MONASH University

MONASH BUSINESS SCHOOL

CENTRE FOR HEALTH ECONOMICS

WORKING PAPERS

Educational and Labour Market Consequences of Adolescent ADHD: Evidence from Australian Administrative Data

Discussion Paper no. 2025-16

Jessica L. Arnup, Nicole Black and David W. Johnston

Keywords: ADHD, Education, Unemployment, Fixed Effects, Mental Health

JEL Classification: I2, I2, J6

Jessica L. Arnup: Australian National University, POLIS: Centre for Social Policy Research (email: Jessica.Arnup@anu.edu.au); Nicole Black: Monash University, Monash Business School, Centre for Health Economics (email: nicole.black@monash.edu); David W. Johnston : Monash University, Monash Business School, Centre for Health Economics (email: david.johnston@monash.edu).

Educational and Labour Market Consequences of Adolescent ADHD: Evidence from Australian Administrative Data

Jessica L. Arnup[1], Nicole Black[2], and David W. Johnston[2]

[1]Australian National University, POLIS: Centre for Social Policy Research

[2]Monash University, Monash Business School, Centre for Health Economics

Declaration of competing interests: None

Funding: Jessica L. Arnup was supported through an Australian Government Research Training Program (RTP) Scholarship. Support from the Australian Research Council (DE180100438 and DP200102295) is gratefully acknowledged. The funders had no involvement in this study.

Acknowledgements: The results of these studies are based, in part, on data supplied to the ABS under the Taxation Administration Act 1953, A New Tax System (Australian Business Number) Act 1999, Australian Border Force Act 2015, Social Security (Administration) Act 1999, A New Tax System (Family Assistance) (Administration) Act 1999, Paid Parental Leave Act 2010 and/or the Student Assistance Act 1973. Such data may only be used for the purpose of administering the Census and Statistics Act 1905 or performance of functions of the ABS as set out in section 6 of the Australian Bureau of Statistics Act 1975. No individual information collected under the Census and Statistics Act 1905 is provided back to custodians for administrative or regulatory purposes. Any discussion of data limitations or weaknesses is in the context of using the data for statistical purposes and is not related to the ability of the data to support the Australian Taxation Office, Australian Business Register, Department of Social Services and/or Department of Home Affairs' core operational requirements. Legislative requirements to ensure privacy and secrecy of these data have been followed. For access to PLIDA data under Section 16A of the ABS Act 1975 or enabled by section 15 of the Census and Statistics (Information Release and Access) Determination 2018, source data are de-identified and so data about specific individuals has not been viewed in conducting this analysis. In accordance with the Census and Statistics Act 1905, results have been treated where necessary to ensure that they are not likely to enable identification of a particular person or organisation. This research also uses unit record data from Growing Up in Australia: the Longitudinal Study of Australian Children (LSAC). The LSAC is conducted by the Australian Government Department of Social Services (DSS). The findings and views reported in this paper, however, are those of the authors and should not be attributed to the Australian Government, DSS, or any of DSS' contractors or partners.

Ethics: Ethics approval for this project is not required as it involves secondary data analysis.

CRediT authorship contribution statement: Jessica L. Arnup: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Nicole Black: Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. David W. Johnston: Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization.

Data Availability: The authors do not have permission to share data.

Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is the most common mental health condition among children and adolescents, with diagnosis rates rising sharply over the past two decades. We examine the impact of adolescent ADHD on early adulthood outcomes using whole-of-population administrative data from Australia and two complementary identification strategies: sibling fixed effects and neighbour fixed effects. ADHD is identified through prescription records, capturing moderate-to-severe cases, and models account for a range of comorbid health conditions. Adolescents with ADHD are 12-16 percentage points less likely to be enrolled in tertiary education and 5-6 percentage points more likely to receive unemployment payments at age 20 compared to similar peers. These economic penalties are larger than those for other common conditions, including anxiety/mood and psychotic disorders. Relative reductions in tertiary enrolment are similar for males and females. Additional analyses show that comorbid mental health conditions do not meaningfully exacerbate the disadvantage associated with ADHD. Our findings highlight the substantial and enduring costs of ADHD for young people, even among those receiving treatment, and underscore the need for greater investment in school-based supports and transitional services.

Keywords: ADHD, Education, Unemployment, Fixed Effects, Mental Health

JEL: I2, I2, J6

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is the most common mental health disorder in childhood and adolescence, affecting almost one in ten children in Australia (Lawrence et al., 2015). It is a neurodevelopmental condition characterised by persistent patterns of inattention and/or hyperactivity-impulsivity (American Psychiatric Association, 2022). Diagnoses are more than twice as common in males than females (Hinshaw et al., 2022), and the condition is frequently comorbid with other disorders, including anxiety, depression, conduct disorders, autism spectrum disorder, and asthma (Cortese et al., 2018; Faraone et al., 2024; Franke et al., 2018; Jensen & Steinhausen, 2015).

ADHD is associated with a range of adverse educational and labour market outcomes, including lower school and university completion rates, poorer academic performance, reduced income, and greater reliance on government financial support (Arnold et al., 2020; Fleming et al., 2017; Gordon & Fabiano, 2019; Loe & Feldman, 2007). While these impacts are well-established, the existing literature faces several important limitations. First, much of the previous literature relies on older cohorts diagnosed in the 1980s and 1990s, prior to the sharp rise in ADHD diagnosis and treatment driven by increased awareness (Abdelnour et al., 2022; Bruno et al., 2023; Karanges et al., 2014; Polanczyk et al., 2014). Second, many studies are based on relatively small survey-based samples, limiting statistical precision and constraining the ability to examine heterogeneity in outcomes, such as differences by sex. Third, most research identifies associations using regression models that assume selection on observables or sibling fixed-effects models, which address unobserved family-level confounding (Currie & Stabile, 2006; Fletcher & Wolfe, 2008; Fletcher & Wolfe, 2009; Fletcher, 2014; Klugman et al., 2024). However, sibling designs often rely on modest sample sizes, particularly when considering the number of sibling pairs with variation in ADHD status. They may also underestimate the impact of ADHD due to sibling spillovers effects (e.g., Black et al., 2020; Breining, 2014; Fletcher et al., 2012).

In this paper, we address these limitations by using newly available large-scale national administrative data from Australia spanning 2011-2019 and two complementary statistical approaches to estimate the impacts of adolescent ADHD on educational and labour market outcomes. To address different sources of unobserved confounding, we use two statistical approaches: sibling fixed-effects and neighbour fixed-effects. The sibling FE model compares outcomes between siblings within the same household, holding constant shared family background and unobserved household-level factors. The neighbour FE model compares adolescents of the same age and sex, living in the same small geographic block, and with similar observed socioeconomic characteristics. This approach avoids potential sibling spillover effects and captures local environmental variation. Each method addresses different sources of unobserved heterogeneity, and consistency in results across approaches increases the credibility of our findings. Where estimates diverge, they may help identify spillover channels and establish plausible bounds for the true causal effect of ADHD.

These methods are applied to whole-of-population linked administrative records covering higher education, tax, healthcare, and welfare outcomes in Australia. We follow children aged 12-15 years of age at the 2011 Australian Census and measure their educational and labour market outcomes at 20 years of age. Our total sample consists of over 10,000 children with ADHD. The large sample size provides substantially greater statistical power than most prior studies and allows for disaggregated analyses, including by sex. This is particularly important given concerns that ADHD in females is under-recognised and potentially more severe among those who are diagnosed (Derks et al., 2007; Mowlem et al., 2019). Despite documented differences between males and females with ADHD, relatively little is known about sex-specific impacts on long-term outcomes.[1]

We also use complete prescription medication records to identify a broad range of mental and physical health comorbidities. Given the high rate of comorbidity with ADHD (Faraone et al., 2024), isolating its independent effects is a key empirical challenge. While some prior studies have adjusted for specific health conditions (e.g., Currie et al., 2010; Fletcher, 2014), few have examined this issue in depth. We contribute to this gap by controlling for comorbid diagnoses directly and by investigating whether ADHD has compounding effects when combined with other health conditions, particularly in shaping labour market trajectories.

Results from sibling FE models show that children with ADHD are significantly less likely to be enrolled in tertiary education and more likely to receive unemployment benefits at age 20. We find that the effect of ADHD on later life outcomes is larger in magnitude than anxiety/mood disorders, psychotic disorders, and respiratory conditions, highlighting the substantial negative consequences of ADHD. We find slightly larger estimates for neighbour FE models. Our findings are robust to changes in the sample construction and regression

[1] One notable exception is Currie and Stabile (2006), who present sibling fixed effect regressions including an interaction term for gender and hyperactivity, a key symptom of ADHD

specification. We find little evidence of differences in estimates by sex or by whether children had a comorbid mental disorder.

2. Background

ADHD is characterised by a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with a child's functioning and development (American Psychiatric Association, 2022). ADHD is typically diagnosed in childhood, and symptoms of ADHD are usually present before 12 years of age (Kieling et al., 2010). Symptoms of ADHD tend to decline over time, however 65% of children continue to meet the diagnostic criteria of ADHD into adulthood (Faraone et al., 2006). Survey estimates suggest 7% of children and adolescents have a diagnosis of ADHD in Australia (Lawrence et al., 2015). ADHD is more common in males (10%) compared with females (4%), and prevalence is higher in children living in families with lower socioeconomic characteristics (Lawrence et al., 2015). While ADHD is highly heritable, not all children with a family history will develop ADHD. Recent estimates suggest 12% of later born siblings to a child with ADHD will also have ADHD (Miller et al., 2019).

Several studies have examined the human capital consequences of ADHD using survey data, with the siblings FE approach most commonly used to deal with family-level confounding issues. For example, Currie and Stabile (2006) use sibling FE models and find that U.S. and Canadian children with hyperactivity symptoms have lower math and literacy scores, higher enrolment in special education classes, and a higher probability of grade repetition four years later. Fletcher and Wolfe (2008) extend this work using older children from the Add Health study in the U.S.; using retrospective reported symptoms of hyperactivity and a siblings FE approach, they also show some associations between ADHD and later education outcomes. Fletcher (2014) uses later waves of Add Health to track siblings through to adulthood and find that self-reported diagnoses of ADHD is associated with reductions in earnings and large increases in welfare use during early adulthood. More recently, Klugman et al. (2024) use sibling-fixed effect models and find that parental reports of hyperactivity is associated with significantly less years of schooling. These studies use older cohorts from an era when ADHD was less prevalent, and medication was less commonly prescribed.[2] Our study builds on this work by using a more contemporaneous cohort of children born around 1996-1999, who were young adolescents in 2011. Another point of difference of our study is that instead of using

[2] For example, Fletcher and Wolfe (2008) and Fletcher (2014) examine cohorts born around 1976-1983; Currie and Stabile (2006) examine cohorts born around 1983-1990; and Klugman et al. (2024) use cohorts born around 1985-1996.

retrospective self-reports of ADHD symptoms or diagnoses, or parental reports of behavioural symptoms using survey data, we measure ADHD in a population-wide sample using administrative records of prescribed ADHD medications.

