadow both (some of) the results in the article and the empirical issues with comparing individuals with a diagnosis of ADHD versus 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 $4,000 less than those with no ADHD diagnosis. Individual with ADHD are also 10 percentage points more likely to receive public assistance. However, there are also differences in the family background of individuals with ADHD. On the one hand, these individuals come from more advantaged backgrounds, as measured by maternal education and family income. On the other hand, individuals with ADHD are also more likely to have other health problems, such as asthma, and are also more likely to be exposed to childhood mistreatment. These differences in family background as well as unobserved family factors will be controlled in the analysis. Individuals with ADHD also have several co-occurring illnesses and unhealthy behaviors—they are more likely to smoke marijuana and tobacco, drink alcohol, and be sexually active ($p < 0.16$). The empirical analysis will be able to control for these important sources of heterogeneity.

4. EMPIRICAL MODELS

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

$$\text{Employment}_{i,t} = \beta_0 + \beta_1 \text{ADHD}_{it-1} + X_i\beta_2 + \varepsilon_{it} \quad (1)$$

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):

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

where outcomes are measured at time t (wave 4) and ADHD is reported for age of diagnosis prior to wave 4. This temporal structure reduces concerns with reverse causality in the estimated effects. 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):

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

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

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, 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 Equations (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).[15] 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 in the following sections and are available on request.

5. RESULTS

5.1. Results for employment

Table III 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 percentage point decrease in employment. Separating the results by gender (columns 2 and 3) suggests no differences. Separating the results by race suggests that Black people (14 points) and Hispanic people (17 points) are affected to a greater extent than white people (9.5 points).

Columns 7 and 8 show that the effect is more heavily concentrated in children from poor (lower than the median income) families (13 points) in comparison with children from rich (higher than the median income) families (4.5 points).[16] These differences by income also occur in the other outcomes discussed in the following sections. There are many potential reasons for these differences by family income, but data limitations (e.g. a single year of income data) preclude a more detailed examination. It is possible that children in poorer households are less likely to receive medical (or other) treatment than those in richer households; however, Ritalin and other drugs now prescribed for ADHD symptoms were not widely available in the mid-1980s when the respondents were children (Woodworth, 2000). Although more generally, differences in access to health care based on family income might produce differences in effects of childhood health. A second possibility is that, conditional on receiving a diagnosis, children in poor households had worse symptoms on average. In results not reported, I find no correlation between family income and ADHD symptoms for

[15] If the ADHD diagnosis is measured with error, the use of sibling fixed effects may exacerbate the bias associated with the measurement error. In addition, spillover effects between siblings would bias downward the estimated differences in outcomes (Fletcher and Wolfe, 2008).

[16] Controlling for birth order did not change any results and was not statistically significant.

those who are ever diagnosed. Additional analysis with data that has information on a wider set of potential mechanisms is needed to probe these results further.

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 IV; 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. To examine potential pathways through which ADHD might affect employment, columns 6 to 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,[17] indicating a between 12- and 14-percentage-point reduction in employment for individuals with ADHD, compared with their sibling. As noted in a previous section, these results are unchanged if controls for wave 3 criminal behavior or hours worked are used. Overall, the effects of ADHD on adult employment seem 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.

5.2. Results for earnings

Results for log(earnings) are presented in Tables V and VI. These empirical models are conditional on non-zero earnings.[18] Baseline OLS results in column 1 of Table V indicate a nearly 30% earnings reduction for those with childhood ADHD. The magnitude is nearly twice the Black people/White people 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, to control for measures of environmental factors during adolescence as well as to narrow the comparison groups, controls were included for high school of origin fixed effects in column 2 in Table VI; 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). To examine potential pathways through which ADHD might affect earnings, columns 6 to 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 a between 34% and 36% reduction in earnings for individuals with ADHD, compared with their sibling. Overall, similar to employment, the effects of ADHD on adult earnings seem concentrated in disadvantaged children, are only partially

[17]All individuals with no stated occupation at wave 3 are given a separate (common) value for their occupation code for this analysis.
[18]Results imputing zero earnings for individuals with missing earnings are larger than those presented and are available upon request.

explained by education and health behaviors, and the magnitude of the coefficient is quite robust to controls for several sources of heterogeneity.

5.3. Results for public assistance

Results for public assistance receipt between waves 3 and 4 are presented in Tables VII and VIII. Baseline OLS results in column 1 of Table VI 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, to control for measures of environmental factors (e.g. local unemployment rates) during adolescence as well as to narrow the comparison groups, controls were included for high school of origin fixed effects in column 2 in Table VIII; however, these controls do not alter the estimates from column1. 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. To examine potential pathways through which ADHD might affect earnings, columns 6 to 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 a between 15- and 17-point reduction in social assistance for individuals with ADHD, compared with their sibling. Overall, similar to employment, the effects of ADHD on adult social assistance seem 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.

