

Research Article

Attention Deficit Hyperactivity Disorder Symptoms, Comorbidities, Substance Use, and Social Outcomes among Men and Women in a Canadian Sample

Evelyn Vingilis,¹ Patricia G. Erickson,² Maggie E. Toplak,³ Nathan J. Kolla,⁴
Robert E. Mann,⁵ Jane Seeley,¹ Mark vanderMaas,⁶ and Deanne S. Daigle¹

¹Population and Community Health Unit, Department of Family Medicine, University of Western Ontario,
1151 Richmond Street, London, ON, Canada N6A 5C1

²Department of Sociology, Centre for Criminology and Sociological Studies, University of Toronto, Toronto, ON, Canada M5S 2J4

³Department of Psychology, York University, LaMarsh Centre for Child and Youth Research, Toronto, ON, Canada M3J 1P3

⁴Complex Mental Illness, Forensic Service, Centre for Addiction and Mental Health, Department of Psychiatry,
University of Toronto, Toronto, ON, Canada M5S 2S1

⁵Centre for Addiction and Mental Health, Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada M5S 2S1

⁶Department of Sociology, Collaborative Program in Addiction Studies, University of Toronto, Toronto, ON, Canada M5S 2J4

Correspondence should be addressed to Evelyn Vingilis; evingili@uwo.ca

Received 12 August 2014; Accepted 26 November 2014

Academic Editor: Sahoo Saddichha

Copyright © 2015 Evelyn Vingilis et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Background. Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that can persist in adolescence and adulthood. **Aim.** To examine prevalence of ADHD symptoms and correlates in a representative sample of adults 18 years and older living in Ontario, Canada. **Method.** We used the Centre for Addiction and Mental Health Monitor, an ongoing cross-sectional telephone survey, to examine the relationships between ADHD positive symptoms and comorbidities, substance use, medication use, social outcomes, and sociodemographics. **Results.** Of 4014 residents sampled in 2011-2012, 3.30% (2.75%–3.85%) screened positively for ADHD symptoms (women = 3.6%; men = 3.0%). For men, distress, antisocial symptoms, cocaine use, antianxiety medication use, antidepressant medication use, and criminal offence arrest were associated with positive ADHD screen. For women, distress, cocaine use, antianxiety medication use, antidepressant medication use, pain medication use, and motor vehicle collision in the past year were associated with positive ADHD screen. **Conclusions.** ADHD symptoms are associated with adverse medical and social outcomes that are in some cases gender specific.

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder with symptoms of inattention, hyperactivity, and impulsivity that present in multiple settings [1]. Initially ADHD was viewed as a disease of childhood that declined or disappeared in adulthood. Research over the past 30 years has found ADHD to persist in adolescence and adulthood for 50% to 60% of childhood ADHD cases [2]; though ranges as extreme as 4% to 80% have also been reported [1–6].

Although symptoms of ADHD have been extended developmentally upward to adults and the diagnostic criteria of ADHD have been revised in the DSM-5 to reflect more accurately the experience of affected adults, adult ADHD research is in an early stage [1, 7, 8]. Most ADHD research has focused on homogeneous samples of clinically referred, young Caucasian males [9]. These samples have the advantage of extensive assessment but lack representation from non-clinical groups exhibiting ADHD symptoms [10, 11]. Clinical samples are found to show more symptoms and impairment [11]. Moreover, many of these studies suffer from major

methodological shortcomings, including small sample sizes, referral biases, high loss to follow-up, inadequate matching of groups, and lack of gender inclusion and analysis [9, 10, 12]. On the other hand, population-based, representative samples overcome many of these methodological weaknesses, while their findings allow inferences to be made to the general population [11, 13].

Data on prevalence of adult ADHD are limited, but estimates based on international studies using multistage household probability samples range from 1.2 to 7.3% with an average of 3.4% [14]. No population-based adult ADHD prevalence estimates are available for Canada.

Current research suggests that gender differences in the prevalence of adult ADHD may differ from prevalence patterns reported in children. Studies of ADHD in children find that boys are much more affected than girls, with clinically referred studies having gender differences closer to 9:1 and epidemiological studies closer to 3:1 [15]. Among adults, results are mixed. Kessler et al. [16] found that diagnosis of ADHD in their survey of 18–44-year olds was 5.4% for men and 3.2% for women, while Faraone and Biederman [6] found no differences (men = 3.0%; women = 2.8%). Information on ADHD and age is very limited, despite the historical controversy on whether ADHD stays the same, declines, changes, or disappears in adulthood. A recent meta-analysis on adult ADHD found that only two studies included participants over 60 years of age; the mean ages of most studies were upper teens to mid-30s [9]. The meta-analysis of these age-limited studies showed a gender by age interaction with symptoms declining as men but not women reached their 40s.

