Attention deficit hyperactivity disorder in Australian adults: Prevalence, persistence, conduct problems and disadvantage

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Attention Deficit Hyperactivity Disorder in Australian Adults: Prevalence, Persistence, Conduct Problems and Disadvantage

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Abstract

Background: The Prevalence and persistence of ADHD have not been described in young Australian adults and few studies have examined how conduct problems (CP) are associated with ADHD for this age group. We estimate lifetime and adult prevalence and persistence rates for three categories of ADHD for 3795 Australian adults, and indicate how career, health and childhood risk factors differ for people with ADHD symptoms and ADHD symptoms plus CP.

Methodology: Trained interviewers collected participant experience of ADHD, CP, education, employment, childhood experience, relationship and health variables. Three diagnostic definitions of ADHD used were (i) full DSM-IV criteria; (ii) excluding the age 7 onset criterion (no age criterion); (iii) participant experienced difficulties due to ADHD symptoms (problem symptoms).

Results: Prevalence rates in adulthood were 1.1%, 2.3% and 2.7% for each categorization respectively. Persistence of ADHD from childhood averaged across gender was 55.3% for full criteria, 50.3% with no age criterion and 40.2% for problem symptoms. ADHD symptoms were associated with parental conflict, poor health, being sexually assaulted during childhood, lower education, income loss and higher unemployment. The lifetime prevalence of conduct problems for adults with ADHD was 57.8% and 6.9% for adults without ADHD. The greatest disadvantage was experienced by participants with ADHD plus CP.

Conclusion: The persistence of ADHD into adulthood was greatest for participants meeting full diagnostic criteria and inattention was associated with the greatest loss of income and disadvantage. The disadvantage associated with conduct problems differed in severity and was relevant for a high proportion of adults with ADHD. Women but not men with ADHD reported more childhood adversity, possibly indicating varied etiology and treatment needs. The impact and treatment needs of adults with ADHD and CP and the report of sexual assault during childhood by women and men with ADHD also deserve further study.

Introduction

Attention deficit hyperactivity disorder (ADHD) describes a range of behaviours characterized by forgetfulness, carelessness, inattention, disorganization, distractedness, fidgetiness and impulsivity possibly associated with inhibitory deficits [1,2]. Onset is classically in early childhood with prevalence at age 7 estimated to range between 3% and 7% [3]. Approximately 70% of the variation in ADHD symptoms in childhood is accounted for by genetic effects [4,5], but only 30% in a sample of adults [6]. Experiences specific to an individual appear to account for a greater degree of the variation of ADHD symptoms in adulthood. Identification of environments more strongly associated with ADHD could indicate how and why symptoms vary under certain conditions [7].

Known risk factors for childhood symptoms include low birth weight [8], negative attention from parents [9], physical and emotional neglect [10]. ADHD symptoms have a negative impact on affected individuals, on their families [11] and within our communities [12]. Children affected by symptoms have increased difficulties with reading [13], motor performance [14], emotional regulation and social interaction [15]. They are also at increased
risk for substance use, conduct problems, mood disorders and anxiety [16,17]. As adults this extends to include lower educational attainment, a greater likelihood of multiple marriages, lost productivity at work [18,19], experiencing a second disorder [20] and an increased likelihood of unemployment [21].

The expression of ADHD symptoms in adulthood vary from the childhood criteria listed in the DSM-IV [22], additionally the number of symptoms declines but disability is still evident. Kooij et al. [23] found four or more symptoms of either inattention or hyperactive-impulsivity were associated with higher levels of disability for 1813 adults aged from 18 to 75. Das et al. [17] measured ADHD as a trait in 2091 adults aged 47 to 54 indicating higher trait scores but not necessarily in the clinical range were associated with financial stress, reduced employment, marital difficulties and lower subjective well-being The persistence of ADHD into adulthood has been reported to range from 4% for full DSM-IV diagnostic criteria [24], to 90% when persistence of impairment is considered as a more relevant criterion [25]. Approximately 6% of adult populations may be disadvantaged by ADHD symptoms [20,26].

Higher levels of disadvantage are associated with ADHD when conduct problems are also present [27–29]. It is unclear whether or not this is due to the conduct problems or the environment and little work has examined the impact of conduct problems on ADHD symptoms and associated disadvantage in adulthood.

We address several important questions. (i) What is the sample prevalence rate for lifetime and adult ADHD in the Australian population? (ii) What is the rate at which symptoms persist into adulthood? (iii) Are adults reporting ADHD symptoms more intensely exposed to childhood risk factors? (iv) How are Australian adults disadvantaged by ADHD symptoms? And (v) what is the impact of conduct problems on the disadvantage reported by adults with ADHD?