5.4. Examination by age of onset

Tables IX–X examine the differential effects based on whether the respondent reported an ‘early’ or ‘late’ diagnosis,[19] in which the variables are defined based on the median age of reported diagnosis in the sample (age 12). Table IX shows evidence that early ADHD reduces employment by 12 to 15 percentage points and that late ADHD reduces employment by approximately 5 percentage points.

Table X shows evidence that early ADHD reduces earnings by 35% to 45% and late ADHD reduces earnings by 15% to 25% compared with individuals with no diagnosis, and the results are relatively robust to family fixed effects and additional controls. Finally, Table XI shows that early ADHD increases social assistance receipt by 15 to 20 percentage points and late ADHD increases social assistance by 8 to 14 points in young adulthood. Again, the results are relatively robust to family fixed effects and controls for individual heterogeneity. A potential explanation for these patterns of effects is that ADHD cases that are diagnosed early are more severe in nature, thus prompting action by the school system or parents.

[19]It is worthwhile to again note that age of diagnosis will occur later than age of onset.

These results are also consistent with Currie *et al.* (2010) and suggest that early interventions that are able to reduce ADHD symptoms may be particularly compelling.

5.5. Suggestive robustness check on retrospective reporting

One final issue that requires additional examination is whether individual retrospective reports on ADHD diagnosis may be clouded by 'rationalization bias' (Benitez-Silva *et al.*, 2009), in which because they have experienced trouble in the labor market, they misreport positive prior ADHD diagnosis as a way to rationalize their outcomes. Because the ADHD diagnosis and labor market data are collected contemporaneously, this potential reverse causality issue needs to be addressed. Thus, I substitute the ADHD diagnosis measure from wave 4 with a wave 1 (occurring 15 years previously) self-report of the frequency with which the respondent had trouble paying attention in school (never, just a few times, once a week, almost everyday, and everyday). Results are reported in Table XII and suggest nearly identical patterns in comparison with results presented for ADHD diagnosis. For example, individuals reporting attention troubles 'everyday' are 8 percentage points less likely to be employed at wave 4, face earnings reductions of approximately 30%, and are 10 percentage points more likely to participate in a social program. These results are robust to family fixed effects controls. Although this measure may not be precisely the same as ADHD symptoms, [20] it does suggest that retrospective reports of ADHD diagnosis are not clouded by reverse causality concerns.

6. CONCLUSIONS

This article provides the first evidence in the literature that childhood ADHD diagnosis decreases young adult employment and earnings and provides corroborative evidence that ADHD increases the likelihood of social assistance (Currie *et al.*, 2010). This evidence advances previous literature because it is less susceptible 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%, and increases social assistance receipt by 15 points. Furthermore, the employment reductions seem to be concentrated among children from disadvantaged families. The Add Health data do not contain information on potential ADHD treatment during childhood; a reasonable speculation might therefore place the results in this article as lower bound estimates if some individuals were diagnosed and successfully treated.[21]

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 people/White people earnings gap (24%), the within-sample, within-

[20] Appendix Table A3 shows that the wave 1 attention measure strongly predicts later ADHD diagnosis. I also analyzed the inclusion of these wave 1 attention measures as instruments for ADHD diagnoses in unreported results. The results typically increased by a factor of 4 to 10, although the excludability of these potential instruments was questionable, suggesting these results are biased upward.

[21] Although note that many common pharmaceutical treatments were not widely available during the late 1980s and early 1990s, when the respondents were children and adolescents (Woodworth, 2000).

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% to 10% earnings premium associated with community college completion. Currie and Hyson (1999) report wage reductions of between 2% and 4% 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.

Compared with similar findings from related work, the associations between childhood ADHD and adult outcomes are very large in magnitude. There are several potential explanations of these effect sizes, but it should also be noted that additional research is needed to replicate them in other settings before strong conclusions can be reached. One potential partial explanation is that, in this cohort, rates of modern treatment were likely quite low. As discussed previously, the cohorts under study grew up at a time with much less access to ADHD treatments than presently available. As one example, the Drug Enforcement Agency actively blocked the use of methylphenidate (Ritalin) and similar drugs by classifying it as a schedule II controlled substance since 1971—prior to 1991, the sale of these drugs were stable and small. However, by 1999, they had increased by almost 500% (Woodworth, 2000). The respondents in the Add Health study were teenagers and young adults by 1999 (the typical age of onset of ADHD symptoms is 7 years). As discussed in a previous section, childhood ADHD also persists in a large proportion of individuals into adulthood (60%), whereas, for example, the effects of low birth weight may be less problematic for adults (Fletcher, 2011). However, again, readers should exercise caution in viewing results of this magnitude because they have not yet been replicated and are so large.

If the results are confirmed in other studies, 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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APPENDIX

Table A1.