Clinical studies of adolescents and adults with ADHD have found higher rates of psychopathology, such as mood, anxiety, childhood disruptive, antisocial personality, and substance use disorders compared with control groups [4, 5, 15, 17]. A recent meta-analytic study examining the association of childhood ADHD and substance use and abuse/dependence found that children with ADHD were significantly more likely as young adults to have ever used nicotine, cannabis, and cocaine but not alcohol and were significantly more likely to develop substance use disorders than controls [18].

Those with ADHD are also less likely to enter college and to graduate and generally have 2 years less schooling [19]. They are less likely to be employed and have lower SES and income and higher crash and criminal offence rates, although in some studies direct relationships between ADHD and various delinquencies disappear when comorbid conditions are included [2, 5, 20]. However, Weiss and Hechtman [3] found in their 15-year follow-up that although 50–60% of young adults initially diagnosed with ADHD continue to exhibit symptoms, their adult ADHD patients had lower risk of antisocial or criminal behaviours, despite slightly elevated rates in adolescence. Thus, there is a need for sound epidemiological data to understand the manifestations of ADHD symptoms in adulthood by gender, psychiatric comorbidity, and social outcomes.

The purpose of this study was to examine prevalence of ADHD symptoms and their relationship with comorbidities

and social outcomes and to explore differences by gender, in a large population-based survey of adults in Ontario, Canada.

2. Methods

2.1. Sample. The data are based on telephone interviews (landlines and cell phones) with 4,014 Ontario adults (ages 18 or older) over 24 months between January 2011 and December 2012. The data are from the Centre for Addiction and Mental Health (CAMH) Monitor, an ongoing cross-sectional, computer-assisted telephone survey administered by the Institute for Social Research at York University, Canada (see [21] for details). Each monthly cycle uses a two-stage probability sampling procedure. In the first stage, a random sample of telephone numbers was selected with equal probability from within each regional stratum. In the second stage, one respondent aged 18 or older who was able to complete the interview in English was then selected from within each household according to the most recent birthday of all household members. Response rates based on estimated eligible sample averaged 52.89%.

2.2. Measures. All scales were based on well-validated measures and demonstrated good internal consistency.

2.2.1. ADHD Measures. (1) Adult ADHD Self-Report Scale-V1.1 (ASRS-V1.1) was developed by Kessler et al. [22] as part of the WHO Composite Diagnostic Interview. Psychometric validation against DSM-IV based psychiatric diagnoses by experienced clinicians demonstrated that the 6-item, 5-point Likert scale screener was superior to the 18-item version on specificity (99.5% versus 98.3%), sensitivity (68.7% versus 56.3%), total classification accuracy (97.9% versus 96.2%), and Cohen's kappa (0.76 versus 0.58) [23–25]. Positive ADHD symptoms screen is a total score greater than 13 [25]. (2) Previous ADHD diagnosis was assessed by the item “have you ever been diagnosed with Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD) by a doctor or health care professional?” (3) ADHD medication use was assessed by items querying if, when and how long, they had been treated with medication for ADHD or ADD by a doctor or health care professional, and whether they are currently taking it (adapted from Ontario Student Drug Use and Health Survey) [26].

2.2.2. Psychiatric Distress and Medication Use Measures. (1) General Health Questionnaire (GHQ12) is a 12-item, 4-point widely used screening instrument for current psychiatric distress that captures depression/anxiety and problems with social functioning [27–29] with a score of three and higher as a positive screen; (2) depression/anxiety/pain medication use: in the past 12 months have you taken any prescription medication: to reduce depression? to reduce anxiety or panic attacks? for pain?

2.2.3. Antisocial Behaviour Measure. (1) Antisocial Personality Disorder Scale from the Mini-International Neuropsychiatric Interview (MINI-APD), a 12-item, dichotomous scale,

was designed to provide a short clinical screening tool to assess delinquencies (truancy, cheating/lying/stealing, bullying, and hurting animals/people) before and after age 15. We excluded one item of the MINI-APD (forced someone to have sex before age 15), as required by the ethics review board. A score of three or more on the latter six MINI-APD questions indicated a positive APD screen [30].