Methods

Participants

Participants were monozygotic (MZ) and dizygotic (DZ) twins and their siblings in total 1369 men and 2426 women, recruited through the National Health and Medical Research Council Twin Registry (ATR). The ATR was established to collect data from twins and their families for medical and scientific research. For this study, ATR members born between 1972 and 1979 were invited to participate. Recruitment was multi-stage and of the 3925 initial members. Recruitment was multi-stage and of the 3925 initial families socio-economic status was coded as 1 = no, 2 = average and 3> average. Conflict with parents, parental arguing, parental tension and drinking were scaled as: 1 = never or rarely, 2 = sometimes and 3 = often, parental rules were coded as 1 = inconsistent and 2 = consistent. Being raised by both parents to the age of sixteen was coded as 1 = no and 2 = yes and experiencing a sexual assault during childhood was coded as 1 = no, 2 = once, 3 = more than once.

Childhood risk was primarily measured by circumstances within the family during childhood between the ages of 6 and 13. The socidemographic variables included educational attainment and within the Australian school system there were two valid exit points at which students could gain recognition of achievement; either year 10 or years 10 and 12, but students may have chosen to leave at any time up to year 12. Scholastic and trade qualifications could also be attained through a college of Technical and Further Education (TAFE). Level of educational attainment was coded as 1 = year 10, 2 = year 11 or 12, 3 = TAFE and 4 = degree. School grades during primary and high schools were coded as 1< average, 2 = average and 3> average and weekly income was condensed into categories; 1 = $481, 2 = $482-$769, 3 = $770-$1442, and 4 = $1442. Occupation was also coded into four categories; 1 = not working, 2 = student, 3 = working and 4 = homemaker.

Childhood risk was primarily measured by circumstances within the family during childhood between the ages of 6 and 13. The families socio-economic status was coded as 1 = < average, 2 = average and 3> average. Conflict with parents, parental arguing, parental tension and drinking were scaled as: 1 = never or rarely, 2 = sometimes and 3 = often, parental rules were coded as 1 = inconsistent and 2 = consistent. Being raised by both parents to the age of sixteen was coded as 1 = no and 2 = yes and experiencing a sexual assault during childhood was coded as 1 = no, 2 = once, 3 = more than once.

Health and lifestyle variables included marital status which was coded as: 1 = unmarried, 2 = prior marriage and 3 = married, physical and emotional health were measured as 1 = poor, 2 = fair, 3 = good or excellent. The continuous variables of days ill per year (\( M = 7.3, SD = 23.0 \)) and birth weight (\( M = 2703.0, SD = 684.6 \)) were coded as: 1 = 0–10, 2 = 11–30, 3> 30 and 1< 2333 g and 2e2333 g respectively. The report of problem drinking was coded as 1 = no and 2 = yes. The low birth weight represented in analyses (2333 g) was at the 10th percentile for twins [32]. Within twin pairs, lower birth weight was not associated with inattentive (\( p = .52 \)) or hyperactive-impulsivity symptoms (\( p = .43 \)).

Attention-deficit/hyperactivity disorder. Participants’ report of ADHD symptoms were used to create three diagnostic definitions of ADHD and each was divided into lifetime risk and current diagnoses. First, full DSM-IV diagnostic criteria for primary inattention, hyperactive-impulsivity and combined ADHD: (A) over a 6-month period the experience of six of nine possible inattentive or hyperactive-impulsivity symptoms for each subtype respectively and at least 6 inattentive and 6 hyperactive-impulsivity symptoms for the combined subtype; (B) symptom onset by the age of 7 years; (C) symptoms experienced across two life arenas -

Measures

Data were collected using a combination of computer assisted telephone interview (CATI) administered by trained research interviewers and either an online or paper version of a Health and Lifestyle Personality Questionnaire (HLQ). The CATI was structured to collect self-reported sociodemographic variables; family environment during childhood, school grades, educational attainment, emotional and physical well-being, marital status, income level, employment, sexual assault prior to 18 and data relevant to psychiatric classification. The Semi-Structured Assessment for the Genetics of alcoholism (SSAGA; Bucholz et al., 1994) [31] which is based on diagnostic criteria of the DSM-III-R and DSM-IV, collected data on psychiatric classifications. This included 34-items addressing ADHD diagnostic criteria and 109-items specific to conduct problems. For this study we selected respondent data on the ADHD, conduct problems and sociodemographic variables.