Psychostimulants (such as methylphenidate, commonly referred to by the brand name Ritalin) are recommended as first-line pharmacotherapies for ADHD (Mechler et al., 2022; Van der Oord et al., 2008). ADHD is a chronic condition and medication should be provided consistently, over several years (Efron et al., 2020). A prominent randomised control trial of ADHD treatments suggests short-term symptom reduction in children prescribed ADHD medication compared to behavioural therapy (MTA Cooperative Group, 1999). Previous economic studies find improved later-life outcomes of children with pharmacologically treated ADHD compared to untreated ADHD, including higher GPA's, less risky behaviours, less criminality, and less childhood injuries (Chorniy & Kitashima, 2016; Dalsgaard et al., 2014; Fletcher & Wolfe, 2009; Keilow et al., 2018). However, Currie et al. (2014) find that an insurance change associated with increased psychostimulant prescriptions did not improve children's medium or long-term emotional functioning or academic outcomes. While ADHD medication typically improves the negative symptoms of ADHD, there is incomplete amelioration of ADHD symptoms and functional impacts of ADHD remain (Shaw et al., 2012).

There has been a significant increase in the incidence of pharmacological treatment for ADHD in Australia and internationally (e.g., Karanges et al., 2014; Klau et al., 2021; Raman et al., 2018). Recent epidemiological evidence suggests that the prevalence of children who meet ADHD diagnostic criteria has not increased in three decades, rather increased diagnosis and treatment rates of ADHD, reduction of stigma, and the increased identification of females, is more likely contributing to increased medication use (Polanczyk et al., 2014). In 2020, a population-based survey of prescription records suggests around 2% of girls and 6% of boys under 18 in Australia received a prescription for ADHD (Bruno et al., 2023).

3. Data

The data were drawn from the Australian Bureau of Statistics' (ABS) Person Level Integrated Data Asset (PLIDA). The PLIDA includes administrative data on healthcare utilisation, higher education, and government welfare payments from 2011 to 2019, linked to the 2011 Australian Census of Population and Housing.

3.1 Estimation Samples

Estimation samples were constructed by restricting the sample to adolescents aged between 12 and 15 years at the time of the August 2011 Australian Census. These ages were chosen to ensure that individuals were below the compulsory schooling age in 2011 and could be followed to age 20. The sample was also restricted to adolescents residing in single-family private residences, to enable linkage to records of parents and siblings. Non-biological children of the main householder and those who died after participating in the 2011 Census were omitted. Overall, these restrictions resulted in 556,168 adolescents.

The sibling sample consisted of families with at least two biological siblings between 12 and 15 years of age. This sample contained 161,371 adolescents from 79,280 families. The neighbour sample consisted of 12–15-year-olds grouped with at least one neighbour in the same, small, local area, and of the same sex and observable background characteristics: same parent education level, parent marital status, parent employment status, and parental country of birth. Neighbourhood area is based on the child's parent's location, as measured by the smallest available unit available (the Australian Bureau of Statistics' Statistical Area 1). These represent a small, local neighbourhood area, generally covering a population between 200 and 800 people. This resulted in 322,168 adolescents, in 120,354 neighbourhood groups.

3.2 Measurement of ADHD

We identified adolescents with ADHD using pharmaceutical records of dispensed ADHD medication, an approach consistent with prior research (e.g., Fleming et al., 2017; Hartwig et al., 2022). Specifically, individuals were classified as having ADHD if they filled a prescription for an ADHD medication between July 2011 and December 2012. ADHD medications are defined by the Anatomical Therapeutic Chemical (ATC) classification N06B, which includes psychostimulants such as methylphenidate, dexamfetamine, and atomoxetine. These medications were typically prescribed by paediatricians or psychiatrists. Given prescribing practices in Australia during this period, it is likely that most individuals identified via prescription records had received a formal ADHD diagnosis from a specialist.

A potential concern is that, prior to April 2012, PBS data excluded prescriptions paid fully out-of-pocket. Appendix A investigates this issue empirically and concludes that any under-recording is likely to be small.

Using prescription medication records to identify ADHD avoids the recall and reporting biases common in survey-based diagnosis measures and ensures that the classification captures clinically recognised cases. While it is possible that this approach may not capture adolescents with ADHD who were undiagnosed, untreated, or managed through non-pharmacological interventions, most children with ADHD are likely to have been clinically diagnosed with ADHD and begun medication by the time we observe them.[3]

Consequently, our estimates should be interpreted as reflecting the impacts of clinically recognised and pharmacologically treated ADHD, rather than the full spectrum of the disorder. For simplicity, we refer to this group as "having ADHD" throughout the paper, while clarifying this definition in the conclusion to ensure that our findings and their policy implications are interpreted appropriately.

3.3 Education and Employment Outcomes

We examine the impact of ADHD on two key outcomes at age 20: enrolment in tertiary education and receipt of unemployment benefits. Age 20 is a critical time in the transition to adulthood, as many individuals begin to engage with higher education or the labour market. Assessing outcomes at this age provides insight into early trajectories that can influence long-term socioeconomic status.

Higher education is associated with increased income, better health, and greater social mobility (Conti et al., 2010; Haveman & Smeeding, 2006; Woessmann, 2016). Early engagement in the labour market supports economic security and the accumulation of human capital. In contrast, unemployment in early adulthood is linked to poorer mental and physical health and a heightened risk of long-term poverty (Gedikli et al., 2023; Renahy et al., 2018). Tertiary education is defined as enrolment in any higher education institution, most commonly a bachelor's degree. Unemployment is proxied by receipt of the "Youth Allowance (other)" payment, which is available to individuals aged 20 or under who are actively seeking full-time work or combining part-time study with job search activities.

4. Method

A key methodological challenge in estimating the impact of ADHD on later outcomes is that both ADHD diagnosis and human capital outcomes are strongly correlated with family background. For instance, children with ADHD disproportionately come from disadvantaged

[3] In a worldwide study of the prevalence of mental health disorders, 95% of children with ADHD are diagnosed by 10-15 years of age. By comparison, the median age for first-onset major depressive disorder (i.e., depression) is around 30 years of age (McGrath et al., 2023).

families (Larsson et al., 2014; Russell et al., 2016), and children from disadvantaged backgrounds often have poorer educational and labour market outcomes (Heckman, 2006). To address this, we use two complementary fixed-effects approaches that control for unobserved heterogeneity at the family or neighbourhood level.

We first estimate sibling fixed-effects (FE) models, comparing outcomes between siblings within the same family. This approach removes all time-invariant family-level confounders. Specifically, we estimate:

$$Y_{if} = \gamma_1 ADHD_{if} + \gamma_2 Z'_{if} + h'_{if} + \alpha_f + u_{if} \tag{1}$$

where Y_{if} is a binary indicator for tertiary enrolment or receipt of unemployment benefits at age 20, $ADHD_{if}$ is our main exposure variable, Z_{if} is a vector of characteristics that vary between siblings (age, sex, number of older siblings, number of younger siblings, and whether born in Australia), h_{if} is a vector of prescription-based indicators for comorbid health conditions, α_f is the family (sibling) fixed effect, and u_{if} is an error term. The main coefficient of interest is γ_1 which represents the difference in later outcomes between a child with ADHD and their sibling without ADHD. In the estimation sample, there are 2,489 families with variation in ADHD across siblings.

To complement the sibling FE model and to provide an alternative approach not subject to within-household spillover effects, we also estimate neighbour FE models. These compare adolescents with and without ADHD who are of the same age, sex and socioeconomic background, and live in the same small geographic area. Specifically, a child's neighbour FE is defined by a set of characteristics measured in 2011: age, sex (male or female), main parent's highest level of education (university degree or not), parents' marital status (couple or single parent), parents' immigrant status (parent born outside Australia or not), main parent's employment status (employed or not), and area of residence (Statistical Area 1).

Other than the sample and fixed-effects used, the neighbour FE model mirrors equation (1). The main differences is the covariate set, which includes variables that vary between similar neighbours: number of same-aged siblings, number of other household members, and whether parents were homeowners. Other key factors, such as education, marital status, and employment, are absorbed by the fixed effects. In addition, we exclude siblings of ADHD children from neighbour groupings to avoid within-household spillovers. This model controls for all local-area characteristics, such as school quality and access to health services. Another advantage of this model is that it retains substantial identifying variation despite the multi-dimensional fixed effects, with 4,986 matched groups that include adolescents differing in ADHD status.

A key assumption of the neighbours FE approach is that there are no differences between neighbours with and without ADHD in characteristics associated with ADHD. To test this assumption, we follow Equation (1) with neighbourhood fixed effects to estimate whether ADHD is significantly associated with household income, mother's work hours and mother's age. If the neighbour FE and covariates are sufficient to control for heterogeneity between families, then the estimated associations should be small in magnitude. The results presented in Appendix Table A1 demonstrate this is the case. The coefficient on the ADHD variable is statistically insignificant in each regression and is quantitatively small, relative to the outcome's sample mean (less than 1% for all three outcomes).

A potential limitation of the neighbour FE model is that unobserved differences in family resources or parenting may still confound the ADHD-outcome relationship, potentially leading to upward-biased estimates. In contrast, sibling FE models may understate effects due to spillovers across siblings. We therefore interpret the range between estimates from these models as plausible bounds for the causal impact of ADHD.

In both models, we control for a broad set of comorbid physical and mental health conditions using prescription records. This is important given the high comorbidity of ADHD with other disorders (Lundborg et al., 2014). To mitigate omitted variable bias, we include dummy variables for all Anatomical Therapeutic Chemical (ATC) prescription classes dispensed between July 2011 and December 2012 (see Table 2). While we include 16 health categories, we focus discussion on three comorbid conditions with high prevalence and potential economic relevance: anxiety/mood disorders (treated with anxiolytics or antidepressants), psychotic disorders (treated with antipsychotics), and respiratory conditions (treated with medications for respiratory diseases).