2.2.4. Substance Use and Abuse Measures. (1) Lifetime cannabis and cocaine use (never used = 0, ever used = 1); (2) Alcohol Use Disorders Identification Test (AUDIT) is a validated screening instrument developed by the WHO, to detect individuals at the less severe end of the spectrum of alcohol problems, with a score greater than seven indicating hazardous alcohol use [31–33]. The AUDIT has been extensively used in both national and Ontario surveys which demonstrate the validity of the instrument in Canadian populations and the utility of the 8+ cutoff [34–36]. (3) The cannabis subscale of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) is a 6-item screening instrument to assess risk of experiencing health and other problems (social, financial, legal, and relationship) from their current pattern of cannabis use, with scores of four or more indicating moderate or high risk of problems [37].

2.2.5. Social Problems. These were self-report items: (1) vehicle crash involvement in past year and (2) ever in lifetime arrested for a criminal offence.

2.2.6. Sociodemographics. (1) Gender, (2) age, (3) marital status, (4) educational status, (5) employment status, and (6) income were included.

2.3. Statistical Analysis. All analyses used linearized methods based on sample design and weighted by probability of selection. The percentages reported are considered representative for the population surveyed. We used logistic regression analysis to estimate odds ratios for ADHD positive symptoms associated with sociodemographics, previous ADHD diagnosis, medication use, comorbidities, substance use and abuse, and social problems. We conducted separate regression analyses for men and women. We adjusted for age, marital status, education, and employment. Results are based on “valid” responses; responses such as “do not know” and refusals were considered missing data and excluded from analyses.

3. Results

Overall, 3.30% (C.I.2.75%, 3.85%) of the sample screened above the cutoff for positive ADHD symptoms. Table 1 indicates significant differences between those who screened positively and negatively for ADHD symptoms. A greater percent of those who screened positively were younger, less likely to be married, had lower education, and were part-time employed or other, compared to those who screened negatively. A higher percentage of those who screened positively for ADHD symptoms reported previous ADHD diagnosis,

TABLE 1: Characteristics of CAMH Monitor survey respondents who screened positively and negatively for symptoms on the Adult ADHD Self-Report Scale-V1.1 January 2011–December 2012.

| | ADHD + | | ADHD – | | P |
|--------------------------------------|--------|------|--------|------|--------|
| | Screen | | Screen | | |
| | N | % | N | % | |
| Age | | | | | |
| 18–24 | 26 | 5.4 | 458 | 94.6 | <0.001 |
| 25–44 | 54 | 3.9 | 1346 | 96.1 | |
| 45–64 | 49 | 3.6 | 1326 | 96.4 | |
| ≥65 | 4 | 0.6 | 666 | 99.4 | |
| Gender | | | | | |
| Female | 76 | 3.6 | 2023 | 96.4 | 0.254 |
| Male | 57 | 3.0 | 1847 | 97.0 | |
| Marital status | | | | | |
| Married/partner | 70 | 2.6 | 2584 | 97.4 | 0.002 |
| Widowed/sep./div. | 18 | 4.1 | 421 | 95.9 | |
| Never married | 44 | 5.0 | 831 | 95.0 | |
| Education | | | | | |
| High school | 20 | 5.2 | 366 | 94.8 | 0.015 |
| Completed HS | 20 | 2.5 | 791 | 97.5 | |
| Some after sec. | 56 | 3.9 | 1377 | 96.1 | |
| Univ. deg. | 33 | 2.5 | 1304 | 97.5 | |
| Employment status | | | | | |
| Full time | 54 | 2.8 | 1903 | 97.2 | 0.018 |
| Part time | 22 | 5.5 | 380 | 94.5 | |
| Other | 56 | 3.4 | 1586 | 96.6 | |
| Household income | | | | | |
| <20,000 | 11 | 8.3 | 121 | 91.7 | <0.001 |
| 20–49,999 | 31 | 15.4 | 579 | 94.9 | |
| 50–100,000 | 39 | 19.0 | 1042 | 96.4 | |
| >100,000 | 31 | 2.6 | 1152 | 97.4 | |
| ADHD previously diagnosed | | | | | |
| Yes | 22 | 22.7 | 75 | 77.3 | <0.001 |
| No | 111 | 2.9 | 3783 | 97.1 | |
| ASPD screen (≥4) | | | | | |
| ASPD | 10 | 25.6 | 29 | 74.4 | <0.001 |
| Non-ASPD | 121 | 3.1 | 3791 | 96.9 | |
| Psychiatric distress (GHQ-12) | | | | | |
| Yes (+3) | 67 | 11.8 | 502 | 88.2 | <0.001 |
| No (0–2) | 66 | 1.9 | 3368 | 98.1 | |
| Ever treated with ADHD meds | | | | | |
| Yes | 6 | 15.0 | 34 | 85.0 | <0.001 |
| No | 62 | 3.3 | 1802 | 96.7 | |
| Antidepressant meds use | | | | | |
| Yes | 48 | 17.5 | 227 | 82.5 | <0.001 |
| No | 85 | 2.3 | 3633 | 97.7 | |