Add Health descriptive statistics: sibling sample

Variable	Observed	Mean	SD	Min	
Currently working (10+ h/week)	2,948	0.75	0.43	0	1
Earnings last year ($)	3,468	31,908.40	34,372.17	0	920,000
Social program participation	3,462	0.26	0.44	0	1
Diagnosed ADHD	3,468	0.05	0.21	0	1
Early diagnosis	3,464	0.02	0.15	0	1
Late diagnosis	3,464	0.02	0.15	0	1
Years of schooling	3,468	14.14	2.07	8	21
Ever married	3,467	0.50	0.50	0	1
Test score (wave 3)	3,468	99.97	14.59	9	123
Test score missing	3,468	0.16	0.37	0	1
Age (wave 4)	3,468	28.87	1.76	24.41667	33.58333
Female	3,468	0.53	0.50	0	1
Hispanic people	3,468	0.14	0.35	0	1
Black people	3,468	0.24	0.42	0	1
Maternal years of education	3,468	13.14	2.22	0	17
Family income as adolescent ($1,000 s)	3,468	45.24	41.13	0	800
Married parents	3,468	0.70	0.43	0	1
Test score (wave 1)	3,468	99.25	14.23	15	146
Rural status	3,468	0.27	0.44	0	1
Missing family information	3,468	0.28	0.45	0	1
Childhood mistreatment scale	3,468	0.02	0.61	−0.46231	4.035326
Ever diagnosed asthma	3,468	0.15	0.36	0	1
Low birth weight	3,468	0.19	0.37	0	1
Ever diagnosed with diabetes	3,468	0.03	0.16	0	1
Mistreatment missing	3,468	0.23	0.42	0	1
Low birth weight missing	3,468	0.17	0.38	0	1
Marijuana use (wave 1)	3,468	0.14	0.34	0	1
Obese (wave 1)	3,468	0.07	0.25	0	1
Depressed (wave 1)	3,468	0.09	0.28	0	1
Sexual initiation (wave 1)	3,468	0.37	0.48	0	1
Smoke (wave 1)	3,468	0.27	0.44	0	1
Drink (wave 1)	3,468	0.40	0.49	0	1

Table A2.

Prevalence rate comparison between Add Health and NHIS 2009

ADHD Prevalence	All groups (%)			White (%)			Black (%)			Hispanic (%)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Add Health	5	7	3	7	10	5	2	3	2	2	3	2
NHIS 2009 (ages 2–17)	8	10	5	10	14	6	10	12	7	5	6	3

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Table A3.

The association between wave 1 attention and wave 4 ADHD diagnosis

Outcome	ADHD diagnosis	ADHD diagnosis	ADHD diagnosis
Fixed effects	None	School	Family
Attention troubles in school (just a few times)	0.012 (0.003)	0.011 (0.003)	0.015 (0.016)
Attention troubles in school (about once a week)	0.024 (0.006)	0.021 (0.006)	0.023 (0.022)
Attention troubles in school (almost everyday)	0.050 (0.010)	0.048 (0.010)	0.047 (0.029)
Attention troubles in school (everyday)	0.105 (0.017)	0.103 (0.017)	0.111 (0.051)
Age	0.013 (0.003)	0.011 (0.003)	0.009 (0.011)
Female	−0.027 (0.005)	−0.027 (0.005)	−0.028 (0.014)
Test score	0.001 (0.003)	−0.000 (0.002)	−0.016 (0.011)
Maternal education	0.003 (0.001)	0.002 (0.001)	−0.005 (0.005)
Family income during high school	0.000 (0.000)	0.000 (0.000)	−0.001 (0.001)
Parents married during high school	−0.008 (0.005)	−0.008 (0.005)	−0.028 (0.063)
Hispanic people	−0.032 (0.006)	−0.022 (0.008)	0.048 (0.048)
Black people	−0.042 (0.005)	−0.038 (0.007)	−0.037 (0.048)
Birth order	−0.006 (0.001)	−0.006 (0.001)	−0.016* (0.010)
Rural status during high school	−0.004 (0.005)	−0.002 (0.005)	0.030 (0.044)
Missing family information	−0.003 (0.004)	−0.002 (0.004)	0.006 (0.023)
Constant	−0.290 (0.078)	−0.236 (0.077)	−0.014 (0.311)
Observations	14,483	14,483	4,119
R-squared	0.031	0.050	0.621

Robust standard errors in parentheses, clustered at school/family.

*** $p<0.01$.

** $p<0.05$.

* $p<0.1$.

Additional controls: grade level fixed effects.

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Table I.