Sociodemographic variables. The sociodemographic variables were divided into three categories; those related to career path, childhood circumstances associated with poor outcomes (childhood risk factors) and health and lifestyle variables. The career related variables included educational attainment and within the Australian school system there were two valid exit points at which students could gain recognition of achievement; either year 10 or years 10 and 12, but students may have chosen to leave at any time up to year 12. Scholastic and trade qualifications could also be attained through a college of Technical and Further Education (TAFE). Level of educational attainment was coded as 1 = year 10, 2 = year 11 or 12, 3 = TAFE and 4 = degree. School grades during primary and high schools were coded as 1< average, 2 = average and 3> average and weekly income was condensed into categories; 1 = $481, 2 = $482-$769, 3 = $770-$1442, and 4 = $1442. Occupation was also coded into four categories; 1 = not working, 2 = student, 3 = working and 4 = homemaker.
either home and school for childhood retrospective report and work for the report of continuing symptoms, home and socializing or school/work and socializing; (D) problems resulted from ADHD symptoms; and (E) exclusion of autism and Asperger’s disorder. The second ADHD measure included all criteria with the exception of B – the age of symptom onset was left open. The third measure represented participants who met only criteria C (impairment across two settings) and/or D (impairment was clinically relevant). The report ADHD symptoms caused problems in a persons’ life was our measure of clinical relevance. Participant report of symptoms within the previous 12 months differentiated lifetime risk from current diagnoses.

Conduct problems. Data on symptoms of conduct disorder were collected if participants reported they occurred prior to the age of 18. A symptom count of conduct problems was entered as a covariate in regression analyses and the following DSM-IV criteria were used for diagnosing ADHD with co-morbid conduct problems: (A) three symptoms across three behaviours including – i. aggression to people and animals, ii. destruction of property, iii. deceitfulness or theft and/or serious violation of rules; (B) symptoms have caused problems in social academic or occupational functioning; and (C) a diagnosis of anti-social personality disorder was not applicable. Antisocial personality disorder (ASPD) was diagnosed according to the listed criteria A and B, with the inclusion that; by the age of 15 three symptoms had been experienced within 12 months.

Interview Procedures
Once a twin initiated contact with the ATR an interview time was arranged. The CATI response booklet was sent to the respondent along with information guiding them to the online HLPQ and they were invited to complete the HLPQ prior to the CATI. During the interview respondents, referred to the CATI response booklet when asked by interviewers to indicate their responses. All interviews were recorded and reviewed by editors to ensure consistency across the duration of the study and interviewers.

Analyses

Missing Values
Across variables there were little missing data. The missingness in inattention and hyperactivity-impulsivity items was 2.1%, conduct problems had 3.1% to 4.1%. The career, childhood risk and health related variables had 1.0%, 0.5% and 0.2% missing values respectively, with the exception of alcohol problem and days ill per year. These two variables were only available for a reduced subset of participants due to a change in protocol (data were available for 2681 and 2678 individuals respectively). All analyses were run with available data.

Table 1. Participant Mean Age at Assessment, Sex and Zygosity.

| Zygosity & Sex       | Individuals | Complete pairs | Age (SD) |
|----------------------|-------------|----------------|----------|
| MZ female            | 981         | 400            | 31.8 (2.6) |
| MZ male              | 483         | 171            | 31.7 (2.4) |
| DZ female            | 742         | 302            | 31.7 (2.5) |
| DZ male              | 377         | 119            | 31.8 (2.4) |
| DZ opposite sex      | 740         | 225            | 32.1 (2.5) |
| Non-twin sisters     | 267         | –              | 34.2 (3.2) |
| Non-twin brothers    | 205         | –              | 33.6 (5.0) |
| Total                | 3795        |                |          |

Note: The age within the final sample ranged from 21 to 49.

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Prevalence and Rates of Persistence
Persistence of ADHD into adulthood was calculated with survival analysis using the age of participants at symptom onset, the age at which symptoms were last experienced and whether or not symptoms were remitting. This method takes into consideration the entry and exit of participants to and from the pool of individuals affected by ADHD across time. So participants with a late symptom onset were excluded from the final rate because they did not contribute to the estimate of prevalence before the first remission occurred. Three prevalence rates were calculated corresponding to the three sets of criteria used to measure symptoms of ADHD. Each of the prevalence estimates was standardized to the gender and education distributions of the Australian population to account for the higher prevalence of ADHD in men and the association between ADHD and lower educational attainment.

Regression of ADHD Symptoms Onto Sociodemographic Variables
Ordinal logistic regression (OLR) was used to examine the relationships between ADHD symptoms, conduct problems and sociodemographic variables. Analyses were conducted for the full sample, and differentiated by gender when a significant variable by gender interaction was indicated. Inattentive and hyperactive-impulsive symptom counts were modeled as the outcome variables and all regressions were run twice, the second run included conduct problem symptom count as a covariate. The results of these analyses were weighted to account for the similarity of response among related participants. Weighting was calculated using the averaged correlation between twins within MZ and DZ pairs for ADHD as a proportion of the total variance [39] which was 1.83. The standard error for each analysis was multiplied by this value to increase the variance to what would be expected within an independent sample.