TABLE 1: Continued.

| | ADHD + | | ADHD – | | P |
|--|--------|------|--------|------|--------|
| | Screen | | Screen | | |
| | N | % | N | % | |
| Anti-anxiety Meds Use | | | | | |
| Yes | 27 | 19.6 | 111 | 80.4 | <0.001 |
| No | 42 | 2.4 | 1725 | 97.6 | |
| Pain Meds Use (with and without pres.) | | | | | |
| Yes | 47 | 5.3 | 843 | 94.7 | <0.001 |
| No | 85 | 2.8 | 2996 | 97.2 | |
| AUDIT | | | | | |
| Yes (8+) | 25 | 5.0 | 477 | 95.0 | 0.039 |
| No (0–7) | 106 | 3.1 | 3295 | 96.9 | |
| ASSIST | | | | | |
| Mod/High (4+) | 15 | 7.7 | 180 | 92.3 | <0.001 |
| Low (0–3) | 116 | 3.1 | 3678 | 96.9 | |
| Lifetime used cannabis | | | | | |
| Yes | 94 | 5.8 | 1520 | 94.2 | <0.001 |
| No | 38 | 1.6 | 2329 | 98.4 | |
| Past 12 mths cannabis use | | | | | |
| Yes | 38 | 7.3 | 486 | 92.9 | 0.008 |
| No | 94 | 2.7 | 3352 | 97.3 | |
| Lifetime used cocaine | | | | | |
| Yes | 32 | 11.3 | 251 | 88.7 | <0.001 |
| No | 100 | 2.7 | 3606 | 97.3 | |
| Ever arrested for a crime? | | | | | |
| Yes | 23 | 7.5 | 284 | 92.5 | <0.001 |
| No | 110 | 3.0 | 3573 | 97.0 | |
| Crash in past year | | | | | |
| Yes | 13 | 6.0 | 202 | 94.0 | 0.03 |
| No | 120 | 3.0 | 3868 | 97.0 | |

psychiatric, substance use, and social problems compared to those who screened negatively.

Examination of sociodemographics by gender indicates (Table 2) that for men and women the odds of screening positively for ADHD symptoms were significantly lower for the 25–44-year-old age group compared to the 18–24-year-old group. However, women aged 45–64 had significantly lower rates than those aged 25–44, and those aged 65 and older showed lower rates than those aged 45–64. For marital status, no differences were found by gender.

Different patterns emerged between men and women on education and employment. Among men, those who reported not completing postsecondary education showed higher odds of screening positively for ADHD symptoms than those with only a high school education. For women,

those who reported achieving a postsecondary diploma or degree showed significantly lower odds of screening positively for ADHD symptoms than those who did not complete a postsecondary degree. For employment no significant differences were observed among men between those who reported being unemployed and those who reported working either full or part time. Among women, however, those who reported being employed full time showed significantly lower odds of screening positively for ADHD symptoms.

The adjusted logistic regression (Table 3) shows variables with significant odds ratios. Those who reported previous diagnosis for ADHD and ADHD medication use showed significantly higher odds of screening positively for ADHD symptoms. Gender differences were also found: women showed much higher odds of screening positively for ADHD symptoms when they had been diagnosed (adjusted odds ratio [OR] 15.04, 95% confidence interval [CI] 6.40–35.25) or treated for ADHD (OR 19.25, CI 7.47–49.61) compared to men who reported being diagnosed (OR 6.14, CI 2.65–14.24) or treated (OR 9.00, CI 3.73–21.70). The results also indicated that psychiatric symptoms and medications were comorbid with ADHD positive symptoms. Those who screened positively on the GHQ for distress and reported antidepressant and anti-anxiety medication use had higher odds of screening for ADHD symptoms. Women also showed significantly higher odds of screening for ADHD symptoms when they reported using prescription pain killers in the last year, while men showed no significant relationship. Both men and women who reported past year cannabis use and cocaine use ever showed significantly higher odds of screening positively for ADHD symptoms.

Gender differences also emerged for social problems. While women who reported a collision in the last year showed significantly higher odds of screening positively for ADHD symptoms, no significant relationship was found between arrest for criminal offence and ADHD symptoms. However, the findings were reversed for men.