One potential trade-off in using population-wide medication records to identify ADHD is that the control group may include children with untreated ADHD, which would likely attenuate our estimates. However, the quantitative impact of this is likely to be small. In the sibling fixed effects model, parents with one child diagnosed with ADHD are more likely to seek screening for a second symptomatic child than similar families. This is because they are familiar with the symptoms of ADHD, they have an established relationship with a treating professional, are aware of potential benefits of an ADHD diagnosis (i.e., extra support at school), and less concerned about possible treatment risks (Persson et al., 2021). Further, the control group of the neighbourhood fixed effect models are unlikely to consist of many children with untreated ADHD. Less than 10% of children in Australia are estimated to have ADHD (Lawrence et al., 2015) and most of those diagnosed receive pharmacological treatment between the ages of 10 and 15 (McGrath et al., 2023).[4]

To further investigate potential systematic differences between treated and untreated children with ADHD, we use data from the Longitudinal Study of Australian Children (LSAC) which provides (parent-reported) ADHD diagnoses and ADHD medication usage of children in Australia. Appendix Table A2 presents the means and standard deviations of observed characteristics for three groups of children: those who have never been diagnosed with ADHD ("No ADHD"), those diagnosed with ADHD but who have never taken ADHD medication ("ADHD – Never Medicated"), and those diagnosed with ADHD who have taken ADHD medication ("ADHD –Medicated").[5] As expected, children who are diagnosed with or medicated for ADHD have higher hyperactivity scores at age four compared to children without ADHD (Appendix Table A2). However, when examining mean characteristics between children with untreated ADHD and those receiving medical, only child sex (male) and parental employment status significantly differ between groups. This indicates that there are minimal observable factors that predict pharmacological treatment for children with diagnosed ADHD.[6] Moreover, this finding suggests that our estimates are unlikely to be impacted by socioeconomically differences in ADHD treatment.

5. Results

5.1 Descriptive Statistics

[4] As a robustness exercise, we remove children in the comparison group who receive ADHD medication at an older age and the estimates are unchanged.

[5] For this analysis we use a balanced sample of children who participated in each wave of data collection from age 4/5 to age 14/15 (7 waves). ADHD status is indicated by parent reported ADHD status and parent reported ADHD medication use.

[6] Previous research also indicates only small observable differences between children treated and not treated for ADHD. For example, Dalsgaard et al. (2014) use Danish registry data and exogenous assignment of children to specialists, and find that children with treated ADHD were slightly more likely to have employed parents, and other socioeconomic variables did not significantly differ between children.

Table 1 presents sample means for key demographic characteristics and outcome variables, comparing adolescents with (N = 10,977) and without ADHD (N = 545,191). Consistent with prior evidence, those with ADHD differ systematically from their peers on several sociodemographic characteristics. Adolescents with ADHD are more likely to be male, born in Australia, and live in socioeconomically disadvantaged circumstances: they are more likely to live in single-parent households, have a main parent without a tertiary qualification, have a non-employed parent, and reside in rented housing. These differences underscore the importance of adjusting for family background and other confounders in estimating the independent effects of ADHD.

In the raw data, we observe large differences in early adult outcomes. At age 20, only 15% of adolescents with ADHD are enrolled in tertiary education, compared to 45% of their peers. Similarly, 24% of adolescents with ADHD are receiving unemployment payments at age 20, compared to 12% among those without ADHD.

Table 1: Means and Standard Deviations of Key Variables by ADHD Status

	Without ADHD Diagnosis		With ADHD Diagnosis	
Variable	*M*	*SD*	*M*	*SD*
Child Male	0.50	0.50	0.80	0.40
Child Age (2011)	13.53	1.12	13.41	1.11
Child Australian Born	0.88	0.32	0.94	0.23
Main Parent has Tertiary Degree (2011)	0.23	0.42	0.19	0.39
Child in Single Parent Family (2011)	0.30	0.46	0.41	0.49
Main Parent Employed	0.73	0.44	0.64	0.48
Parent Born Outside Australia	0.40	0.49	0.25	0.43
Parent Owns Home	0.75	0.43	0.65	0.48
Child In Tertiary Education at Age 20	0.45	0.50	0.15	0.36
Child Receives Unemployment at Age 20	0.12	0.32	0.24	0.43

Notes: Sample Sizes: No ADHD = 545,191; ADHD = 10,977. Main parent is mother, or father if no mother is present.

Table 2 shows the proportion of adolescents with at least one prescription in each major ATC drug class during 2011-12, separately by ADHD status. The statistics confirm that ADHD is highly comorbid with other health conditions. Adolescents with ADHD are significantly more likely than their peers to receive prescriptions for nearly all medication classes ($p < 0.01$), with the exception of blood and blood forming agents (not significant) and the musculo-skeletal system ($p < 0.10$).

The most notable differences relate to medications for anxiety, mood, and psychotic disorders. Among adolescents with ADHD, 16.4% were prescribed antidepressants or anxiolytics, compared to 2.7% of those without ADHD. This likely reflects treatment for comorbid anxiety or depression. Similarly, 7.6% of those with ADHD were prescribed antipsychotics, compared to just 0.4% among those without. Antipsychotics are used to treat conditions such as schizophrenia, bipolar disorder, autism-related behavioural disturbances, and Tourette syndrome (Sultan et al., 2019). The use of antipsychotics shows some effectiveness for children with ADHD with significant behaviour concerns (Baker et al., 2021), but is not currently recommended as a first or second-line treatment in Australia (ADHD Guideline Development Group, 2022). Prescription rates for respiratory medications were also substantially higher among adolescents with ADHD (14.9% vs. 8.4%), consistent with documented comorbidity between ADHD and asthma (Cortese et al., 2018).

Across the remaining prescription classes, adolescents with ADHD consistently show higher rates of medication use, underscoring the complexity of their health profiles. These patterns highlight the importance of accounting for comorbid physical and mental health conditions when estimating the impacts of ADHD on later-life outcomes.

Table 2: Sample Proportions Receiving Prescription Medications

	Without ADHD	With ADHD
Antidepressants/Anxiolytics	2.74	16.39
Antipsychotics	0.41	7.64
Respiratory system	8.44	14.89
Alimentary tract and metabolism	4.67	7.14
Anti-infective for systemic use	38.09	51.07
Antineoplastic and immunomodulating agents	0.20	-
Antiparasitic products, insecticides, and repellents	0.65	1.05
Blood and blood forming agents	0.73	0.66
Cardiovascular system	1.78	14.18
Dermatologicals	9.78	11.37
Genito urinary systems and sex hormones	4.75	3.96
Musculo-skeletal system	2.63	2.94
Nervous System – Remaining	4.51	8.96
Nervous System – Sedatives	0.15	0.41
Sensory Organs	5.19	8.41
Systemic hormonal preparations	3.63	6.22

Notes: Sample Sizes: Without ADHD = 545,191; With ADHD = 10,977. Prevalence of ATC drug class indicated by the presence of at least one prescription in the second half of 2011 or full year of 2012. All drug classes significantly differ by ADHD status to the $p < .01$ level, except for blood and blood forming agents (not significant) and musculo-skeletal system ($p < .10$). The proportion for antineoplastic and immunomodulating agents among the 'with ADHD diagnosis' group is suppressed due to a small sample size.

5.2 ADHD and Outcomes at Age 20

Table 3 reports regression results for the association between adolescent ADHD and tertiary education enrolment (Panel A) and receipt of unemployment payments (Panel B). We present estimates from three models: a baseline OLS regression without fixed effects (Column 1), a sibling FE model (Column 2), and a neighbour FE model (Column 3). All models control for basic demographic variables and prescription-based indicators for comorbid health conditions. For brevity, the table presents only the estimates for three key comorbidities – anxiety/mood disorders, psychotic disorders, and respiratory conditions – while results for all 16 health conditions and control variables are provided in Appendix Tables A3 and A4.

Panel A shows that adolescents with ADHD are significantly less likely to be enrolled in tertiary education at age 20. In the baseline OLS model, ADHD is associated with a 17.6 percentage point reduction in the likelihood of enrolment. This estimate shrinks to 12.0 percentage points in the sibling FE model and 15.8 percentage points in the neighbour FE model.

Panel B examines the effect of ADHD on unemployment benefit receipt. In the OLS model, ADHD is associated with an 8.2 percentage point increase in the probability of receiving unemployment payments. This estimate declines to 4.9 percentage points in the sibling FE model and is slightly larger in the neighbour FE model, equalling 6.5 percentage points.

Overall, the results from both FE approaches indicate that ADHD has a substantial negative association with early adult outcomes, even after accounting for confounders. The sibling FE estimates are consistently smaller than those from the neighbour FE models, which is in line with the expected biases in each approach: sibling models may understate effects due to negative spillovers on non-ADHD siblings, while neighbour models may overstate effects due to residual unobserved family-level confounding. Another explanation is that the variation arises from differences in sample composition. However, we have re-estimated the regressions using a common sample and find a similar pattern of results (Appendix Table A5). Taken together, these results suggest that the true causal effect of adolescent ADHD on educational and labour market outcomes likely lies between the two sets of estimates.

Table 3: Regression of Young Adult Outcomes on Adolescent ADHD

	Simple OLS (1)	Sibling FE (2)	Neighbour FE (3)
A. Tertiary Education			
ADHD	-0.176***	-0.120***	-0.158***
	(0.003)	(0.010)	(0.007)
Anxiety/Mood Disorders	-0.107***	-0.086***	-0.097***
	(0.003)	(0.009)	(0.006)
Psychotic Disorders	-0.114***	-0.118***	-0.119***
	(0.007)	(0.018)	(0.012)
Respiratory Conditions	0.014***	0.003	0.010***
	(0.002)	(0.005)	(0.004)
B. Unemployment Payments			
ADHD	0.082***	0.049***	0.065***
	(0.004)	(0.010)	(0.006)
Anxiety/Mood Disorders	0.061***	0.036***	0.058***
	(0.003)	(0.008)	(0.005)
Psychotic Disorders	-0.013*	-0.051***	-0.017
	(0.008)	(0.019)	(0.012)
Respiratory Conditions	0.013***	0.005	0.011***
	(0.002)	(0.004)	(0.003)
Number of Observations	556,168	161,371	322,168

Notes: Models include additional covariates that are not shown - see Section 4 for a discussion and Appendix Table A3/A4 for the full estimates. Column 1 uses robust standard errors, Column 2 uses clustered standard errors at the family level, Column 3 uses clustered standard errors at the neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

5.2.1 Robustness Checks

Although previous research suggests that most children are diagnosed with (and medically treated for) ADHD by 10-15 years of age, it is possible that ADHD diagnosis or pharmacological treatment occurs in later adolescence and therefore outside of our observation window. We find our results are robust to expanding our window of observation of ADHD prescriptions up until 19 years of age (see Appendix Table A6). However, a limitation of expanding the observation window to 19 years of age is that it increases the probability of reverse causality, for example poor educational achievement in late adolescence may be a reason why children get prescribed ADHD medication in later adolescence.

An additional concern is the possibility that the comparison group consists of adolescents who had ADHD but were yet to be treated, which may attenuate our results. To mitigate this issue, we remove later-treated children from the analysis (i.e., children who *do not* receive a prescription for ADHD in our initial 18-month observation window but who *do* receive a prescription for ADHD medication in later years). Our main results are robust to this change (see Appendix Table A7). We also find that our results remain robust to removing children born outside of Australia, who may not be eligible for subsidised prescriptions, higher education places, or welfare payments (see Appendix Table A8). Our main results are also robust when we include only children and parents who report living in the same location (see Appendix Table A9). This restriction is made because approximately 15% of children report residing in a different neighbourhood than their parent, likely due to lagged address updating in the administrative data.