Results
The Persistence and Prevalence of ADHD in Adulthood
DSM-IV ADHD full criteria. The lifetime prevalence of ADHD was 0.9% for women (21/2406) and 2.1% for men (28/1341). There were 0.5% of women (12/2415) and 1.4% of men (19/1350) with current ADHD, standardized and raw prevalence estimates across education and gender categories are presented in Table 2. The rate at which symptoms persisted into adulthood was 47.6% (27.9%–81.3%) and 63.0% (45.5%–87.2%) for women and men respectively as presented in Figure 2. The prevalence \[x^2(1) = 7.22, \ p = .007\] but not persistence of symptoms \[x^2(1) = 0.22, \ p = .64\] was higher for men. Prevalence rates were not associated with birth year which was represented in quartiles \[x^2(3) = 0.64, \ p = .89\], possibly due to the restricted age of the sample. The prevalence of antisocial personality disorder within this ADHD categorization was 35.5% (SD = 6.3%) compared to 3.4% (SD = 0.1%) in the full sample. MZ twins, DZ twins and singletons did not differ significantly in prevalence of symptoms and diagnoses [approximately \[x^2(25) = 30.0, \ p = .22\] for each comparison].

DSM-IV ADHD with no age of onset criterion. The lifetime prevalence of ADHD when only age of onset criterion was dropped was 3.8% for men (50/1319) and 2.4% for women (58/2369). Symptoms were reported as current by 1.2% women (29/2398) and 2.4% men (32/1337). Since not all participants had experienced symptoms by the age of the first remission (which was 14), we adjusted for both left and right censoring to estimate a persistence rate of 60.2% (46.9%–77.2%) for men and 40.3% (28.2%–57.4%) for women. Again the prevalence but not persistence of symptoms was significantly higher for men \[x^2(1) = 6.75, \ p = .009\] and \[x^2(1) = 1.93, \ p = .18\] respectively and there was no difference in ADHD prevalence across birth year \[x^2(1) = 1.03, \ p = .79\]. There were 26.2% (SD = 3.5%) of these participants meeting criteria for antisocial personality disorder.

Measure of persisting problem ADHD symptoms. The problem symptoms category represented participants meeting DSM-IV ADHD criterion C impairment is evident in two or more settings and/or D impairment is clinically relevant. It was not a requirement that these participants met criterion A (six inattentive or hyperactive-impulsive symptoms) so the lifetime prevalence of problematic ADHD symptoms–3.1% for women (74/2352) and 4.8% for men (63/1310) – was higher than the previous two categories. There were 2.9% and 1.4% of men and women respectively within this category, reporting current symptoms and this gender difference was significant \[x^2(1) = 9.77, \ p = .002\]. Persistence of symptoms into adulthood was 55.7% (42.5%–73.1%) for men and 24.6% (10.3%–58.5%) for women, this difference reached significance \[x^2(1) = 3.73, \ p = .05\]. Again there was some censoring due to a later age of symptom onset for participants with problem symptoms and all had experienced at least six or more ADHD symptoms, which was the criterion for asking whether or not symptoms were experienced as problematic. The prevalence of anti-social personality disorder within this group was 23.9% (SD = 2.8%).

Career Related Outcomes, Inattention, Hyperactive-Impulsivity and Conduct Problems
Ordinal Logistic Regression of career related variables onto ADHD symptoms was conducted for the full sample and results are provided in Table 3. Participants with higher levels of inattention with and without conduct problems attained lower levels of education than participants with none or few symptoms \(p<.01\) and \(p<.05\) respectively. Men and women reporting low grades in primary and high schools also reported more symptoms of inattention \(p<.001\) and hyperactivity-impulsivity \(p<.05\). The odds ratios indicated this relationship was strongest when conduct problems were also present. Both women and men reporting inattentive symptoms earned less money each week than participants with fewer or no inattentive symptoms. Participants with higher levels of inattention were more likely to be unemployed \(p<.05\) and the likelihood increased when they had also experienced conduct problems \(p<.001\).

Childhood Risk Factors, Inattention, Hyperactive-Impulsivity and Conduct Problems
As summarized in Table 4 symptoms of inattention and hyperactive-impulsivity were predicted by low socio-economic status during childhood in association with conduct problems \(p<.05\). A relationship between hyperactive-impulsivity and being raised in a one-parent household was predicted by comorbid conduct problems \(p<.05\) but this relationship was suggested for inattention with conduct problems and hyperactive-impulsivity only. There was a strong relationship between childhood sexual assault, inattentive and hyperactivity-impulsive symptoms \(p<.001\) and \(p<.01\) respectively whether or not conduct symptoms were also experienced. There were significant gender interactions; conflict with parents, parental arguing, parental tension and parental rules predicted more symptoms of ADHD for women but not men. This relationship was strongest for women reporting conflict with their parents during childhood \(p<.001\), but also apparent with the report of more parental tension \(p<.05\).
Figure 2. Probability of ADHD persistence and pattern of remission for each ADHD categorisation by gender.