4. Discussion

This first population-based Canadian study of adult ADHD symptoms found prevalence of 3.3% screening positively for ADHD symptoms and no differences between men and women. This is congruent with M. D. Weiss and J. R. Weiss's [37] suggestion that the higher clinical prevalence of boys to girls could reflect differential referral patterns between children and adults. This finding is also consistent with the average prevalence of 3.4% found in a review of other countries using similar epidemiological sampling methodology [13]. Kessler et al. [25], using the same ADHD screening instrument, found 4.4% screened positively for ADHD, but their sample was limited to American adults 18–44 years of age. Our study is among the few that included elderly persons. We found reported ADHD symptoms highest among the 18–24-year olds, consistent with other studies [38], although for women the odds of ADHD positive symptoms decreased across all age groups whereas for men ADHD positive symptoms stabilized from young adulthood. Nonetheless, our

TABLE 2: Odds ratios (ORs) and confidence intervals (CIs) for positive ADHD symptoms by sociodemographic variables for men and women.

| Variables | Men | | | Women | | |
|-----------------------|------|-----------|----|-------|-----------|-----|
| | OR | 95% CI | P | OR | 95% CI | P |
| Age | | | | | | |
| 18–24 (ref.) | | | | | | |
| 25–44 | 0.18 | 0.06–0.53 | ** | 0.13 | 0.02–0.64 | * |
| 45–64 | 0.86 | 0.36–2.03 | NS | 0.12 | 0.03–0.40 | *** |
| ≥65 | 0.83 | 0.47–1.47 | NS | 0.51 | 0.28–0.95 | * |
| Marital status | | | | | | |
| Married (ref.) | | | | | | |
| Wid./div./sep. | 2.20 | 0.84–5.77 | NS | 1.91 | 0.96–3.79 | NS |
| Never married | 1.12 | 0.44–2.80 | NS | 1.41 | 0.73–2.74 | NS |
| Education | | | | | | |
| <high school (ref.) | | | | | | |
| High school compl. | 0.59 | 0.33–1.04 | NS | 0.55 | 0.28–1.06 | NS |
| Some after sec. | 2.1 | 1.15–3.65 | * | 0.93 | 0.52–1.66 | NS |
| University degree | 0.88 | 0.48–1.59 | NS | 0.51 | 0.31–0.83 | ** |
| Employment | | | | | | |
| Unemployed (ref.) | | | | | | |
| Full time | 0.82 | 0.41–1.67 | NS | 0.57 | 0.33–0.98 | * |
| Part time | 2.17 | 0.94–4.99 | NS | 0.91 | 0.46–1.78 | NS |

NS: not significant, *P < 0.05, **P < 0.01, and ***P < 0.001.

TABLE 3: Adjusted odds ratios (ORs) and confidence intervals (CIs) associated with positive ADHD symptoms for men and women by ADHD diagnosis, medication use, comorbidity screeners, and social problems as relevant in overall regression analyses.

| Variables | Men | | | Women | | |
|------------------------------------|-------------------|------------|-----|-------------------|------------|-----|
| | OR _{adj} | 95% CI | P | OR _{adj} | 95% CI | P |
| ADHD diagnosis | 6.14 | 2.65–14.24 | *** | 15.04 | 6.40–35.35 | *** |
| ADHD meds | 9.00 | 3.73–21.70 | *** | 19.25 | 7.47–49.61 | *** |
| Presc. pain meds | 1.28 | 0.68–2.39 | NS | 2.02 | 1.24–3.28 | ** |
| Antianxiety meds | 4.88 | 2.38–10.02 | *** | 9.07 | 5.47–15.06 | *** |
| Antidepressant meds | 6.59 | 3.13–13.89 | *** | 8.75 | 5.17–14.79 | *** |
| Distress—GHQ | 6.48 | 3.59–11.70 | *** | 5.31 | 3.26–8.66 | *** |
| Antisocial screen (≥4 symptoms) | 11.61 | 4.01–33.63 | *** | | No cases | |
| Cannabis use | | | | | | |
| Past yr | 2.24 | 1.20–4.20 | * | 2.20 | 1.18–4.08 | * |
| Cocaine use | | | | | | |
| Lifetime | 3.40 | 1.73–6.64 | *** | 4.51 | 2.32–8.75 | *** |
| Collision | | | | | | |
| Past yr | 0.36 | 0.05–2.46 | NS | 2.97 | 1.43–6.19 | ** |
| Arrested criminal offence lifetime | 2.62 | 1.33–5.16 | ** | 1.25 | 0.42–3.67 | NS |

OR_{adj}: odds ratio adjusted for age, marital status, education, and employment status, NS: not significant, *P < 0.05, **P < 0.01, and ***P < 0.001.

results confirm that ADHD symptoms persist for some adults across the adult lifespan among both men and women and are associated with adverse psychiatric, substance use, and social outcomes that were in some cases gender specific. Accordingly, these results suggest the importance of screening for ADHD among adult patients presenting with internalizing or externalizing psychiatric symptoms and/or substance use.