National Longitudinal Study of Adolescent Health (Add Health, Descriptive Statistics)

Variable	Observed	Mean	SD	Min	Max
Currently working (10+ h/week)	12,229	0.77	0.42	0	1
Earnings last year ($)	14,436	34,137.57	37,521.63	0	920,000
Social program participation	14,414	0.24	0.43	0	1
Diagnosed ADHD	14,436	0.05	0.22	0	1
Early diagnosis	14,426	0.023	0.15	0	1
Late diagnosis	14,426	0.027	0.16	0	1
Years of schooling	14,433	14.28	2.06	8	21
Ever married	14,428	0.50	0.50	0	1
Test score (wave 3)	14,436	101.06	14.09	9	123
Test score missing	14,436	0.19	0.39	0	1
Age (wave 4)	14,436	28.96	1.74	24.25	34.66667
Female	14,436	0.54	0.50	0	1
Hispanic people	14,436	0.16	0.37	0	1
Black people	14,436	0.22	0.41	0	1
Maternal years of education	14,436	13.21	2.24	0	17
Family income as adolescent ($1,000 s)	14,436	46.12	42.27	0	990
Married parents	14,436	0.71	0.42	0	1
Test score (wave 1)	14,436	100.74	14.47	13	146
Rural status	14,436	0.26	0.44	0	1
Missing family information	14,436	0.30	0.46	0	1
Childhood mistreatment scale	14,436	0.00	0.58	−0.46231	4.545121
Ever diagnosed asthma	14,436	0.15	0.36	0	1
Low birth weight	14,436	0.11	0.28	0	1
Ever diagnosed diabetes	14,436	0.03	0.16	0	1
Mistreatment missing	14,436	0.25	0.43	0	1
Low birth weight missing	14,436	0.17	0.38	0	1
Marijuana use (wave 1)	14,436	0.14	0.35	0	1
Obese (wave 1)	14,436	0.07	0.26	0	1
Depressed (wave 1)	14,436	0.08	0.27	0	1
Sexual initiation (wave 1)	14,436	0.39	0.49	0	1
Smoke (wave 1)	14,436	0.25	0.43	0	1
Drink (wave 1)	14,436	0.41	0.49	0	1

Table II.

Comparison between Ever ADHD versus Never ADHD (descriptive statistics)

Variable	Observed	Mean Never ADHD	Observed	Mean Ever ADHD	Difference
Currently working (10+ h week)	11,576	0.77	653	0.68	<0.001***
Earnings last year ($)	13,710	34,346.04	726	30,200.77	0.003***
Social program participation	13,690	0.23	724	0.33	<0.001***
Diagnosed ADHD	13,710	0.00	726	1.00	
Early diagnosis	13,710	0.00	716	0.47	
Late diagnosis	13,710	0.00	716	0.53	
Years of schooling	13,708	14.30	725	13.88	<0.001***
Ever married	13,702	0.50	726	0.47	<0.001***
Test score (wave 3)	13,710	100.97	726	102.68	<0.001***
Test score missing	13,710	0.19	726	0.23	<0.001***
Age (wave 4)	13,710	28.97	726	28.80	0.009***
Female	13,710	0.55	726	0.37	<0.001***
Hispanic people	13,710	0.16	726	0.08	<0.001***
Black people	13,710	0.22	726	0.10	<0.001***
Maternal years of education	13,710	13.19	726	13.64	<0.001***
Family income as adolescent ($1,000 s)	13,710	45.79	726	52.50	<0.001***
Married parents	13,710	0.71	726	0.72	0.60
Test score (wave 1)	13,710	100.62	726	103.09	<0.001***
Rural status	13,710	0.26	726	0.27	0.48
Missing family information	13,710	0.30	726	0.26	0.03**
Childhood mistreatment scale	13,710	0.00	726	0.09	<0.001***
Ever diagnosed asthma	13,710	0.14	726	0.25	<0.001***
Low birth weight	13,710	0.11	726	0.11	0.74
Ever diagnosed diabetes	13,710	0.03	726	0.02	0.59
Mistreatment missing	13,710	0.25	726	0.31	<0.001***
Low birth weight missing	13,710	0.17	726	0.17	0.60
Marijuana use (wave 1)	13,710	0.14	726	0.20	<0.001***
Obese (wave 1)	13,710	0.07	726	0.07	0.49
Depressed (wave 1)	13,710	0.08	726	0.10	0.02**
Sexual initiation (wave 1)	13,710	0.39	726	0.37	0.15
Smoke (wave 1)	13,710	0.25	726	0.35	<0.001***
Drink (wave 1)	13,710	0.41	726	0.45	0.02**

Table III.