5.2.2 Role and Relative Impact of Comorbid Health Conditions

A distinctive feature of our empirical strategy is the inclusion of a comprehensive set of controls for other health conditions, proxied using prescription medication records. To assess the importance of these controls, we check the robustness of the results to their exclusion (Appendix Table A10). We find that omitting health condition controls leads to upward-biased estimates of ADHD effects, particularly for tertiary education: the ADHD coefficients are 11–14% larger across specifications. For receipt of unemployment benefits, the ADHD estimate remains similar in the sibling FE model but increases by 12% in the neighbour FE model. These results suggest modest but meaningful confounding, whereby some of the observed association between ADHD and later outcomes is attributable to comorbid conditions.

We next compare the estimated ADHD associations with those of three common comorbidities: anxiety/mood disorders, psychotic disorders, and respiratory conditions. These comparisons help contextualise the magnitude of the ADHD estimates relative to other health-related disadvantages. For both outcomes, the ADHD estimate exceeds that of all three comparison conditions across models. For tertiary education (Table 3, Panel A) and for receipt of unemployment benefits (Panel B) the anxiety/mood disorders estimates are consistently negative and significant, but approximately two-thirds the size of the ADHD estimate. ADHD may interact more directly with institutional settings, such as school discipline, classroom engagement, and behavioural expectations, leading to greater cumulative disadvantage relative to mood or anxiety disorders.

Psychotic disorders also have strong negative associations with tertiary enrolment (Panel A), but these are smaller than those for ADHD. The absence of a positive association between psychotic disorders and unemployment payments (Panel B) is notable: estimates are small and statistically insignificant in the neighbour FE model and significantly negative in the sibling FE model. This likely reflects program substitution. In Appendix Table A11, we show that individuals with psychotic disorders are approximately 30 percentage points more likely to receive the Disability Support Pension (DSP) than an unaffected sibling or neighbour. Since unemployment benefit eligibility in Australia requires job search activity, the lower rate of unemployment payments among individuals with psychotic disorders likely reflects classification as unable to work due to a serious, ongoing health condition.

Finally, respiratory conditions are estimated to have small positive associations with both tertiary education and unemployment receipt in OLS and neighbour FE models, but these associations disappear in sibling FE models. This suggests that the observed associations may reflect unobserved family background characteristics rather than direct causal effects.

5.3 Sex Differences

Previous research documents substantial sex differences in ADHD, including in prevalence, symptom presentation, severity, and treatment patterns. These differences raise the possibility that ADHD may also have heterogeneous effects on educational and labour market outcomes. To investigate this, we re-estimate our main models separately for males and females. In the sibling FE models, we compare brothers with each other and sisters with each other; in the neighbour FE models, we compare males to similar male neighbours and females to similar female neighbours.

Results for tertiary education enrolment are presented in Table 4. Across both identification strategies, the point estimates of ADHD are larger for females: in the neighbour FE model (Column 4), females with ADHD are 21.4 percentage points less likely to be enrolled in tertiary education at age 20 compared to similar female neighbours without ADHD, while for males (Column 2), the corresponding reduction is 14.6 percentage points. However, this difference in point estimates largely reflects underlying sex differences in baseline tertiary enrolment rates. When expressed in relative terms, the reduction is 42.3% for females and 39.9% for males, suggesting that ADHD is associated with similarly large proportional declines in tertiary education enrolment for both sexes.

Table 4: Fixed Effect Regressions of Enrolment in Tertiary Education: Males and Females

	Males		Females	
	Sibling FE (1)	Neighbour FE (2)	Sibling FE (3)	Neighbour FE (4)
ADHD	-0.117***	-0.146***	-0.223***	-0.214***
	(0.016)	(0.007)	(0.031)	(0.016)
Mean Enrolled in Tertiary	0.360	0.366	0.501	0.505
Number of Observations	41,432	163,265	39,924	158,903
Number of Groups	20,542	60,805	19,791	59,549

Notes: Sample restricted to males or females only. Control variables are included but not shown (see Section 4). Clustered standard errors at the family level or neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table 5 presents estimates for the association between adolescent ADHD and receipt of unemployment payments at age 20, separately for males and females. In the neighbour FE models (Columns 2 and 4), the estimated associations are very similar for both sexes: ADHD is associated with a 6.5 percentage point increase in the probability of receiving unemployment benefits for males and a 6.9 percentage point increase for females, with both estimates statistically significant. In contrast, in the sibling FE models, we find a significant estimate for males (Column 1) but not for females (Column 3), despite comparable sample sizes. This pattern differs from what we observed for tertiary education in Table 4, where the ADHD estimates were significant and substantial for both sexes across both FE models.

Any explanation for this discrepancy is therefore likely to be specific to labour market outcomes. One possibility is that labour market participation at age 20 is more influenced by family circumstances for females, such as expectations to assist with caregiving, part-time employment while studying, or informal work within the household. These dynamics may reduce variation in employment outcomes between sisters, making it harder to detect differences associated with ADHD in sibling comparisons. Alternatively, spillover effects related to ADHD may manifest differently in employment than in education. If diagnosed girls have more complex behavioural or emotional symptoms, these may disrupt household functioning in ways that influence their sisters' ability or decision to participate in the labour market. This could attenuate within-family comparisons in employment outcomes even if true differences exist. However, we cannot rule out that the difference reflects greater heterogeneity in female employment pathways at this age. Overall, while the sibling FE estimate for females is not statistically significant, the neighbour FE results suggest that ADHD is associated with similarly sized labour market disadvantages for both sexes by early adulthood.

Table 5: Fixed Effect Regressions of Unemployment Payments: Males and Females

	Males		Females	
	Sibling FE	Neighbour FE	Sibling FE	Neighbour FE
	(1)	(2)	(3)	(4)
ADHD	0.058***	0.065***	0.016	0.069***
	(0.016)	(0.007)	(0.035)	(0.014)
Mean Enrolled in Tertiary	0.122	0.110	0.116	0.109
Number of Observations	41,432	163,265	39,924	158,903
Number of Groups	20,542	60,805	19,791	59,549

Notes: Sample restricted to males or females only. Control variables are included but not shown (see Section 4). Clustered standard errors at the family level or neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

5.4 ADHD and Comorbid Conditions

ADHD frequently co-occurs with other mental and physical health conditions, which may compound its impact on educational and labour market outcomes. However, few studies distinguish between the effects of ADHD alone and those of ADHD combined with other conditions. Understanding whether comorbidity exacerbates disadvantage is important for identifying particularly vulnerable subgroups and for designing targeted support strategies that go beyond single-diagnosis approaches.

We extend the models presented in Table 3 by including interaction terms between ADHD and three common comorbid conditions: anxiety/mood disorders, psychotic disorders, and respiratory conditions. These models allow us to estimate whether the associations between ADHD and later-life outcomes differ depending on the presence of comorbidities. We focus on neighbour FE models in Table 6, as they provide a substantially larger sample and more identifying variation across diagnostic combinations. In addition, spillover effects within families may be more pronounced in cases involving complex comorbidities, meaning that sibling comparisons could attenuate true differences. Neighbour comparisons are less susceptible to this form of bias and therefore more suitable for capturing variation in outcomes across diagnostic profiles. Results from sibling FE models are provided in Appendix Table A12.

For tertiary education enrolment (Table 6, Column 1), we find a statistically significant interaction between ADHD and anxiety/mood disorders. The estimated reduction in enrolment for individuals with ADHD alone is 17.6 percentage points, and for those with an anxiety/mood disorder alone it is 10.2 percentage points. The interaction term between ADHD and anxiety/mood disorders is +7.4 percentage points. This implies that having both conditions is associated with a 20.4 percentage point reduction in enrolment (–0.176 –0.102 + 0.074), relative to neighbours without either condition. Compared to ADHD alone, this reflects a modest additional reduction of 2.8 percentage points, which is only marginally statistically significant ($p < 0.10$). For those with ADHD and a psychotic disorder, the estimated combined reduction in enrolment is 19.7 percentage points (–0.176 –0.157 + 0.136), compared to 17.6 points for ADHD alone. However, the interaction term is not statistically significant, indicating no clear additional disadvantage associated with this comorbidity.

Table 6: Fixed Effect Regressions of ADHD and Comorbid Conditions: Neighbourhood Fixed Effect Models

	Tertiary Education (1)	Unemployment (2)
ADHD	-0.176***	0.080***
	(0.008)	(0.007)
Anxiety/Mood Disorder	-0.102***	0.062***
	(0.006)	(0.005)
Psychotic Disorder	-0.157***	0.01
	(0.015)	(0.014)
Respiratory Conditions	0.010***	0.012***
	(0.004)	(0.003)
ADHD × Anxiety/Mood Disorder	0.074***	-0.056***
	(0.018)	(0.019)
ADHD × Psychotic Disorder	0.136***	-0.093***
	(0.026)	(0.030)
ADHD × Respiratory Condition	-0.003	-0.011
	(0.016)	(0.019)
Number of Observations	322,168	322,168
Number of Groups	120,354	120,354

Notes: Control variables are included but not shown (see Section 2.3). Clustered standard errors at the neighbour level in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Turning to unemployment payments (Table 6, Column 2), we again find only modest differences between individuals with ADHD alone and those with additional conditions. For anxiety/mood disorders, the combined association is an 8.6 percentage point increase in unemployment payments (0.080 + 0.062 – 0.056), compared to 8.0 percentage points for ADHD alone. This difference is not statistically significant.

In contrast, we find a significant negative interaction between ADHD and psychotic disorders. While ADHD alone is associated with an 8.0 percentage point increase in unemployment receipt, individuals with both ADHD and a psychotic disorder have an estimate close to zero (0.080 + 0.010 – 0.093 = –0.003). This likely reflects program substitution: individuals with psychotic disorders are more likely to qualify for the Disability Support Pension, which is not included in our unemployment payment outcome.

Across both outcomes, we find that having ADHD and a comorbid mental health condition results in only modest differences in disadvantage compared to having ADHD alone. This is somewhat surprising given the greater clinical complexity and treatment burden associated with comorbid cases. One interpretation is that ADHD on its own already carries substantial educational and labour market disadvantage, leaving limited room for additional conditions to exert a marginal effect on these early outcomes. It may also reflect that support systems (e.g., school adjustments, welfare eligibility) respond similarly to ADHD with or without additional diagnoses. The findings also suggest that the primary burden of disadvantage is tied to ADHD itself, reinforcing the importance of early intervention and support for adolescents with ADHD regardless of the presence of comorbidities.