Our study found few differences in the clinical phenotypes of men and women who screened positively for ADHD symptoms. Although diagnosis of ADHD among those who

screened positively was low at 22.7%, women reporting ADHD diagnosis and medication treatment had more than two times higher adjusted odds of screening positively for ADHD symptoms compared to men. Given that girls with ADHD tend to be underidentified because of their less disruptive behaviours [37], it may be that those who have been diagnosed have more severe symptoms and hence are more likely to have been treated. Additionally, it may be that women are more willing to respond positively to screening items compared to men.

Psychiatric comorbidities are commonly found among adult ADHD patients, in particular, mood, anxiety, substance use, and antisocial personality disorders [5, 37]. The higher adjusted odds of positive ADHD symptoms for those who reported distress and antidepressant and anti-anxiety medication use could reflect the higher comorbidities found with ADHD. A portion could also be due to misdiagnosis of ADHD symptoms or possibly treatment with SSRIs for ADHD. Or ADHD symptoms can also be part of the symptom cluster for mood and anxiety disorders.

ADHD patients are also at significant risk for substance use, particularly for cannabis and cocaine, with 40% prevalence of lifetime diagnosis of substance use disorders [39]. A recent meta-analysis found that young adults diagnosed with ADHD as children were significantly more likely to use cannabis and cocaine but not alcohol [18]. Our study found that for those screening positively for ADHD symptoms, adjusted odds for cannabis use in past year and lifetime cocaine use were significantly higher, but not for the AUDIT or the ASSIST suggesting greater use but not necessarily abuse. The gender differences found for prescription pain medication, antisocial screen, and collisions in past year and lifetime arrest for criminal offence may reflect differences in externalizing and internalizing outcomes for men and women associated with ADHD symptoms.

The results of this study are subject to important limitations. These data are based on self-report screeners and do not reflect the breadth of information needed for clinical diagnoses. This is a key issue because the current study only reflects self-reported symptoms and does not examine impaired functioning and other issues related to specific diagnoses. Indeed, Gambino [40] cautions on the use of screening tests in prevalence estimation because screening tests tend to have relatively high false positive rates which result in overestimation of true prevalence in a population study. Thus, this population based sample may represent functioning persons with some ADHD and/or other comorbid symptoms but not actual diagnoses, although the screening tool (ASRS-V1.1) was validated against DSM-IV based psychiatric diagnoses by experienced clinicians and demonstrated good psychometrics. Additionally, although the response rate over 50% is very good for a telephone survey and data were weighted to reflect a representative sample of Ontario residents, the sample could potentially be biased. Moreover, although the total sample size is over 4000, cell sizes can be very small because psychiatric problems, such as ADHD, substance use, and collisions have low prevalence; small cell sizes and large CIs suggest a low level of precision, as indicated in some of the variables in Table 3. Nevertheless, these observations are of substantial interest in providing prevalence estimates by gender and by age, particularly for older age groups.

There are several clinical implications. Higher reports of ADHD symptoms are associated with more difficulties, further validating the ADHD self-report construct in a community sample. The relationships between the variables in this study also provide insights into better operationalizing self-reported adult ADHD symptoms. ADHD is typically regarded as an externalizing condition, but it has been acknowledged in the literature that internalizing symptoms

are comorbid in adolescence and adulthood [6]. It is unclear why these internalizing symptoms emerge, whether they emerge biologically after adolescence or whether adults with ADHD have become depressed because of their chronic behavioural difficulties that may have persisted since childhood. The nature of the comorbidities is important to understand for treatment directions. A final notable finding is the proportion of symptoms reported in the 18–24-year olds that is higher than that in the older participants. This will be an important finding to follow to determine whether this is the result of more public awareness of ADHD, or whether this reflects some cohort effect in increased reported ADHD symptoms in our young people.

Ethical Approval

The study received ethical approval from the CAMH, York University, and University of Western Ontario research ethics boards.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgment

This study was supported by a Canadian Institutes for Health Research (CIHR) operating grant (no. MOP 102537).