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Inconsistent parental rules predicted inattention with and without conduct problems for women but not for men \(p<.01\) and \(p<.05\), respectively. Parental arguing predicted inattention and hyperactivity-impulsivity for women but only when they occurred with conduct problems \(p<.05\). There was no systematic relationship between parental drinking and symptoms of ADHD. Results for gender specific analyses are available from the first author on request.

Health Related Outcomes, Inattention, Hyperactive-Impulsivity and Conduct Problems

Poor physical and emotional health were predicted by higher levels of inattention and hyperactivity with and without conduct problems \(p<.05\) to \(p<.001\); Table 5). There were significant interactions between gender and ADHD symptoms for days ill per year and birth weight. Women with symptoms of inattention on their own and with conduct problems, reported being ill for a relatively high number of days each year \(p<.001\). However there was no significant effect of birth weight when gender was differentiated, though females generally have a lower birth weight than males [32]. The relationship between ADHD symptoms and a reduced likelihood of marriage only reached significance when gender was analyzed separately. In our study males were found to be at a lower risk of ADHD than females, while in a cross-national study indicating the prevalence of DSM-IV ADHD in adults was 3.4% [20] also used retrospective self-report and indicated our estimates were comparatively low. Within their study of adults aged from 18 to 44, Fayyad and colleagues also found men had a higher prevalence than women as was found in this study. In contrast Kooij and colleagues found no sex difference in their prevalence of DSM-IV diagnosed ADHD and a higher rate for women when using a four rather than the six symptom criterion A, the age of their participants ranged from 18 to 75. Similarly Das and colleagues [17] found no sex difference in their prevalence of DSM-IV diagnosed ADHD and a higher rate for women when using a four rather than the six symptom criterion A, the age of their participants ranged from 18 to 75. Similarly Das and colleagues [17] found no sex differences in the prevalence of ADHD in their older sample. The differences in the prevalence of adult ADHD across studies suggests variation in the expression of ADHD could be related to developmental change [22] cultural differences across populations and/or differences in methodology across studies [24] as has previously been suggested.

The persistence of ADHD into adulthood occurred for 24.6% to 63.0% of ADHD affected women and men across ADHD categorizations. The highest degree of persistence occurred for adults meeting full DSM-IV criteria, symptom severity has previously been found to predict symptom persistence [34]. The persistence found in a study by Kessler and others was also similar to ours (28.0% to 49.3%) and corresponded to increasingly restrictive diagnostic criteria. Persistence and prevalence rates of ADHD vary with the diagnostic criteria used to define symptoms.
ADHD diagnoses have been found to vary across raters and scales [35] so our estimates cannot be considered as true but relative to the study design we used. Our finding that childhood risk factors did predict higher levels of ADHD symptoms supports previous research indicating an association between childhood adversity and retrospective report of ADHD [34]. We extended this work and examined sex differences. More conflict with parents, more parental arguing, inconsistent parental rules and more parental tension predicted more inattentive and hyperactive-impulsive symptoms for women but not for men. It may be that females and males vary in their perception of parental behaviour [36], or boys and girls are treated differently by their parents. Children with ADHD, most particularly inattention more frequently report lack of supervision, neglect, physical and sexual abuse than children without ADHD symptoms [37]. Sexual assault during childhood predicted higher symptom count of inattentive and hyperactive-impulsive symptoms. ADHD is not a natural sequela of child sexual assault but higher levels of conduct problems, depression, anxiety, alcoholism and panic disorder have previously been found for adults reporting childhood sexual abuse [38].