Effects of ADHD on adult employment status: baseline results

Outcome	Employed	Employed	Employed	Employed	Employed	Employed	Employed	Employed
Sample	Full	Males	Females	White people	Black people	Hispanic people	Rich	Poor
Fixed effects	None	None	None	None	None	None	None	None
Ever diagnosed with ADHD	−0.100*** (0.018)	−0.100*** (0.025)	−0.110*** (0.032)	−0.094*** (0.022)	−0.141** (0.062)	−0.169** (0.075)	−0.045* (0.027)	−0.131*** (0.031)
Age	−0.029*** (0.006)	−0.017** (0.007)	−0.040*** (0.008)	−0.029*** (0.009)	−0.043*** (0.011)	−0.010 (0.012)	−0.016 (0.012)	−0.032*** (0.007)
Female	−0.087*** (0.011)			−0.134*** (0.013)	0.015 (0.017)	−0.089*** (0.019)	−0.100*** (0.014)	−0.086*** (0.014)
Maternal education	0.006*** (0.002)	0.002 (0.002)	0.011*** (0.003)	0.008** (0.003)	0.012*** (0.004)	0.003 (0.003)	−0.007* (0.004)	0.008*** (0.003)
Family income During high school	0.000 (0.000)	0.000 (0.000)	−0.000 (0.000)	0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	0.002*** (0.000)
Parents married During high school	0.029*** (0.009)	0.053*** (0.015)	0.009 (0.012)	0.020 (0.014)	0.029 (0.019)	0.059*** (0.022)	0.008 (0.022)	0.017 (0.012)
Hispanic	0.043*** (0.012)	0.017 (0.016)	0.068*** (0.016)				0.007 (0.025)	0.074*** (0.020)
Black	−0.006 (0.011)	−0.084*** (0.018)	0.055*** (0.014)				−0.013 (0.022)	0.021 (0.014)
Test score During high school	0.029*** (0.006)	0.016** (0.008)	0.039*** (0.007)	0.020** (0.008)	0.034*** (0.011)	0.045*** (0.011)	0.016 (0.011)	0.030*** (0.007)
Rural status During high school	−0.020* (0.011)	−0.006 (0.013)	−0.031** (0.014)	−0.019 (0.013)	0.014 (0.019)	−0.093*** (0.034)	0.001 (0.015)	−0.019 (0.016)
Missing family information	−0.003 (0.009)	−0.016 (0.011)	0.008 (0.013)	−0.001 (0.014)	−0.023 (0.017)	0.005 (0.019)	−0.040 (0.030)	0.016 (0.020)
Constant	1.424*** (0.162)	1.176*** (0.192)	1.576*** (0.228)	1.451*** (0.249)	1.661*** (0.294)	1.017*** (0.339)	1.313*** (0.324)	1.437*** (0.181)
Observations	12,515	5,823	6,692	6,950	2,865	1,891	3,707	5,896
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.

*** $p<0.01$,

** $p<0.05$,

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* $p<0.1$.

Additional controls: wave 1 grade level fixed effects.

Table IV.

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*** (0.018)	−0.104*** (0.018)	−0.133*** (0.038)	−0.130*** (0.041)	−0.126** (0.058)	−0.116** (0.057)	−0.116** (0.057)	−0.143** (0.059)
Age	−0.029*** (0.006)	−0.030*** (0.006)	−0.020** (0.009)	−0.019** (0.009)	−0.009 (0.017)	−0.005 (0.017)	−0.001 (0.017)	0.006 (0.018)
Female	−0.087*** (0.011)	−0.086*** (0.011)	—0.114*** (0.018)	−0.115*** (0.019)	−0.076*** (0.027)	−0.072*** (0.028)	−0.088*** (0.027)	−0.077** (0.031)
Test score during high school	0.029*** (0.006)	0.021*** (0.006)	0.021** (0.010)	0.014 (0.011)	0.035* (0.019)	0.035* (0.019)	0.027 (0.019)	0.033* (0.019)
Constant	1.424*** (0.162)	1.483*** (0.167)	1193*** (0.249)	1.214*** (0.251)	0.958*** (0.341)	0.862** (0.354)	0.505 (0.386)	0.708* (0.425)
Observations	12,515	12,515	2,955	2,955	2,958	2,958	2,958	2,888
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table V.

Effects of ADHD on adult earnings: baseline results

Outcome								
Sample	Full	Males	Females	White People	Black People	Hispanic People	Rich	Poor
Fixed effects	None	None	None	None	None	None	None	None
Ever diagnosed with ADHD	−0.290*** (0.045)	−0.296*** (0.055)	−0.312*** (0.068)	−0.263*** (0.047)	−0.466*** (0.145)	−0.379*** (0.144)	−0.252*** (0.073)	−0.338*** (0.079)
Age	−0.074*** (0.018)	−0.035* (0.019)	−0.116*** (0.028)	−0.084*** (0.019)	−0.078*** (0.029)	−0.056 (0.042)	−0.027 (0.026)	−0.063*** (0.019)
Female	−0.322*** (0.029)			−0.445*** (0.024)	−0.143*** (0.045)	−0.188*** (0.066)	−0.317*** (0.037)	−0.323*** (0.039)
Test score During high school	0.110*** (0.012)	0.095*** (0.018)	0.124*** (0.015)	0.103*** (0.013)	0.168*** (0.025)	0.104*** (0.025)	0.084*** (0.019)	0.109*** (0.016)
Maternal education	0.027*** (0.006)	0.018*** (0.006)	0.035*** (0.008)	0.038*** (0.008)	0.053*** (0.010)	−0.013 (0.012)	0.021*** (0.008)	0.011 (0.008)
Family income During high school	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001 (0.001)	0.001 (0.001)	0.001** (0.000)	0.007*** (0.001)
Parents married During high school	0.087*** (0.022)	0.082*** (0.031)	0.092*** (0.029)	0.045 (0.031)	0.108** (0.047)	0.079* (0.046)	−0.061 (0.051)	0.012 (0.029)
Hispanic people	0.056* (0.030)	−0.071* (0.042)	0.178*** (0.048)				−0.003 (0.055)	0.150*** (0.046)
Black people	−0.166*** (0.034)	−0.317*** (0.042)	−0.044 (0.041)				−0.147** (0.065)	−0.103** (0.045)
Rural status During high school	−0.078** (0.032)	−0.034 (0.035)	−0.119*** (0.042)	−0.054 (0.034)	−0.040 (0.083)	−0.045 (0.087)	−0.072 (0.044)	−0.060 (0.041)
Missing family Information	0.001 (0.020)	0.020 (0.025)	−0.015 (0.029)	0.012 (0.025)	−0.002 (0.041)	−0.115*** (0.042)	−0.176** (0.068)	−0.100** (0.044)
Constant	11.640*** (0.505)	10.792*** (0.514)	12.243*** (0.770)	11.815*** (0.545)	11.169*** (0.806)	11.673*** (1.161)	10.785*** (0.707)	11.397*** (0.541)
Observations	13,434	6,467	6,967	7,433	2,947	2,134	4,166	6,158
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 VI.