References

- [1] H. R. Searight, J. M. Burke, and F. Rottnek, "Adult ADHD: evaluation and treatment in family medicine," *American Family Physician*, vol. 62, no. 9, pp. 2077–2086, 2000.
- [2] S. Okie, "ADHD in adults," *The New England Journal of Medicine*, vol. 354, no. 25, pp. 2637–2641, 2006.
- [3] G. Weiss and L. Hechtman, *Hyperactive Children Grown Up: ADHD in Children, Adolescents, and Adults*, Guilford Press, New York, NY, USA, 1993.
- [4] R. A. Barkley, K. Murphy, and D. Kwasnik, "Psychological adjustment and adaptive impairments in young adults with ADHD," *Journal of Attention Disorders*, vol. 1, no. 1, pp. 41–54, 1996.
- [5] J. Biederman, M. C. Monuteaux, E. Mick et al., "Young adult outcome of attention deficit hyperactivity disorder: a controlled 10-year follow-up study," *Psychological Medicine*, vol. 36, no. 2, pp. 167–179, 2006.
- [6] S. V. Faraone and J. Biederman, "What is the prevalence of adult ADHD? Results of a population screen of 966 adults," *Journal of Attention Disorders*, vol. 9, no. 2, pp. 384–391, 2005.
- [7] S. Young, "ADHD children grown up: an empirical review," *Counselling Psychology Quarterly*, vol. 13, no. 2, pp. 191–200, 2000.
- [8] A. G. Fischer, C. H. D. Bau, E. H. Grevet et al., "The role of comorbid major depressive disorder in the clinical presentation of adult ADHD," *Journal of Psychiatric Research*, vol. 41, no. 12, pp. 991–996, 2007.