6. Discussion and Conclusion

In this paper, we examined how adolescent ADHD is associated with early adult outcomes in education and the labour market. Using sibling and neighbour fixed effect models and controlling for a wide set of comorbid health conditions, we aimed to isolate the association between ADHD and these outcomes while addressing unobserved background heterogeneity. By identifying ADHD through prescription records, our analysis captures cases where symptoms were sufficiently severe to warrant pharmacological treatment, excluding milder or subclinical cases.

Our modelling strategy exploits both sibling comparisons and comparisons with demographically similar neighbours. The sibling FE approach controls for shared family-level confounding but may attenuate estimates if ADHD generates spillover effects that negatively influence the outcomes of unaffected siblings. Neighbour comparisons avoid this form of bias but may be more vulnerable to residual confounding from unobserved family characteristics. The broadly similar estimates across the two models increase our confidence in the robustness of our findings.

We find that adolescents with ADHD are significantly less likely to be enrolled in tertiary education and more likely to be receiving unemployment payments at age 20. The magnitude of these associations is substantial: a 12–16 percentage point reduction in tertiary enrolment and a 5–6 percentage point increase in unemployment benefit receipt. Our education results are similar to that of Klugman et al. (2024) who finds (parent reported) hyperactivity behaviour in the U.S is associated with a 14-percentage point reduction in college enrolment within a sibling pair, although this is weakly significant. Fletcher and Wolfe (2008) also examine longer term educational outcomes, including college attendance, but finds very small and statistically insignificant effects of ADHD symptoms in their siblings FE model. They suggest this may be due to negative sibling spillover effects or compensatory parental behaviour to support children with ADHD in the long term. Our unemployment results are broadly in line with Fletcher (2014) who finds that a reported diagnosis of ADHD is associated with a 12-14 percentage point reduction in employment in adults (average age of 30) and 15-17 percentage point reduction in social assistance receipt. These relatively large effects may in part be due to the study cohort growing up during a period (1980's to early 1990s) when access to ADHD medication (and other support services) was less common.

Notably, our estimated impact of ADHD is greater than that for other common conditions such as anxiety/mood disorders and psychotic disorders. While this may be surprising given the severity typically associated with psychotic disorders, our results likely reflect the disruptive effects of ADHD on learning and behaviour across school years, as well as the potential benefits of effective pharmacological treatment for other conditions.

Although females with ADHD have higher overall rates of tertiary enrolment than males with ADHD, we find the relative size of the ADHD association is similar across sexes; both males and females with ADHD experience about a 40% reduction in tertiary enrolment relative to peers of the same sex. This suggests that despite concerns about underdiagnosis in girls, and the possibility that girls diagnosed represent more severe cases, the relative disadvantage associated with ADHD appears consistent across sexes. The neighbour FE estimates also suggest similar estimates for unemployment receipt across sexes.

A key contribution of the paper is our analysis of comorbidities. ADHD commonly co-occurs with other mental health conditions, yet few studies examine whether outcomes differ for those with ADHD alone versus ADHD and another diagnosis. We find little evidence that comorbid conditions substantially worsen outcomes beyond ADHD alone. For example, the estimated reduction in tertiary enrolment for those with both ADHD and an anxiety/mood disorder is only marginally larger than for ADHD alone, and not statistically significant. Similarly, while we find a significant interaction between ADHD and psychotic disorders for unemployment payment receipt, this likely reflects higher rates of Disability Support Pension receipt among this group, rather than better labour market outcomes. These results challenge the view that comorbidity necessarily compounds disadvantage and suggest that, at least for some early adult outcomes, ADHD itself plays a dominant role.

These findings highlight the potential for large social and economic returns from investing in better support for adolescents with ADHD. International evidence suggests that behavioural management programs, particularly those embedded within schools and focused on skill-building with performance feedback, are among the most effective psychosocial interventions for children with ADHD (Evans et al., 2018). However, in Australia, school systems offer only limited specialised support for students with ADHD (Zendarski et al., 2020), and ADHD alone does not qualify for the National Disability Insurance Scheme (NDIS). The results of this study highlight that ADHD is a serious condition, and even among those who receive pharmacological treatment, there are real socioeconomic consequences in young adulthood. Without targeted and sustained intervention, the long-term costs of ADHD to individuals, families, and society are likely to remain high.

References

Abdelnour, E., Jansen, M. O., & Gold, J. A. (2022). ADHD Diagnostic Trends: Increased Recognition or Overdiagnosis? *Missouri Medicine, 119*(5), 467-473.

ADHD Guideline Development Group. (2022). *Australian evidence-based clinical practice guideline for Attention Deficit Hyperactivity*. Australian ADHD Professionals Association. https://adhdguideline.aadpa.com.au/

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders: DSM-5-TR*. American Psychiatric Association. https://doi.org/https://doi.org/10.1176/appi.books.9780890425787

Arnold, L. E., Hodgkins, P., Kahle, J., Madhoo, M., & Kewley, G. (2020). Long-term outcomes of ADHD: Academic achievement and performance. *Journal of Attention Disorders, 24*(1), 73-85. https://doi.org/10.1177/1087054714566076

Baker, M., Huefner, J. C., Bellonci, C., Hilt, R., & Carlson, G. A. (2021). Polypharmacy in the Management of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents: A Review and Update. *Journal of Child and Adolescent Psychopharmacology, 31*(3), 148-163. https://doi.org/10.1089/cap.2020.0162

Black, S. E., Breining, S., Figlio, D. N., Guryan, J., Karbownik, K., Nielsen, H. S., Roth, J., & Simonsen, M. (2020). Sibling spillovers. *The Economic Journal, 131*(633), 101-128. https://doi.org/10.1093/ej/ueaa074

Breining, S. N. (2014). The presence of ADHD: Spillovers between siblings. *Economics Letters, 124*(3), 469-473. https://doi.org/https://doi.org/10.1016/j.econlet.2014.07.010

Bruno, C., Havard, A., Gillies, M. B., Coghill, D., Brett, J., Guastella, A. J., Pearson, S.-A., & Zoega, H. (2023). Patterns of attention deficit hyperactivity disorder medicine use in the era of new non-stimulant medicines: A population-based study among Australian children and adults (2013–2020). *Australian & New Zealand Journal of Psychiatry, 57*(5), 675-685. https://doi.org/10.1177/00048674221114782

Chorniy, A., & Kitashima, L. (2016). Sex, drugs, and ADHD: The effects of ADHD pharmacological treatment on teens' risky behaviors. *Labour Economics, 43*, 87-105. https://doi.org/https://doi.org/10.1016/j.labeco.2016.06.014

Conti, G., Heckman, J., & Urzua, S. (2010). The education-health gradient. *American Economic Review, 100*(2), 234-238. https://doi.org/10.1257/aer.100.2.234

Cortese, S., Sun, S., Zhang, J., Sharma, E., Chang, Z., Kuja-Halkola, R., Almqvist, C., Larsson, H., & Faraone, S. V. (2018). Association between attention deficit hyperactivity disorder and asthma: A systematic review and meta-analysis and a Swedish population-based study. *The Lancet Psychiatry, 5*(9), 717-726. https://doi.org/10.1016/S2215-0366(18)30224-4

Currie, J., & Stabile, M. (2006). Child mental health and human capital accumulation: The case of ADHD. *Journal of Health Economics, 25*(6), 1094-1118. https://doi.org/https://doi.org/10.1016/j.jhealeco.2006.03.001

Currie, J., Stabile, M., & Jones, L. (2014). Do stimulant medications improve educational and behavioral outcomes for children with ADHD? *Journal of Health Economics, 37*, 58-69. https://doi.org/https://doi.org/10.1016/j.jhealeco.2014.05.002

Currie, J., Stabile, M., Manivong, P., & Roos, L. L. (2010). Child health and young adult outcomes. *The Journal of Human Resources, 45*(3), 517-548. http://www.jstor.org/stable/25703468

Dalsgaard, S., Nielsen, H. S., & Simonsen, M. (2014). Consequences of ADHD medication use for children's outcomes. *Journal of Health Economics, 37*, 137-151. https://doi.org/https://doi.org/10.1016/j.jhealeco.2014.05.005

Derks, E. M., Hudziak, J. J., & Boomsma, D. I. (2007). Why more boys than girls with ADHD receive treatment: A study of Dutch twins. *Twin Research and Human Genetics, 10*(5), 765-770. https://doi.org/10.1375/twin.10.5.765

Efron, D., Mulraney, M., Sciberras, E., Hiscock, H., Hearps, S., & Coghill, D. (2020). Patterns of long-term ADHD medication use in Australian children. *Archives of Disease in Childhood, 105*(6), 593. https://doi.org/10.1136/archdischild-2019-317997

Evans, S. W., Owens, J. S., Wymbs, B. T., & Ray, A. R. (2018). Evidence-Based Psychosocial Treatments for Children and Adolescents With Attention Deficit/Hyperactivity Disorder. *Journal of Clinical Child & Adolescent Psychology, 47*(2), 157-198. https://doi.org/10.1080/15374416.2017.1390757

Faraone, S. V., Bellgrove, M. A., Brikell, I., Cortese, S., Hartman, C. A., Hollis, C., Newcorn, J. H., Philipsen, A., Polanczyk, G. V., Rubia, K., Sibley, M. H., & Buitelaar, J. K. (2024). Attention-deficit/hyperactivity disorder. *Nature Reviews Disease Primers, 10*(1), 11. https://doi.org/10.1038/s41572-024-00495-0

Faraone, S. V., Biederman, J., & Mick, E. (2006). The age-dependent decline of attention deficit hyperactivity disorder: A meta-analysis of follow-up studies. *Psychological Medicine, 36*(2), 159-165. https://doi.org/10.1017/S003329170500471X

Fleming, M., Fitton, C. A., Steiner, M. F. C., McLay, J. S., Clark, D., King, A., Mackay, D. F., & Pell, J. P. (2017). Educational and health outcomes of children treated for attention-deficit/hyperactivity disorder. *JAMA Pediatrics, 171*(7), e170691. https://doi.org/10.1001/jamapediatrics.2017.0691

Fletcher, J., Hair, N. L., & Wolfe, B. L. (2012). Am I my brother's keeper? Sibling spillover effects: The case of developmental disabilities and externalizing behavior. *National Bureau of Economic Research*. https://doi.org/10.3386/w18279

Fletcher, J., & Wolfe, B. (2008). Child mental health and human capital accumulation: The case of ADHD revisited. *Journal of Health Economics, 27*(3), 794-800. https://doi.org/https://doi.org/10.1016/j.jhealeco.2007.10.010

Fletcher, J., & Wolfe, B. (2009). Long-term consequences of childhood ADHD on criminal activities. *Journal of Mental Health Policy and Economics, 12*(3), 119-138. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3398051

Fletcher, J. M. (2014). The effects of childhood ADHD on adult labor market outcomes. *Health Economics, 23*(2), 159-181. https://doi.org/https://doi.org/10.1002/hec.2907