Effects of ADHD on adult earnings: extended results

Outcome	Log(earnings)	Log(eamings)	Log(earnings)	Log(earnings)	Log(eamings)	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*** (0.045)	−0.299*** (0.045)	−0.345*** (0.080)	−0.363*** (0.089)	−0.403*** (0.119)	−0.367*** (0.118)	−0.336*** (0.116)	−0.362*** (0.114)
Age	−0.074*** (0.018)	−0.066*** (0.018)	−0.015 (0.031)	−0.003 (0.031)	0.071* (0.038)	0.080** (0.039)	0.092** (0.037)	0.078** (0.038)
Female	−0.322*** (0.029)	−0.328*** (0.031)	−0.346*** (0.047)	−0.349*** (0.049)	−0.314*** (0.060)	−0.287*** (0.061)	−0.353*** (0.062)	−0.240*** (0.069)
Test score During high school	0.110*** (0.012)	0.097*** (0.011)	0.100*** (0.027)	0.116*** (0.026)	0.155*** (0.041)	0.146*** (0.040)	0.102** (0.043)	0.102** (0.043)
Constant	11.640*** (0.505)	11.557*** (0.501)	10.067*** (0.840)	9.876*** (0.869)	8.225*** (0.786)	8.150*** (0.794)	6.624*** (0.827)	7.978*** (0.869)
Observations	13,434	13,434	3,202	3,202	3,205	3,205	3,205	3,146
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table VII.

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	White People	Black People	Hispanic People	Rich	Poor
Fixed effects	None	None	None	None	None	None	None	None
Ever diagnosed with ADHD	0.132*** (0.021)	0.108*** (0.022)	0.164*** (0.032)	0.113*** (0.022)	0.141** (0.062)	0.191*** (0.057)	0.081*** (0.025)	0.154*** (0.030)
Age	0.040*** (0.008)	0.042*** (0.009)	0.041*** (0.009)	0.048*** (0.009)	0.051*** (0.012)	0.003 (0.013)	0.014 (0.011)	0.040*** (0.009)
Female	0.110*** (0.010)			0.082*** (0.012)	0.205*** (0.020)	0.097*** (0.021)	0.061*** (0.011)	0.140*** (0.015)
Test score During high school	−0.037*** (0.005)	−0.020*** (0.006)	−0.051*** (0.007)	−0.052*** (0.007)	−0.040*** (0.010)	−0.024*** (0.008)	−0.040*** (0.007)	−0.023*** (0.007)
Maternal education	−0.015*** (0.002)	−0.010*** (0.002)	−0.019*** (0.003)	−0.016*** (0.003)	−0.023*** (0.004)	−0.004* (0.002)	−0.013*** (0.003)	−0.008*** (0.003)
Family income During high school	−0.001*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	0.000 (0.000)	−0.000 (0.000)	−0.004*** (0.001)
Parents married During high school	−0.077*** (0.010)	−0.050*** (0.014)	−0.099*** (0.014)	−0.055*** (0.013)	−0.086*** (0.018)	−0.099*** (0.029)	−0.021 (0.019)	−0.032*** (0.012)
Hispanic people	−0.043*** (0.014)	−0.039** (0.018)	−0.044** (0.019)				−0.006 (0.018)	−0.080*** (0.018)
Black people	0.099*** (0.011)	0.043*** (0.015)	0.143*** (0.016)				0.088*** (0.017)	0.074*** (0.016)
Rural status During high school	0.038*** (0.014)	0.030* (0.017)	0.046*** (0.017)	0.039** (0.017)	−0.013 (0.025)	0.065** (0.030)	0.020 (0.014)	0.029* (0.017)
Missing family Information	0.006 (0.008)	0.008 (0.011)	0.005 (0.012)	0.007 (0.011)	0.027 (0.020)	0.014 (0.019)	0.039 (0.027)	0.055*** (0.020)
Constant	−0.618*** (0.208)	−0.741*** (0.232)	−0.488** (0.231)	−0.790*** (0.248)	−0.753** (0.329)	0.185 (0.333)	−0.075 (0.298)	−0.615** (0.241)
Observations	14,743	6,844	7,899	8,137	3,283	2,325	4,474	6,829
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.