| Career Variables | Frequency (n) | ADHD Inattention | ADHD Hyperactive-impulsive | ADHD + CP Inattention | ADHD + CP Hyperactive-impulsive |
|------------------|---------------|------------------|---------------------------|----------------------|-------------------------------|
| **Education**    |               |                  |                           |                      |                               |
| ≤ Year 10        | 259           | (1)              | (1)                       | (1)                  | (1)                           |
| Year 11 or 12    | 701           | 0.86             | 0.90                      | 0.64                 | 0.69                          |
|                  |               | (0.41–1.81)      | (0.42–1.92)               | (0.32–1.31)          | (0.33–1.42)                   |
| TAFE             | 1093          | 0.70             | 0.83                      | 0.49*                | 0.59                          |
|                  |               | (0.34–1.44)      | (0.40–1.73)               | (0.24–0.96)          | (0.30–1.19)                   |
| Degree           | 1817          | 0.47*            | 0.73                      | 0.28**               | 0.44*                         |
|                  |               | (0.23–0.98)      | (0.35–1.49)               | (0.14–0.56)          | (0.22–0.86)                   |
| **Primary School**|              |                  |                           |                      |                               |
| < Average        | 174           | (1)              | (1)                       | (1)                  | (1)                           |
| Average          | 1797          | 0.13***          | 0.39*                     | 0.11***              | 0.32***                       |
|                  |               | (0.07–0.24)      | (0.19–0.78)               | (0.06–0.21)          | (0.16–0.62)                   |
| > Average        | 1817          | 0.10***          | 0.39*                     | 0.08***              | 0.29***                       |
|                  |               | (0.05–0.19)      | (0.19–0.80)               | (0.04–0.15)          | (0.15–0.58)                   |
| **High School**  |              |                  |                           |                      |                               |
| < Average        | 226           | (1)              | (1)                       | (1)                  | (1)                           |
| Average          | 1943          | 0.20**           | 0.39*                     | 0.14***              | 0.32***                       |
|                  |               | (0.11–0.37)      | (0.19–0.78)               | (0.08–0.25)          | (0.17–0.59)                   |
| > Average        | 1622          | 0.15***          | 0.39*                     | 0.09***              | 0.31***                       |
|                  |               | (0.08–0.28)      | (0.19–0.80)               | (0.05–0.16)          | (0.17–0.58)                   |
| **Income**       |              |                  |                           |                      |                               |
| ≤ $481           | 1051          | (1)              | (1)                       | (1)                  | (1)                           |
| $482–$769        | 636           | 0.92             | 0.73                      | 1.00                 | 0.80                          |
|                  |               | (0.52–1.64)      | (0.41–1.33)               | (0.57–1.73)          | (0.45–1.42)                   |
| $770–$1442       | 1362          | 0.50*            | 0.73                      | 0.61*                | 0.74                          |
|                  |               | (0.36–0.98)      | (0.45–1.17)               | (0.37–1.00)          | (0.46–1.18)                   |
| ≥ $1443          | 789           | 0.50*            | 0.83                      | 0.53*                | 0.85                          |
|                  |               | (0.27–0.94)      | (0.48–1.43)               | (0.29–0.98)          | (0.50–1.44)                   |
| **Occupation**   |              |                  |                           |                      |                               |
| Not Working      | 101           | (1)              | (1)                       | (1)                  | (1)                           |
| Student          | 96            | 0.43             | 1.03                      | 0.31                 | 0.68                          |
|                  |               | (0.11–1.79)      | (0.26–4.12)               | (0.08–1.22)          | (0.18–2.54)                   |
| Working          | 3201          | 0.29*            | 0.57                      | 0.21***              | 0.39*                         |
|                  |               | (0.12–0.69)      | (0.22–1.50)               | (0.09–0.47)          | (0.16–0.96)                   |
| Homemaker        | 472           | 0.35*            | 0.66                      | 0.22**               | 0.40                          |
|                  |               | (0.12–0.96)      | (0.22–1.97)               | (0.08–0.59)          | (0.14–1.13)                   |

Note: * p ≤ .05, ** p ≤ .10, *** p ≤ .001. CI = confidence intervals.
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[24]. Additionally ADHD diagnoses have been found to vary across raters and scales [35] so our estimates cannot be considered as true but relative to the study design we used.

Our finding that childhood risk factors did predict higher levels of ADHD symptoms supports previous research indicating an association between childhood adversity and retrospective report of ADHD [34]. We extended this work and examined sex differences. More conflict with parents, more parental arguing, inconsistent parental rules and more parental tension predicted more inattentive and hyperactive-impulsive symptoms for women but not for men. It may be that females and males vary in their
Table 4. Odds Ratio (CI) Of ADHD Symptoms With and Without CP For Childhood Risk Factors.