Franke, B., Michelini, G., Asherson, P., Banaschewski, T., Bilbow, A., Buitelaar, J. K., Cormand, B., Faraone, S. V., Ginsberg, Y., Haavik, J., Kuntsi, J., Larsson, H., Lesch, K.-P., Ramos-Quiroga, J. A., Réthelyi, J. M., Ribases, M., & Reif, A. (2018). Live fast, die young? A review on the developmental trajectories of ADHD across the lifespan. *European Neuropsychopharmacology, 28*(10), 1059-1088. https://doi.org/https://doi.org/10.1016/j.euroneuro.2018.08.001

Gedikli, C., Mariella, M., Sara, C., Mark, B., & and Watson, D. (2023). The relationship between unemployment and wellbeing: an updated meta-analysis of longitudinal evidence. *European Journal of Work and Organizational Psychology, 32*(1), 128-144. https://doi.org/10.1080/1359432X.2022.2106855

Gordon, C. T., & Fabiano, G. A. (2019). The transition of youth with ADHD into the workforce: Review and future directions. *Clinical Child and Family Psychology Review, 22*(3), 316-347. https://doi.org/10.1007/s10567-019-00274-4

Hartwig, C. A. M., Robiyanto, R., de Vos, S., Bos, J. H. J., van Puijenbroek, E. P., Hak, E., & Schuiling-Veninga, C. C. M. (2022). In utero antidepressant exposure not associated with ADHD in the offspring: A case control sibling design. *Frontiers in Pharmacology, 13*. https://doi.org/10.3389/fphar.2022.1000018

Haveman, R., & Smeeding, T. (2006). The role of higher education in social mobility. *The Future of Children, 16*(2), 125-150. http://www.jstor.org/stable/3844794

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science, 312*(5782), 1900-1902. https://doi.org/10.1126/science.1128898

Hinshaw, S. P., Nguyen, P. T., O'Grady, S. M., & Rosenthal, E. A. (2022). Annual Research Review: Attention-deficit/hyperactivity disorder in girls and women - Underrepresentation, longitudinal processes, and key directions. *Journal of Child Psychology and Psychiatry, 63*(4), 484-496. https://doi.org/https://doi.org/10.1111/jcpp.13480

Jensen, C. M., & Steinhausen, H.-C. (2015). Comorbid mental disorders in children and adolescents with attention-deficit/hyperactivity disorder in a large nationwide study. *ADHD Attention Deficit and Hyperactivity Disorders, 7*(1), 27-38. https://doi.org/10.1007/s12402-014-0142-1

Karanges, E. A., Stephenson, C. P., & McGregor, I. S. (2014). Longitudinal trends in the dispensing of psychotropic medications in Australia from 2009–2012: Focus on children, adolescents and prescriber specialty. *Australian & New Zealand Journal of Psychiatry, 48*(10), 917-931. https://doi.org/10.1177/0004867414538675

Keilow, M., Holm, A., & Fallesen, P. (2018). Medical treatment of Attention Deficit/Hyperactivity Disorder (ADHD) and children's academic performance. *PLOS ONE, 13*(11), e0207905. https://doi.org/10.1371/journal.pone.0207905

Kieling, C., Kieling, R. R., Rohde, L. A., Frick, P. J., Moffitt, T., Nigg, J. T., Tannock, R., & Castellanos, F. X. (2010). The age at onset of Attention Deficit Hyperactivity Disorder. *American Journal of Psychiatry, 167*(1), 14-16. https://doi.org/10.1176/appi.ajp.2009.09060796

Klau, J., Bernardo, C. D. O., Gonzalez-Chica, D. A., Raven, M., & Jureidini, J. (2021). Trends in prescription of psychotropic medications to children and adolescents in Australian primary care from 2011 to 2018. *Australian & New Zealand Journal of Psychiatry, 56*(11), 1477-1490. https://doi.org/10.1177/00048674211067720

Klugman, J., Schnittker, J., & Vazquez, V. (2024). Childhood mental health and educational attainment: Within-family associations in a late 20th Century U.S. birth cohort. *Social Science & Medicine, 362*, 117417. https://doi.org/https://doi.org/10.1016/j.socscimed.2024.117417

Larsson, H., Sariaslan, A., Långström, N., D'Onofrio, B., & Lichtenstein, P. (2014). Family income in early childhood and subsequent attention deficit/hyperactivity disorder: a quasi-experimental study. *Journal of Child Psychology and Psychiatry, 55*(5), 428-435. https://doi.org/https://doi.org/10.1111/jcpp.12140

Lawrence, D., Johnson, S., Hafekost, J., Boterhoven de Haan, K., Sawyer, M., Ainley, J., & Zubrick, S. R. (2015). *The mental health of children and adolescents: Report on the second Australian child and adolescent survey of mental health and wellbeing*. https://www.health.gov.au/resources/publications/the-mental-health-of-children-and-adolescents

Loe, I. M., & Feldman, H. M. (2007). Academic and educational outcomes of children with ADHD. *Journal of Pediatric Psychology, 32*(6), 643-654. https://doi.org/10.1093/jpepsy/jsl054

McGrath, J. J., Al-Hamzawi, A., Alonso, J., Altwaijri, Y., Andrade, L. H., Bromet, E. J., Bruffaerts, R., de Almeida, J. M. C., Chardoul, S., Chiu, W. T., Degenhardt, L., Demler, O. V., Ferry, F., Gureje, O., Haro, J. M., Karam, E. G., Karam, G., Khaled, S. M., Kovess-Masfety, V., Magno, M., Medina-Mora, M. E., Moskalewicz, J., Navarro-Mateu, F., Nishi, D., Plana-Ripoll, O., Posada-Villa, J., Rapsey, C., Sampson, N. A., Stagnaro, J. C., Stein, D. J., ten Have, M., Torres, Y., Vladescu, C., Woodruff, P. W., Zarkov, Z., Kessler, R. C., Aguilar-Gaxiola, S., Al-Hamzawi, A., Alonso, J., Altwaijri, Y. A., Andrade, L. H., Atwoli, L., Benjet, C., Bromet, E. J., Bruffaerts, R., Bunting, B., Caldas-de-Almeida, J. M., Cardoso, G., Chardoul, S., Cía, A. H., Degenhardt, L., De Girolamo, G., Gureje, O., Haro, J. M., Harris, M. G., Hinkov, H., Hu, C.-y., De Jonge, P., Karam, A. N., Karam, E. G., Karam, G., Kazdin, A. E., Kawakami, N., Kessler, R. C., Kiejna, A., Kovess-Masfety, V., McGrath, J. J., Medina-Mora, M. E., Moskalewicz, J., Navarro-Mateu, F., Nishi, D., Piazza, M., Posada-Villa, J., Scott, K. M., Stagnaro, J. C., Stein, D. J., Ten Have, M., Torres, Y., Viana, M. C., Vigo, D. V., Vladescu, C., Williams, D. R., Woodruff, P., Wojtyniak, B., Xavier, M., & Zaslavsky, A. M. (2023). Age of onset and cumulative risk of mental disorders: a cross-national analysis of population surveys from 29 countries. *The Lancet Psychiatry, 10*(9), 668-681. https://doi.org/https://doi.org/10.1016/S2215-0366(23)00193-1

Mechler, K., Banaschewski, T., Hohmann, S., & Häge, A. (2022). Evidence-based pharmacological treatment options for ADHD in children and adolescents. *Pharmacology & Therapeutics, 230*, 107940. https://doi.org/https://doi.org/10.1016/j.pharmthera.2021.107940

Miller, M., Musser, E. D., Young, G. S., Olson, B., Steiner, R. D., & Nigg, J. T. (2019). Sibling recurrence risk and cross-aggregation of Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorder. *JAMA Pediatr, 173*(2), 147-152. https://doi.org/10.1001/jamapediatrics.2018.4076

Mowlem, F. D., Rosenqvist, M. A., Martin, J., Lichtenstein, P., Asherson, P., & Larsson, H. (2019). Sex differences in predicting ADHD clinical diagnosis and pharmacological treatment. *European Child & Adolescent Psychiatry, 28*(4), 481-489. https://doi.org/10.1007/s00787-018-1211-3

MTA Cooperative Group. (1999). A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. *Archives of General Psychiatry, 56*(12), 1073-1086. https://doi.org/10.1001/archpsyc.56.12.1073

Persson, P., Qiu, X., & Rossin-Slater, M. (2021). Family spillover effects of marginal diagnoses: The case of ADHD. *National Bureau of Economic Research Working Paper Series, No. 28334*. https://doi.org/10.3386/w28334

Polanczyk, G. V., Willcutt, E. G., Salum, G. A., Kieling, C., & Rohde, L. A. (2014). ADHD prevalence estimates across three decades: An updated systematic review and meta-regression analysis. *International Journal of Epidemiology, 43*(2), 434-442. https://doi.org/10.1093/ije/dyt261

Raman, S. R., Man, K. K. C., Bahmanyar, S., Berard, A., Bilder, S., Boukhris, T., Bushnell, G., Crystal, S., Furu, K., KaoYang, Y.-H., Karlstad, Ø., Kieler, H., Kubota, K., Lai, E. C.-C., Martikainen, J. E., Maura, G., Moore, N., Montero, D., Nakamura, H., Neumann, A., Pate, V., Pottegård, A., Pratt, N. L., Roughead, E. E., Macias Saint-Gerons, D., Stürmer, T., Su, C.-C., Zoega, H., Sturkenbroom, M. C. J. M., Chan, E. W., Coghill, D., Ip, P., & Wong, I. C. K. (2018). Trends in attention-deficit hyperactivity disorder medication use: A retrospective observational study using population-based databases. *The Lancet Psychiatry, 5*(10), 824-835. https://doi.org/10.1016/S2215-0366(18)30293-1

Renahy, E., Mitchell, C., Molnar, A., Muntaner, C., Ng, E., Ali, F., & O'Campo, P. (2018). Connections between unemployment insurance, poverty and health: A systematic review. *European Journal of Public Health, 28*(2), 269-275. https://doi.org/10.1093/eurpub/ckx235

Russell, A. E., Ford, T., Williams, R., & Russell, G. (2016). The association between socioeconomic disadvantage and Attention Deficit/Hyperactivity Disorder (ADHD): A systematic review. *Child Psychiatry & Human Development, 47*(3), 440-458. https://doi.org/10.1007/s10578-015-0578-3

Shaw, M., Hodgkins, P., Caci, H., Young, S., Kahle, J., Woods, A. G., & Arnold, L. E. (2012). A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: Effects of treatment and non-treatment. *BMC Medicine, 10*(1), 99. https://doi.org/10.1186/1741-7015-10-99

Sultan, R. S., Wang, S., Crystal, S., & Olfson, M. (2019). Antipsychotic treatment among youths with Attention-Deficit/Hyperactivity Disorder. *JAMA network open, 2*(7), e197850. https://doi.org/10.1001/jamanetworkopen.2019.7850

