



Attention deficit hyperactivity disorder and arrest history: Differential association of clinical characteristics by sex

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ABSTRACT

Attention deficit hyperactivity disorder (ADHD) is often cited as a risk factor for criminality. However, many studies do not take other criminogenic variables into account when reporting on this relationship. It is even less clear whether models that include ADHD as a potential risk factor for criminality consider the importance of sex differences. To answer this question, we collected data from a telephone population survey sampling adults over the age of 18 years in the province of Ontario, Canada (final sample size = 5196). Respondents were screened for ADHD using the Adult ADHD Self-Report Version 1.1 Screener (ASRS-V1.1) and four extra items. Problematic drinking was assessed using the Alcohol Use Disorders Identification Test (AUDIT), while cannabis misuse was evaluated using the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). The Antisocial Personality Disorder Scale from the Mini-International Neuropsychiatric Interview provided a measure of previous conduct disorder symptoms and the 12-item General Health Questionnaire screening procedure was used to gauge general distress. History of arrest was self-reported. Three separate logistic regression analyses (entire sample, male only, and female only) were applied to estimate the association of the foregoing variables with arrest history. In the combined sample, conduct disorder symptoms, problem alcohol use, and problem cannabis use all predicted history of arrest. With regard to the male sample, conduct disorder symptoms, elevated AUDIT and ASSIST scores, and general distress were associated with an arrest history. For the female subsample, only conduct disorder symptoms and problematic cannabis use showed a relationship with criminality. To summarize, ADHD did not predict history of arrest for either subsample or the combined sample. When comparing males and females, conduct disorder symptoms and cannabis misuse exerted stronger effects on history of arrest for females than males. These results suggest that the relative importance and type of clinical risk factors for arrest may differ according to sex. Such information could be useful for crime prevention policies and correctional programs that take into account differences in experience by sex.

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1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that onsets in youth and persists into adulthood to cause impairment in over 65% of cases (Weiss, Murray, & Weiss, 2002). The clinical comorbidities that characterize the childhood phenotype, namely mood, conduct, and substance use disorders, parallel those observed in adult ADHD (Faraone et al., 2000). Some population studies

suggest that the prevalence of adult ADHD is similar among sexes (Vingilis et al., 2015), while other reports indicate that it is more common in males (Yallop et al., 2015). These discrepancies highlight the need to consider sex an important variable in the study of adult ADHD.

Evidence indicates that adult ADHD manifests different symptomatology in males and females. For example, one study found that males with ADHD presented higher rates of alcohol abuse and psychoactive substance use disorders, poorer academic functioning in childhood, and greater cognitive deficits (Biederman, Faraone, Monuteaux, Bober, & Cadogen, 2004), while in another study, females with self-reported ADHD endorsed higher 12-month rates of major depressive disorder and generalized anxiety disorder (Hesson & Fowler, 2015). In one of the few population-based studies to examine adult ADHD and a

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wide range of psychosocial outcomes, conduct disorder symptoms, cocaine use, medication use, drug use, criminal offenses, and distress intolerance were found to be more common in males. Females showed some similarities but also some important differences, including increased motor vehicle collisions in the past 12 months and lack of a criminal history (Vingilis et al., 2015).

With regard to criminality, several studies have examined the relationship between adult ADHD and criminal behavior outcomes. Most of the literature has focused on adolescent and male populations (Babinski, Hartsough, & Lambert, 1999; Mannuzza, Klein, & Moulton III, 2008; Savolainen et al., 2015; Sourander et al., 2006). However, some investigations have found an association of adult ADHD with violent behavior, independent of antisocial personality disorder (ASPD), alcohol or drug dependence, and anxiety (Gonzalez, Kallis, & Coid, 2013). Conversely, other studies report the absence of a connection between ADHD and criminal activity when other externalizing conditions, such as conduct disorder or ASPD, are taken into account (Grieger & Hosser, 2012). This heterogeneity in results likely reflects varying study designs and outcome measures. Interestingly, with few exceptions (Gonzalez et al., 2013), most studies have not considered the role of substance misuse in criminal outcomes when adult ADHD is present. This variable deserves attention, especially since substance misuse is frequently comorbid with adult ADHD (Fateas et al., 2016) and is also independently associated with criminal activity (Teesson et al., 2015).

Socioeconomic status (SES) has also been shown to exert influence on brain development (Hackman, Farah, & Meaney, 2010) and mental health outcomes (Hudson, 2005). Education is a common study indicator of SES and has a complex relationship with ADHD. Low educational attainment is a common negative psychosocial outcome associated with ADHD in adults (Davidson, 2008). As documented by Loe and Feldman (2007), symptoms of ADHD are associated with poor educational outcomes for those with and without a formal ADHD diagnosis. Further, education is often identified as an important component of crime prevention policy (Lochner, 2004). Longitudinal analysis has shown that policies aimed at increasing educational achievement at the population level have been associated with reductions in overall crime (Machin, Marie, & Vujčić, 2011). Therefore, we consider the relationships between education, and crime and ADHD in our analyses.