| Childhood Risk Factors          | Frequency (n) | ADHD Inattention | ADHD Hyperactive-Impulsive | ADHD + CP Inattention | ADHD + CP Hyperactive-Impulsive |
|--------------------------------|---------------|------------------|---------------------------|-----------------------|--------------------------------|
| CSA                            |               |                  |                           |                       |                                |
| No                             | 3463          | (1)              | (1)                       | (1)                   | (1)                            |
| Once                           | 128           | 1.61             | 1.18                      | 1.87                  | 1.36                           |
| >Once                          | 199           | 2.67***          | 2.58**                    | 4.30***               | 3.61***                        |
|                                |               | (1.52–5.42)      | (1.37–4.86)               | (2.37–7.79)           | (1.97–6.59)                     |
| Childhood SES                  |               |                  |                           |                       |                                |
| < Average                      | 519           | (1)              | (1)                       | (1)                   | (1)                            |
| Average                        | 2721          | 0.68             | 0.68                      | 0.54*                 | 0.58*                          |
| >Average                       | 626           | 1.00             | 1.00                      | 0.73                  | 0.92                           |
|                                |               | (0.54–1.87)      | (0.54–1.87)               | (0.38–39)             | (0.50–1.69)                     |
| With both parents              |               |                  |                           |                       |                                |
| No                             | 684           | 0.87             | 0.64                      | 0.68                  | 0.54*                          |
|                                |               | (0.53–0.43)      | (0.41–0.01)               | (0.43–10)             | (0.35–0.83)                     |
| Yes                            | 3188          | 1.48             | 1.26                      | 1.73*                 | 1.46                           |
|                                |               | (0.93–2.36)      | (0.82–1.95)               | (1.10–2.72)           | (0.96–2.24)                     |
| Conflict w Parents             |               |                  |                           |                       |                                |
| Never/Rarely                   | 2008          | (1)              | (1)                       | (1)                   | (1)                            |
| Sometimes                      | 1397          | 1.48             | 1.26                      | 1.73*                 | 1.46                           |
|                                |               | (0.93–2.36)      | (0.82–1.95)               | (1.10–2.72)           | (0.96–2.24)                     |
| Often                          | 465           | 2.61***          | 2.46***                   | 3.80***               | 3.41***                        |
|                                |               | (1.49–4.57)      | (1.46–4.16)               | (2.23–6.46)           | (2.07–5.62)                     |
| Parental arguing               |               |                  |                           |                       |                                |
| Never/Rarely                   | 2570          | (1)              | (1)                       | (1)                   | (1)                            |
| Sometimes                      | 871           | 1.47             | 1.31                      | 1.54                  | 1.37                           |
|                                |               | (0.92–2.36)      | (0.83–2.06)               | (0.97–2.44)           | (0.88–2.13)                     |
| Often                          | 416           | 1.62             | 1.48                      | 1.96*                 | 1.73*                          |
|                                |               | (0.90–2.93)      | (0.83–2.61)               | (1.11–3.46)           | (1.00–2.99)                     |
| Parental Tension               |               |                  |                           |                       |                                |
| None/A little                  | 2822          | (1)              | (1)                       | (1)                   | (1)                            |
| Some                           | 651           | 1.47             | 1.07                      | 1.62                  | 1.18                           |
|                                |               | (0.88–2.45)      | (0.64–1.78)               | (0.98–2.66)           | (0.72–1.95)                     |
| A lot                          | 397           | 2.17*            | 1.76*                     | 2.60***               | 2.02*                          |
|                                |               | (1.24–3.78)      | (1.02–3.03)               | (1.52–4.44)           | (1.19–3.43)                     |
| Parental Rules                 |               |                  |                           |                       |                                |
| Inconsistent                   | 366           | (1)              | (1)                       | (1)                   | (1)                            |
| Consistent                     | 3500          | 0.54*            | 0.75                      | 0.44**                | 0.60                           |
|                                |               | (0.31–0.96)      | (0.42–1.35)               | (0.26–0.75)           | (0.35–1.05)                     |
| Parental Drinking              |               |                  |                           |                       |                                |
| Never/Rarely                   | 1259          | (1)              | (1)                       | (1)                   | (1)                            |
| Sometimes                      | 1404          | 0.63             | 0.83                      | 0.59*                 | 0.79                           |
|                                |               | (0.37–1.06)      | (0.52–1.33)               | (0.35–0.98)           | (0.50–1.24)                     |
| Often                          | 1207          | 1.05             | 0.91                      | 1.16                  | 1.01                           |
|                                |               | (0.66–1.69)      | (0.57–1.45)               | (0.73–1.83)           | (0.64–1.59)                     |

Note: These variables represent participant retrospective report of home life from the age of 6 to 13. *p ≤ 0.05, **p ≤ 0.10, ***p ≤ 0.001. CSA = sexual assault during childhood.

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The disadvantage adults with ADHD symptoms reported included lower educational attainment, loss of income, increased unemployment, poor physical health, more days ill each year, reduced likelihood of marriage and fewer close friends. The disadvantage associated with comorbid conduct problems did not appear to differ qualitatively from that associated with ADHD symptoms but was more severe. The report of conduct problems was uniquely associated with being raised by one parent only, lower socio-economic status, more conflict with parents and problem drinking though these trends were evident for participants with ADHD symptoms only. The lifetime prevalence of conduct problems for participants with no history of ADHD was 6.9%. For participants with a history of ADHD this rate increased to 67.9% and the high incidence of antisocial personality disorder indicated ongoing and severe difficulties for ADHD affected adults.