Van der Oord, S., Prins, P. J. M., Oosterlaan, J., & Emmelkamp, P. M. G. (2008). Efficacy of methylphenidate, psychosocial treatments and their combination in school-aged children with ADHD: A meta-analysis. *Clinical Psychology Review, 28*(5), 783-800. https://doi.org/https://doi.org/10.1016/j.cpr.2007.10.007

Woessmann, L. (2016). The economic case for education. *Education Economics, 24*(1), 3-32. https://doi.org/10.1080/09645292.2015.1059801

Zendarski, N., Sciberras, E., Mensah, F., & Hiscock, H. (2020). Factors associated with educational support in young adolescents with ADHD. *Journal of Attention Disorders, 24*(5), 750-757. https://doi.org/10.1177/1087054718804351

Online Supplementary Appendix

Appendix A: Recording of ADHD Prescriptions

Our measure of ADHD is based on pharmaceutical records from Australia's Pharmaceutical Benefits Scheme (PBS). A limitation of the PBS dataset is that, prior to April 2012, the PBS database only captured prescriptions that attracted a government subsidy (i.e. those with prices that exceeded the patient co-payment threshold). Prescriptions priced below this threshold were paid entirely out-of-pocket and were therefore not recorded. In 2012, the patient co-payment amount was approximately AUD 35 for general patients and about AUD 6 for eligible concession card holders. This under-recording primarily affected general patients (individuals without concession cards) because they faced a higher co-payment threshold and were more likely to pay the full cost of a dispensed medication themselves. Given a relatively high proportion of adolescents with ADHD come from lower socioeconomic backgrounds, they are more likely to reside in families with concession cards and therefore more likely to have complete pharmaceutical records captured prior to April 2012.

While some ADHD prescriptions are missing from the PBS data prior to April 2012, the impact on our analysis is likely to be modest. Among the ADHD medications available during this period (Methylphenidate, Dexamfetamine, and Atomoxetine), Methylphenidate accounted for the vast majority of prescriptions among children and adolescents (Australian Institute of Health and Welfare 2025). Based on publicly available PBS data from 2012–13 (Australian Government Department of Health and Ageing 2024; Australian Institute of Health and Welfare 2025), which is the first year that full information on all dispensed prescriptions were recorded, we estimate that only around 9.6% of all Methylphenidate prescriptions were under the co-payment threshold (for either general or concession card holders). Note that this proportion is for all patients of all age groups.

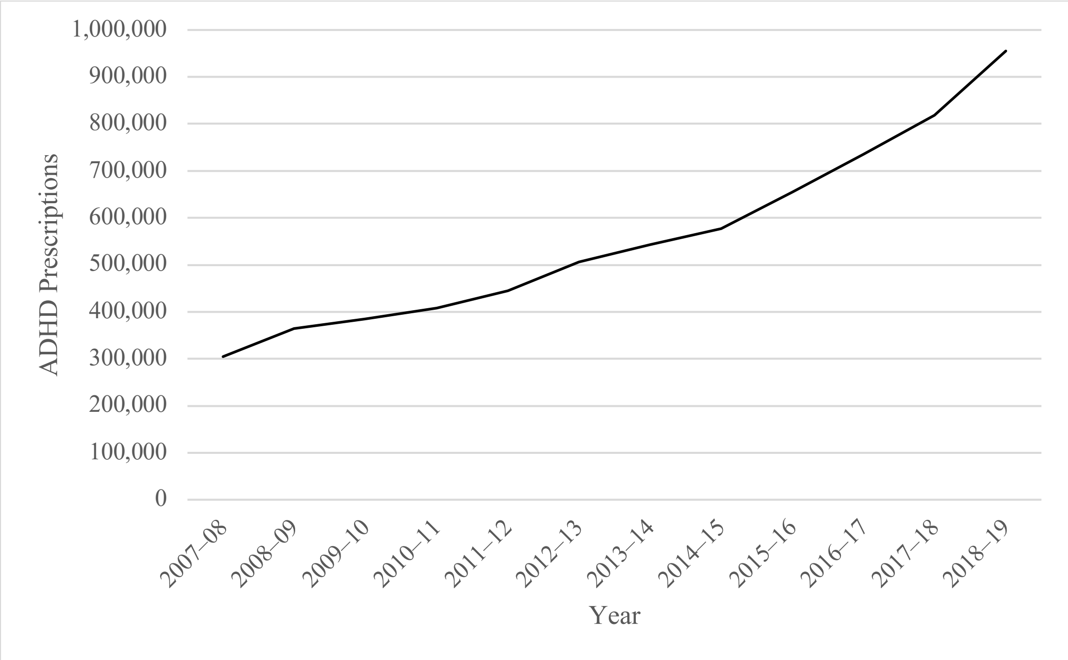
To assess the extent of this potential issue, we plotted annual trends in the number of ADHD prescriptions for over time for 0–17-year-olds. Figure A1 show a smooth, continuous increase in prescription volumes across years, with no evidence of a structural break or abrupt jump around 2012. If a large share of prescriptions had previously been missing and began to be recorded after the policy change, we would expect to see a visible increase in that year. The absence of such a change provides reassurance that under-recording was modest and that our ADHD exposure measure captures the overwhelming majority of pharmacologically treated cases. Any resulting measurement error is therefore expected to be minor.

References:

Australian Institute of Health and Welfare (2025), ADHD medications dispensed 2004-05 to 2023-24, AIHW, Canberra. Accessed 26 June 2025. https://www.aihw.gov.au/mental-health/topic-areas/mental-health-prescriptions/adhd-medications-dispensed-overtime

Australian Government Department of Health and Ageing (2024), PBS/RPBS Under Co-payment Prescriptions Data 2023-24, Australian Government, Canberra. Accessed 26 June 2025. https://www.pbs.gov.au/pbs/statistics/under-co-payment/ucp-data-report?

Figure A1: Number of ADHD Prescriptions – 0-17 years: 2007/08 – 2018/19



Source: Australian Institute of Health and Welfare (2025)

Appendix Tables

Table A1: Neighbour Fixed Effect Regressions: Group Analysis

	Mother's Work Hours (1)	Household Income (2)	Mother's Age (3)
ADHD	-0.164	-2.666	-0.093
	(0.230)	(7.092)	(0.086)
Fixed Effects	Neighbours	Neighbours	Neighbours
Mean	22.50	832.06	43.12
Number of Observations	306,954	278,013	311,016
Number of Groups	118,577	115,021	118,881

Notes: Table shows neighbourhood fixed effect models with mother's work hours, weekly household income (equivalised) and mother's age (measured in 2011) as the outcome variables. Control variables included in the model are discussed in Section 4. Sample size varies due to missing data. Clustered standard errors at the neighbour level, in parentheses. ****p*<0.01; ***p*<0.05; **p*<0.10.

Table A2: Sample Means and Standard Deviations by Children's ADHD Status

	No ADHD (1)	ADHD - Never Medicated (2)	ADHD - Medicated (3)	P-value (Col 2 vs. Col 3) (4)
Child Male	.50 (.50)	.65 (.48)	.77 (.42)	0.023
Child Australian Born	.98 (.12)	1.00 (.00)	.99 (.07)	0.447
Main Parent has Tertiary Degree	.38 (.48)	.33 (.47)	.30 (.46)	0.529
Child in Single Parent Family	.08 (.28)	.14 (.35)	.13 (.33)	0.649
Main Parent Employed	.65 (.48)	.55 (.50)	.71 (.45)	0.004
Parent Born Outside Australia	.39 (.49)	.41 (.49)	.34 (.48)	0.259
Parent Own Home	.79 (.40)	.74 (.44)	.70 (.46)	0.500
Child Hyperactivity Score (Parent Rating)	3.16 (2.11)	5.07 (2.29)	5.51 (2.57)	0.156
Sample Size	5,728	111	191	

Notes: Data from the Longitudinal Study of Australian Children (LSAC). Sample consists of children from the "Birth" Cohort and "Kindergarten" Cohort from ages 4/5 to 14/15, and who participated in each wave of data collection. ADHD status is measured via parent report of child's ongoing ADD/ADHD. ADHD medication use is determined by parent report of child has ever taken medication for ADD/ADHD. Variables presented in the table were measured at age 4/5, and children who had started ADHD medication prior to age 4/5 were omitted (*n* = 11). Main parent refers to the primary parent, which in most cases is the child's mother. Child hyperactivity score calculated via the Strengths and Difficulties Questionnaire (SDQ), completed by the main parent, with higher scores indicating more hyperactivity (score range 0-10). Column 4 reports the p-values from t-tests comparing the estimates in Column 2 and Column 3.

Table A3 - Regression Models for Enrolment in Tertiary Education at Age 20 – Full Results

	OLS Full Sample		Sibling FE		Neighbours FE	
ADHD	-0.176***	(0.003)	-0.120***	(0.010)	-0.158***	(0.007)
Anxiety/Mood Disorders	-0.107***	(0.003)	-0.086***	(0.009)	-0.097***	(0.006)
Psychotic Disorders	-0.114***	(0.007)	-0.118***	(0.018)	-0.119***	(0.012)
Respiratory Conditions	0.014***	(0.002)	0.003	(0.005)	0.010***	(0.004)
Child Male	-0.146***	(0.001)	-0.137***	(0.003)	-	
Child Age (REF = 12)						
13	0.002	(0.002)	0.006	(0.004)	0.003	(0.003)
14	0.005***	(0.002)	0.022***	(0.006)	0.010***	(0.003)
15	0.011***	(0.002)	0.037***	(0.008)	0.013***	(0.003)
Child Australian Born	-0.055***	(0.002)	0.001	(0.013)	-0.034***	(0.004)
Number Older Siblings	-0.031***	(0.001)	-0.004	(0.020)	-0.035***	(0.001)
Number Younger Siblings	-0.007***	(0.001)	0.019	(0.020)	-0.001	(0.001)
Number Same-Age Siblings	-0.032***	(0.006)	-		-0.035***	(0.010)
Number Other Household Members	-0.048***	(0.002)	-		-0.039***	(0.004)
Main Parent has Tertiary Degree	0.266***	(0.002)	-		-	
Child in Single Parent Family	-0.069***	(0.001)	-		-	
Main Parent Employed	0.013***	(0.001)	-		-	
Parent Born Outside Australia	0.131***	(0.001)	-		-	
Parents Owns Home	0.137***	(0.001)	-		0.116***	(0.003)
Alimentary tract and metabolism	-0.001	(0.003)	-0.011	(0.007)	-0.010**	(0.005)
Anti-infectives for systemic use	-0.026***	(0.001)	-0.017***	(0.003)	-0.024***	(0.002)
Antineoplastic and immunomodulating agents	0.019	(0.014)	0.049	(0.031)	0.022	(0.023)
Antiparasitic products, insecticides and repellents	-0.153***	(0.005)	-0.024*	(0.013)	-0.098***	(0.010)
Blood and blood forming agents	-0.002	(0.007)	0.005	(0.017)	0.009	(0.012)
Cardiovascular system	0.035***	(0.004)	0.015	(0.010)	0.022***	(0.007)
Dermatologicals	0.054***	(0.002)	0.010*	(0.005)	0.030***	(0.003)
Genito urinary systems and sex hormones	-0.134***	(0.003)	-0.020***	(0.007)	-0.083***	(0.005)
Musculo-skeletal system	-0.017***	(0.004)	-0.005	(0.009)	-0.017***	(0.006)
Nervous System – Remaining	-0.048***	(0.003)	-0.032***	(0.007)	-0.033***	(0.005)
Nervous System – Sedatives	-0.008	(0.015)	-0.039	(0.039)	-0.015	(0.026)
Sensory Organs	-0.013***	(0.003)	-0.013**	(0.006)	-0.017***	(0.004)
Systemic hormonal preparations	-0.020***	(0.003)	0.000	(0.008)	-0.012**	(0.005)
Observations	556,168		161,371		322,168	
Groups			79,280		120,354	

Notes: Standard errors shown in parentheses. Column 1 uses robust standard errors, Column 2 uses clustered standard errors at the family level, Column 3 uses clustered standard errors at the neighbour level. ****p*<0.01; ***p*<0.05; **p*<0.10.