It is well-documented that males perpetrate more criminal offenses than women (Rowe, Vazsonyi, & Flannery, 1995). Still, many studies focus on male-driven crime or do not take sex differences into account. Furthermore, to our knowledge, the contribution of ADHD, substance misuse, and conduct disorder pathology in predicting history of arrest has never been examined at the population level. Analyzing these relationships can detect associations that may be more relevant to population-based approaches to health and delinquency than studies performed in clinic-referred or selected cohorts. Therefore, the goal of the present study was to explore the interplay between adult ADHD, conduct disorder symptoms, and substance misuse at the population level in predicting self-reported arrests by controlling for sex. We hypothesized that sex differences would emerge from these analyses given the results of previous population-based reports showing variation in the types of substance misuse and psychosocial correlates of adult ADHD between males and females (Kolla et al., 2016; Vingilis et al., 2015).

2. Materials and methods

2.1. Sample

This study uses data collected from the Centre for Addiction and Mental Health (CAMH) Survey Monitor for the years 2011 to 2013. The CAMH Monitor is an annual survey collected on a quarterly basis that gathers information on mental health, substance use, problem behaviors, and a wide range of demographic data from adults aged 18 years and older in the province of Ontario, Canada. The survey provides representative data by using a random digit dialing design with a two-stage probability

sampling procedure. This first stage involves a random selection of land-line and cellular telephone numbers in Ontario including unlisted and unpublished numbers, divided into six regional strata. The second stage involves selecting the household member over 18 years of age with the birthday closest to the date of the call. Interviewers are trained and employ computer-assisted interviewing software to complete the survey (Ialomiteanu, Hamilton, Adlaf, & Mann, 2014). For the three-year period, 25,623 numbers were dialed, of which 17,525 were estimated to be eligible for the survey; 9090 respondents participated, representing an overall effective response rate of about 51.8%. The number of participants that completed the version of the survey for the three-year period of study, which included the ADHD questionnaire, was 6074. After listwise deletion for missing study variable data, the final study sample was 5196 (Ialomiteanu et al., 2014).

2.2. Measures

Past arrest was modeled as a binary variable. It was a single item independent of other study scales that asked respondents whether they had ever been arrested for a criminal offense. ADHD was analyzed as a binary variable. It was indicated by screening as probable ADHD on the Adult ADHD Self-Report Scale-V1.1 (ASRS-V1.1) (Kessler et al., 2005). This short screening tool is considered appropriate for assessing ADHD within the general population. The ASRS-V1.1 has shown good sensitivity (68.7%) and high specificity (99.5%) in detecting ADHD among adults, and its brevity makes it a strong tool for large-scale survey research (Kessler et al., 2005). Problem drinking was also analyzed as a binary variable as indicated by a score of eight or more on the Alcohol Use Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The AUDIT is one of the most widely used measures of problem drinking and has been validated in many research settings (Reinert & Allen, 2002). Problem cannabis use was indicated by a score of four or more on the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (World Health Organization ASSIST Working Group, 2002). History of conduct disorder was indicated by a score on the last five questions of the Antisocial Personality Disorder Scale from the Mini-International Neuropsychiatric Interview (MINI-APD) (Sheehan et al., 1997), which queries behaviors before the age of 15. The full scale could not be used as the entire questionnaire was only asked of those who met the initial screening requirements. Psychological distress has been linked to both ADHD (Barkley, Murphy, & Kwasnick, 1996) and substance use (Khantzian, 1997). Therefore, psychological distress was measured as a binary variable using the GHQ-12 screening procedure (Goldberg & Williams, 1988). Age was measured as a continuous variable and sex was modeled as a binary variable. Both were self-reported. In order to control for SES, highest educational attainment was added to the models. This variable was comprised of the following four levels: less than high school, high school diploma or equivalent, completed trade or college degree or some university, and completed university degree or higher. High school diploma or equivalent was used as the reference category.

2.3. Analysis

Pearson's chi-squared tests were used in comparisons across categorical variables, and independent samples *t*-tests were used for comparing continuous variables. A series of logistic regressions were performed to examine the relationship between past arrest, ADHD, and possible confounding variables such as conduct disorder symptoms, distress, and current substance use problems. Analyses were performed on the complete dataset and two subsets of the of the data, one with all those identifying as male and the other with all those identifying as female. Data were weighted to account for sampling design to reflect the general population. All analyses were completed using the R package for statistical computing (R Core Team, 2013).

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