*** $p<0.01$.

** $p<0.05$.

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[*] $p<0.1$.

Additional controls: wave 1 grade level fixed effects.

Table VIII.

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*** (0.021)	0.130*** (0.020)	0.190*** (0.034)	0.193*** (0.034)	0.168*** (0.045)	0.158*** (0.044)	0.153*** (0.044)	0.153*** (0.045)
Age	0.040*** (0.008)	0.035*** (0.008)	0.029* (0.015)	0.025* (0.015)	−0.007 (0.013)	−0.018 (0.014)	−0.020 (0.014)	−0.016 (0.014)
Female	0.110*** (0.010)	0.110*** (0.011)	0.113*** (0.015)	0.115*** (0.016)	0.128*** (0.021)	0.127*** (0.021)	0.139*** (0.021)	0.147*** (0.024)
Test score during high school	−0.037*** (0.005)	−0.034*** (0.004)	−0.041*** (0.010)	−0.043*** (0.009)	−0.017 (0.014)	−0.018 (0.013)	−0.008 (0.014)	−0.012 (0.014)
Maternal education	−0.015*** (0.002)	−0.011*** (0.002)	−0.021*** (0.004)	−0.018*** (0.004)				
Constant	−0.618*** (0.208)	−0.570*** (0.201)	−0.175 (0.403)	−0.171 (0.388)	0.475* (0.269)	0.723*** (0.276)	1.063*** (0.303)	0.787** (0.326)
Observations	14,743	14,743	3,470	3,470	3,474	3,474	3,474	3,395
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table IX.

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*** (0.026)	−0.125*** (0.026)	—0.191*** (0.051)	−0.192*** (0.057)	−0.148* (0.087)	−0.141* (0.085)	−0.146* (0.085)	−0.204** (0.085)
Diagnosed ADHD (late)	−0.076*** (0.025)	−0.082*** (0.025)	−0.060 (0.059)	−0.057 (0.063)	−0.066 (0.076)	−0.055 (0.075)	−0.051 (0.076)	−0.038 (0.080)
Age	−0.029*** (0.006)	−0.030*** (0.006)	−0.020** (0.009)	−0.019** (0.009)	−0.011 (0.017)	−0.008 (0.017)	−0.003 (0.017)	0.004 (0.018)
Female	−0.087*** (0.010)	−0.086*** (0.010)	−0.114*** (0.018)	−0.116*** (0.019)	−0.073*** (0.027)	−0.070** (0.028)	−0.086*** (0.027)	−0.077** (0.031)
Test score	0.028*** (0.006)	0.021*** (0.006)	0.021** (0.010)	0.014 (0.011)	0.035* (0.019)	0.035* (0.019)	0.027 (0.019)	0.033* (0.019)
Constant	1.436*** (0.163)	1.495*** (0.169)	1.197*** (0.250)	1.224*** (0.252)	0.988*** (0.342)	0.908** (0.355)	0.553 (0.386)	0.754* (0.429)
Observations	12,506	12,506	2,951	2,951	2,954	2,954	2,954	2,884
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table X.

Effects of early and late ADHD on earnings

Outcome	Log(eamings)	Log(earnings)	Log(eamings)	Log(earnings)	Log(earnings)	Log(eamings)	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*** (0.064)	−0.363*** (0.063)	−0.519*** (0.119)	−0.535*** (0.135)	−0.480*** (0.152)	−0.453*** (0.153)	−0.426*** (0.152)	−0.423*** (0.148)
Diagnosed ADHD (late)	−0.212*** (0.062)	−0.229*** (0.063)	−0.141 (0.117)	−0.149 (0.127)	−0.284* (0.171)	−0.242 (0.171)	−0.209 (0.166)	−0.257 (0.163)
Age	−0.074*** (0.018)	−0.066*** (0.018)	−0.013 (0.030)	−0.001 (0.031)	0.072* (0.038)	0.082** (0.039)	0.094** (0.037)	0.080** (0.038)
Female	−0.323*** (0.029)	−0.329*** (0.031)	−0.349*** (0.046)	−0.353*** (0.049)	−0.319*** (0.060)	−0.293*** (0.061)	−0.359*** (0.062)	−0.247*** (0.069)
Test score	0.110*** (0.012)	0.097*** (0.011)	0.101*** (0.027)	0.117*** (0.026)	0.157*** (0.041)	0.148*** (0.040)	0.104** (0.043)	0.104** (0.043)
Constant	11.637*** (0.505)	11.557*** (0.502)	10.022*** (0.828)	9.849*** (0.859)	8.190*** (0.786)	8.113*** (0.793)	6.582*** (0.826)	7.927*** (0.869)
Observations	13,426	13,426	3,200	3,200	3,203	3,203	3,203	3,144
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table XI.