Table A4: Regression Models for Receipt of Unemployment at Age 20 – Full Results

	OLS Full Sample		Sibling FE		Neighbours FE	
ADHD	0.082***	(0.004)	0.049***	(0.010)	0.065***	(0.006)
Anxiety/Mood Disorders	0.061***	(0.003)	0.036***	(0.008)	0.058***	(0.005)
Psychotic Disorders	-0.013*	(0.008)	-0.051***	(0.019)	-0.017	(0.012)
Respiratory Conditions	0.013***	(0.002)	0.005	(0.004)	0.011***	(0.003)
Child Male	0.006***	(0.001)	0.002	(0.002)	-	
Child Age (REF = 12)						
13	0.005***	(0.001)	-0.001	(0.003)	0.004**	(0.002)
14	0.017***	(0.001)	0.011**	(0.005)	0.016***	(0.002)
15	0.023***	(0.001)	0.010*	(0.006)	0.019***	(0.002)
Child Australian Born	0.029***	(0.001)	-0.009	(0.009)	0.016***	(0.003)
Number Older Siblings	0.000	(0.001)	0.013	(0.016)	0.001	(0.001)
Number Younger Siblings	0.007***	(0.001)	0.024	(0.015)	0.004***	(0.001)
Number Same-Age Siblings	-0.003	(0.004)	-		0.002	(0.006)
Number Other Household Members	0.031***	(0.002)	-		0.027***	(0.003)
Main Parent has Tertiary Degree	-0.047***	(0.001)	-		-	
Child in Single Parent Family	0.082***	(0.001)	-		-	
Main Parent Employed	-0.079***	(0.001)	-		-	
Parent Born Outside Australia	-0.015***	(0.001)	-		-	
Parents Owns Home	-0.110***	(0.001)	-		-0.080***	(0.002)
Alimentary tract and metabolism	0.016***	(0.002)	0.016***	(0.006)	0.012***	(0.004)
Anti-infectives for systemic use	0.014***	(0.001)	0.001	(0.002)	0.010***	(0.001)
Antineoplastic and immunomodulating agents	-0.021**	(0.010)	0.01	(0.020)	-0.02	(0.014)
Antiparasitic products, insecticides and repellents	0.147***	(0.008)	0.013	(0.022)	0.094***	(0.013)
Blood and blood forming agents	0.028***	(0.006)	0.022	(0.015)	0.025**	(0.010)
Cardiovascular system	-0.012***	(0.003)	0.001	(0.007)	-0.012**	(0.005)
Dermatologicals	-0.011***	(0.001)	-0.008**	(0.004)	-0.003	(0.002)
Genito urinary systems and sex hormones	0.024***	(0.002)	-0.007	(0.006)	0.008**	(0.004)
Musculo-skeletal system	0.022***	(0.003)	-0.003	(0.008)	0.015***	(0.005)
Nervous System – Remaining	0.009***	(0.002)	0.000	(0.006)	0.001	(0.004)
Nervous System – Sedatives	0.018	(0.014)	0.023	(0.034)	0.015	(0.023)
Sensory Organs	0.013***	(0.002)	-0.001	(0.005)	0.013***	(0.003)
Systemic hormonal preparations	0.009***	(0.003)	-0.002	(0.006)	-0.003	(0.004)
Observations	556,168		161,371		322,168	
Groups			79,280		120,354	

Notes: Standard errors shown in parentheses. Column 1 uses robust standard errors, Column 2 uses clustered standard errors at the family level, Column 3 uses clustered standard errors at the neighbour level. ***p<0.01; **p<0.05; *p<0.10.

Table A5: Fixed Effect Regressions of Outcomes – ADHD Children Only

	Tertiary Education (1)	Tertiary Education (2)	Unemployment (3)	Unemployment (4)
ADHD	-0.134***	-0.166***	0.050***	0.084***
	(0.017)	(0.013)	(0.017)	(0.012)
Fixed Effects	Siblings	Neighbours	Siblings	Neighbours
Mean	0.228	0.368	0.210	0.123
Number of Observations	2,617	5,675	2,617	5,675
Number of Groups	1,271	1,262	1,271	1,262

Notes: Control variables are included but not shown (see Section 4). Analysis includes children with ADHD who appear in both the sibling FE models and neighbour FE models. Clustered standard errors at the family or neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table A6: Fixed Effect Regressions of Outcomes – ADHD up to Age 19

	Tertiary (1)	Tertiary (2)	Unemployment (3)	Unemployment (4)
ADHD	-0.129***	-0.142***	0.053***	0.064***
	(0.009)	(0.006)	(0.008)	(0.005)
Fixed Effects	Siblings	Neighbours	Siblings	Neighbours
Number of Observations	161,371	322,168	161,371	322,168
Number of Groups	79,280	120,354	79,280	120,354

Notes: Control variables are not shown (see Section 4). ADHD status observed between age 12-15 until age 19. Clustered standard errors at the family or neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table A7: Fixed Effect Regressions of Outcomes – Later Diagnosed Cases Removed

	Tertiary (1)	Tertiary (2)	Unemployment (3)	Unemployment (4)
ADHD	-0.121***	-0.158***	0.054***	0.066***
	(0.010)	(0.007)	(0.010)	(0.006)
Fixed Effects	Siblings	Neighbours	Siblings	Neighbours
Number of Observations	159,408	318,425	159,408	318,425
Number of Groups	79,192	120,319	79,192	120,319

Notes: Control variables are not shown (see Section 4). Children who are later diagnosed with ADHD are not included in this analysis. Clustered standard errors at the family or matched-neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table A8: Fixed Effect Regressions of Outcomes – Australian Born Children Only

	Tertiary (1)	Tertiary (2)	Unemployment (3)	Unemployment (4)
ADHD	-0.115***	-0.151***	0.051***	0.063***
	(0.010)	(0.007)	(0.010)	(0.007)
Fixed Effects	Siblings	Neighbours	Siblings	Neighbours
Number of Observations	144,836	288,607	144,836	288,607
Number of Groups	72,011	115,350	72,011	115,350

Notes: Control variables are not shown (see Section 4). Analysis restricted to children born in Australia. Clustered standard errors at the family level or neighbour level, in parentheses. ****p*<0.01; ***p*<0.05; **p*<0.10.

Table A9: Fixed Effect Regressions of Outcome – Parent and Child Matched Address

	Tertiary (1)	Unemployment (2)
ADHD	-0.176***	0.067***
	(0.008)	(0.007)
Number of Observations	269,282	269,282
Number of Groups	113,850	113,850

Notes: Control variables are not shown (see Section 4). Sample restricted to neighbours subsample, where child and parent location match. Standard errors at the neighbour level, in parentheses. ****p*<0.01; ***p*<0.05; **p*<0.10.

Table A10: Fixed Effect Regressions of Outcomes – No Prescription Controls

	Tertiary Education (1)	Tertiary Education (2)	Unemployment (3)	Unemployment (4)
ADHD	-0.134***	-0.181***	0.048***	0.073***
	(0.010)	(0.006)	(0.010)	(0.006)
Fixed Effects	Siblings	Neighbours	Siblings	Neighbours
Number of Observations	161,371	322,168	161,371	322,168
Number of Groups	79,280	120,354	79,280	120,354

Notes: Control variables are included but not shown (see Section 4) - controls for prescription classes are not included in the model. Clustered standard errors at the family or neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table A11: Fixed Effect Regressions of Receipt of Disability Support Pension at Age 20

	OLS (1)	Sibling FE (2)	Neighbours FE (3)
ADHD	0.097***	0.086***	0.098***
	(0.003)	(0.008)	(0.005)
Anxiety/Mood Disorders	0.059***	0.047***	0.054***
	(0.003)	(0.006)	(0.004)
Psychotic Disorders	0.320***	0.295***	0.305***
	(0.009)	(0.019)	(0.013)
Respiratory Conditions	0.003***	-0.003	0.002*
	(0.001)	(0.002)	(0.001)
Fixed Effects	No	Sibling	Neighbours
Number of Observations	556,168	161,371	322,168
Number of Groups	-	79,280	120,354

Notes: Regressions follow Table 3, but the outcome variable is receipt of the Disability Support Pension at age 20. Control variables are included but not shown in the table (see Section 4). Column 1 uses robust standard errors, Column 2 uses clustered standard errors at the family level, Column 3 uses clustered standard errors at the neighbour level, in parentheses. ***p<0.01; **p<0.05; *p<0.10.

Table A12: Sibling Fixed Effect Regressions of ADHD and Comorbid Conditions

	Tertiary Education (1)	Unemployment (2)
ADHD	-0.131***	0.048***
	(0.011)	(0.011)
Anxiety/Mood Disorders	-0.088***	0.034***
	(0.009)	(0.008)
ADHD* Anxiety/Mood Disorders	0.034	0.02
	(0.026)	(0.029)
Psychotic Disorders	-0.154***	-0.037*
	(0.022)	(0.022)
ADHD* Psychotic Disorders	0.126***	-0.053
	(0.038)	(0.044)
Respiratory Conditions	0.003	0.005
	(0.005)	(0.004)
ADHD* Respiratory Conditions	-0.009	0.012
	(0.023)	(0.028)
Fixed Effects	Siblings	Siblings
Number of Observations	161,371	161,371
Number of Groups	79,280	79,280

Notes: Control variables are not shown (see Section 4). Clustered standard errors at the family level, in parentheses. ****p*<0.01; ***p*<0.05; **p*<0.10.