There were several limitations that influence the interpretation of our findings. The survival analysis was based on the report of the first and last experience of symptoms. Even though a participant may have met full diagnostic criteria the variation of these symptoms across time could not be measured precisely. Further the use of a CATI rather than a clinician appraisal to diagnose ADHD may have resulted in a loss of rapport only

| Health & Lifestyle Variables | Frequency (n) | ADHD | ADHD | ADHD + CP | ADHD + CP |
|----------------------------|--------------|------|------|----------|----------|
| Days Ill year              |              |      |      |          |          |
| 0–10                       | 3073         | (1)  | (1)  | (1)      | (1)      |
| 11–30                      | 317          | 2.40*| 1.71 | 2.71***  | 1.92*    |
|                           |             | (1.29–4.44) | (0.93–3.14) | (1.51–4.86) | (1.07–3.43) |
| >30                        | 98           | 3.85**| 1.91 | 4.78***  | 2.47     |
|                           |             | (1.59–9.31) | (0.72–5.06) | (2.06–11.06) | (0.98–6.22) |
| Birth Weight               |              |      |      |          |          |
| <2333 g                    | 451          | (1)  | (1)  | (1)      | (1)      |
| ≥2333 g                    | 1181         | 0.74 | 0.85 | 0.83     | 0.90     |
|                           |             | (0.42–1.33) | (0.52–1.41) | (0.40–1.72) | (0.48–1.70) |
| Physical health            |              |      |      |          |          |
| Poor                       | 110          | (1)  | (1)  | (1)      | (1)      |
| Fair                       | 668          | 0.64 | 0.50 | 0.61     | 0.49     |
|                           |             | (0.24–1.67) | (0.19–1.27) | (0.24–1.53) | (0.20–1.20) |
| ≥ Good                     | 3090         | 0.32*| 0.35*| 0.27**   | 0.30*    |
|                           |             | (0.13–0.80) | (0.15–0.84) | (0.11–0.64) | (0.13–0.69) |
| Emotional health           |              |      |      |          |          |
| Poor                       | 92           | (1)  | (1)  | (1)      | (1)      |
| Fair                       | 582          | 0.43 | 0.68 | 0.35**   | 0.54     |
|                           |             | (0.18–1.03) | (0.27–1.74) | (0.15–0.81) | (0.22–1.35) |
| ≥ Good                     | 3194         | 0.10***| 0.26**| 0.08***  | 0.19***  |
|                           |             | (0.04–0.23) | (0.11–0.64) | (0.03–0.17) | (0.08–0.46) |
| Close friends              |              |      |      |          |          |
| No                         | 132          | (1)  | (1)  | (1)      | (1)      |
| Yes                        | 3736         | 0.46 | 0.51 | 0.38**   | 0.45     |
|                           |             | (0.20–1.07) | (0.22–1.19) | (0.17–0.85) | (0.20–1.00) |
| Marital status             |              |      |      |          |          |
| Unmarried                  | 1593         | (1)  | (1)  | (1)      | (1)      |
| Prior marriage             | 201          | 1.20 | 1.04 | 1.09     | 0.99     |
|                           |             | (0.52–2.80) | (0.46–2.33) | (0.48–2.46) | (0.45–2.18) |
| Married                    | 2080         | 0.74 | 0.69 | 0.62*    | 0.60*    |
|                           |             | (0.48–1.13) | (0.46–1.02) | (0.41–0.94) | (0.41–0.88) |
| Alcohol problem            |              |      |      |          |          |
| No                         | 3427         | (1)  | (1)  | (1)      | (1)      |
| Yes                        | 103          | 1.37 | 1.75 | 3.55**   | 3.96***  |
|                           |             | (0.52–3.56) | (0.71–4.28) | (1.52–8.30) | (1.77–8.84) |

Note: *p < 0.05, **p < 0.10, ***p < 0.001. CI = confidence intervals.

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possible in a face-to-face interview, and influenced our findings. Our prevalence rate of adult ADHD was comparatively low to previous estimates and the adjustment made for gender and education could not fully account for this difference and we were unable to estimate the effect due to methodological variation in ADHD diagnoses. The degree to which missing values were random could not be defined. But, participants returning the HLPQ and not completing the CATI did not appear to differ from full participants in rates of substance use, autism, Asperger’s syndrome or ADHD (data are not shown).

In conclusion our findings indicate ADHD in adults occurs for a high proportion of people who report symptoms during their earlier years. These symptoms are associated with income loss for men and women and according to our criteria affect approximately 250 000 to 750 000 Australians at a conservative estimate. Identification of disadvantage associated with subclinical ADHD symptoms and associated conduct problems in adults and a possible need for treatment will help to alleviate personal, familial and community issues resulting from the symptoms reported by these adults. Further research into the increased number of ADHD symptoms associated with childhood adversity for women and for women and men also experiencing a sexual assault during childhood could indicate ways in which symptoms and etiology vary across gender and how treatments may also need to vary.

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Author Contributions

Conceived and designed the experiments: JLE DD. Performed the experiments: JLE. Analyzed the data: JLE. Wrote the paper: JLE. Data collection and cleaning: SEM ML AH JLE. Revision of intellectual content: ML DD JV CG SEM NM.

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