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*** (0.029)	0.168*** (0.028)	0.274*** (0.055)	0.230*** (0.056)	0.230*** (0.067)	0.217*** (0.067)	0.215*** (0.067)	0.216*** (0.068)
Diagnosed ADHD (late)	0.083*** (0.028)	0.089*** (0.026)	0.101* (0.051)	0.146*** (0.052)	0.085 (0.058)	0.080 (0.058)	0.071 (0.058)	0.071 (0.059)
Age	0.040*** (0.008)	0.035*** (0.008)	0.028* (0.015)	0.025* (0.015)	−0.006 (0.014)	−0.016 (0.014)	−0.019 (0.014)	−0.015 (0.014)
Female	0.111*** (0.010)	0.110*** (0.010)	0.113*** (0.015)	0.115*** (0.016)	0.128*** (0.021)	0.126*** (0.021)	0.139*** (0.021)	0.147*** (0.025)
Test score	−0.037*** (0.005)	−0.034*** (0.004)	−0.042*** (0.009)	−0.043*** (0.009)	−0.018 (0.014)	−0.019 (0.014)	−0.009 (0.014)	−0.012 (0.014)
Constant	−0.621*** (0.210)	−0.575*** (0.203)	−0.166 (0.398)	−0.185 (0.390)	0.456* (0.270)	0.696** (0.277)	1.041*** (0.304)	0.766** (0.327)
Observations	14,733	14,733	3,466	3,466	3,470	3,470	3,470	3,391
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 III controls. Health controls: asthma, low birth weight, diabetes, childhood mistreatment, high school marijuana, tobacco and alcohol use, high school obesity, depression, sexual activity, and missing information dummies. Education controls: test score at wave 3, completed schooling at wave 4.

Table XII.

The effects of wave 1 attention troubles on labor market outcomes

Outcome	Employment	Employment	Log(earning)	Log(earnings)	Social Program	Social Program
Sample	Full	Family	Full	Family	Full	Family
Fixed effects	None	Family	None	Family	None	Family
Attention troubles in school (just a few times)	−0.007 (0.008)	−0.030 (0.023)	−0.004 (0.022)	−0.043 (0.064)	0.028*** (0.009)	0.032 (0.023)
Attention troubles in school (about once a week)	−0.027*** (0.010)	−0.088*** (0.030)	−0.017 (0.028)	−0.111 (0.079)	0.044*** (0.012)	0.070** (0.030)
Attention troubles in school (almost everyday)	−0.040*** (0.013)	−0.073** (0.034)	−0.173*** (0.032)	−0.193** (0.095)	0.091*** (0.015)	0.126*** (0.035)
Attention troubles in school (everyday)	−0.084*** (0.018)	−0.081 (0.051)	−0.179*** (0.056)	−0.373*** (0.133)	0.099*** (0.019)	0.102** (0.051)
Age	−0.032*** (0.005)	−0.020 (0.015)	−0.095*** (0.017)	0.035 (0.039)	0.047*** (0.008)	0.012 (0.015)
Female	−0.095*** (0.009)	−0.106*** (0.022)	−0.325*** (0.029)	−0.305*** (0.058)	0.109*** (0.010)	0.124*** (0.021)
Test score during high school	0.025*** (0.005)		0.103*** (0.012)		−0.037*** (0.005)	
Maternal education	0.006*** (0.002)		0.027*** (0.006)		−0.014*** (0.002)	
Family income during high school	0.000 (0.000)		0.001*** (0.000)		−0.001*** (0.000)	
Parents married during high school	0.031*** (0.008)		0.091*** (0.022)		−0.076*** (0.011)	
Hispanic people	0.044*** (0.010)		0.054* (0.031)		−0.043*** (0.014)	
Black people	0.000 (0.010)		−0.165*** (0.034)		0.098*** (0.011)	
Rural status during high school	−0.015 (0.010)		−0.080** (0.032)		0.039*** (0.014)	
Missing family information	−0.000 (0.008)		0.004 (0.020)		0.006 (0.008)	
Constant	1.562*** (0.152)	1.173*** (0.309)	12.168*** (0.465)	9.023*** (0.854)	−0.813*** (0.209)	0.106 (0.308)

Outcome	Employment	Employment	Log(earning)	Log(earnings)	Social Program	Social Program
Observations	14,481	3,407	13,195	3,142	14,455	3,402
R-squared	0.036	0.022	0.092	0.044	0.092	0.036
Total number of families		1,668		1,642		1,668

Robust standard errors in parentheses, clustered at school/family.

*** $p<0.01$.

** $p<0.05$.

* $p<0.1$.

Additional controls: grade level fixed effects.