- [9] V. Simon, P. Czobor, S. Bálint, Á. Mészáros, and I. Bitter, "Prevalence and correlates of adult attention-deficit hyperactivity disorder: meta-analysis," *British Journal of Psychiatry*, vol. 194, no. 3, pp. 204–211, 2009.
- [10] J. Gershon, "A meta-analytic review of gender differences in ADHD," *Journal of Attention Disorders*, vol. 5, no. 3, pp. 143–154, 2002.
- [11] C. E. Cunningham and M. H. Boyle, "Preschoolers at risk for attention-deficit hyperactivity disorder and oppositional defiant disorder: family, parenting, and behavioral correlates," *Journal of Abnormal Child Psychology*, vol. 30, no. 6, pp. 555–569, 2002.
- [12] J. J. Rucklidge, "Gender differences in ADHD: implications for psychosocial treatments," *Expert Review of Neurotherapeutics*, vol. 8, no. 4, pp. 643–655, 2008.
- [13] A. S. Rowland, C. A. Lesesne, and A. J. Abramowitz, "The epidemiology of attention-deficit/hyperactivity disorder (ADHD): a public health view," *Mental Retardation and Developmental Disabilities Research Reviews*, vol. 8, no. 3, pp. 162–170, 2002.
- [14] J. Fayyad, R. de Graaf, R. Kessler et al., "Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder," *The British Journal of Psychiatry*, vol. 190, pp. 402–409, 2007.
- [15] A. Angola, E. J. Costello, and A. Erkanli, "Comorbidity," *Journal of Child Psychology and Psychiatry and Allied Disciplines*, vol. 40, no. 1, pp. 57–87, 1999.
- [16] R. C. Kessler, L. Adler, R. Berkley et al., "The prevalence and correlates of adult ADHD in the United States: results from the National Comorbidity Survey Replication," *American Journal of Psychiatry*, vol. 163, no. 4, pp. 716–723, 2006.
- [17] M. Fischer, R. A. Barkley, L. Smallish, and K. Fletcher, "Young adult follow-up of hyperactive children: self-reported psychiatric disorders, comorbidity, and the role of childhood conduct problems and teen CD," *Journal of Abnormal Child Psychology*, vol. 30, no. 5, pp. 463–475, 2002.
- [18] S. S. Lee, K. L. Humphreys, K. Flory, R. Liu, and K. Glass, "Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: a meta-analytic review," *Clinical Psychology Review*, vol. 31, no. 3, pp. 328–341, 2011.
- [19] S. Mannuzza, R. G. Klein, A. Bessler, P. Malloy, and M. E. Hynes, "Educational and occupational outcome of hyperactive boys grown up," *Journal of the American Academy of Child and Adolescent Psychiatry*, vol. 36, no. 9, pp. 1222–1227, 1997.
- [20] S. G. Kaplan and D. G. Cornell, "Psychopathy and ADHD in adolescent male offenders," *Youth Violence and Juvenile Justice*, vol. 2, pp. 148–160, 2004.
- [21] A. Ialomiteanu and E. M. Adlaf, *CAMH Monitor 2011: Metadata User's Guide*, Centre for Addiction and Mental Health, Toronto, Canada, 2012, http://www.camh.net/Research/camh_monitor.html.
- [22] R. C. Kessler, L. Adler, M. Ames et al., "The World Health Organization adult ADHD self-report scale (ASRS): a short screening scale for use in the general population," *Psychological Medicine*, vol. 35, no. 2, pp. 245–256, 2005.
- [23] S. L. Able, J. A. Johnston, L. A. Adler, and R. W. Swindle, "Functional and psychosocial impairment in adults with undiagnosed ADHD," *Psychological Medicine*, vol. 37, no. 1, pp. 97–107, 2007.
- [24] L. A. Adler, T. Spencer, S. V. Faraone et al., "Validity of pilot adult ADHD self-report scale (ASRS) to rate adult ADHD symptoms," *Annals of Clinical Psychiatry*, vol. 18, no. 3, pp. 145–148, 2006.
- [25] R. C. Kessler, L. A. Adler, M. J. Gruber, C. A. Sarawate, T. Spencer, and D. L. Van Brunt, "Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) Screener in a representative sample of health plan members," *International Journal of Methods in Psychiatric Research*, vol. 16, no. 2, pp. 52–65, 2007.
- [26] A. Paglia-Boak, R. E. Mann, E. M. Adlaf et al., *Detailed OSDUHS Findings. The Mental Health and Well-Being of Ontario Students 1991–2011*, CAMH Research Document Series no. 33, Centre for Addiction and Mental Health, Toronto, Canada, 2012.
- [27] S. Donath, "The validity of the 12-item General Health Questionnaire in Australia: a comparison between three scoring methods," *Australian and New Zealand Journal of Psychiatry*, vol. 35, no. 2, pp. 231–235, 2001.
- [28] D. P. Goldberg and V. F. Hillier, "A scaled version of the General Health Questionnaire," *Psychological Medicine*, vol. 9, no. 1, pp. 139–145, 1979.
- [29] G. E. Hardy, D. A. Shapiro, C. E. Haynes, and J. E. Rick, "Validation of the General Health Questionnaire-12 using a sample of employees from England's health care services," *Psychological Assessment*, vol. 11, no. 2, pp. 159–165, 1999.
- [30] D. V. Sheehan, Y. Lecrubier, K. H. Sheehan et al., "The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10," *The Journal of Clinical Psychiatry*, vol. 59, no. 20, pp. 22–33, 1998.
- [31] D. A. L. Newcombe, R. E. Humeniuk, and R. Ali, "Validation of the world health organization alcohol, smoking and substance involvement screening test (ASSIST): report of results from the Australian site," *Drug and Alcohol Review*, vol. 24, no. 3, pp. 217–226, 2005.
- [32] J. B. Saunders, O. G. Aasland, T. F. Babor, J. R. de la Fuente, and M. Grant, "Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption II," *Addiction*, vol. 88, no. 6, pp. 791–804, 1993.
- [33] WHO ASSIST Working Group, "The Alcohol, smoking and substance involvement screening test (ASSIST): development, reliability and feasibility," *Addiction*, vol. 97, no. 9, pp. 1183–1194, 2002.
- [34] A. Ialomiteanu, E. M. Adlaf, H. Hamilton, and R. E. Mann, "CAMH Monitor eReport: addiction and mental health indicators among Ontario adults 1977–2011," CAMH Research Document Series No. 35, Centre for Addiction and Mental Health, Toronto, Canada, 2012.
- [35] M. Kirst, G. Mecredy, and M. Chaiton, "The prevalence of tobacco use co-morbidities in Canada," *Canadian Journal of Public Health*, vol. 104, no. 3, pp. e210–e215, 2013.
- [36] R. E. Mann, G. Stoduto, E. Vingilis et al., "Alcohol and driving factors in collision risk," *Accident Analysis and Prevention*, vol. 42, no. 6, pp. 1538–1544, 2010.
- [37] M. D. Weiss and J. R. Weiss, "A guide to the treatment of adults with ADHD," *Journal of Clinical Psychiatry*, vol. 65, no. 3, pp. 27–37, 2004.
- [38] K. Murphy and R. A. Barkley, "Prevalence of DSM-IV symptoms of ADHD in adult licensed drivers: implications for clinical diagnosis," *Journal of Attention Disorders*, vol. 1, no. 3, pp. 147–161, 1996.

- [39] J. Biederman, S. V. Faraone, M. C. Monuteaux, M. Bober, and E. Cadogen, "Gender effects on attention-deficit/hyperactivity disorder in adults, revisited," *Biological Psychiatry*, vol. 55, no. 7, pp. 692–700, 2004.
- [40] B. Gambino, "The correction for bias in prevalence estimation with screening tests," *Journal of Gambling Studies*, vol. 13, no. 4, pp. 343–351, 1997.



Hindawi
Submit your manuscripts at
<http://www.hindawi.com>

