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Childhood ADHD symptoms are associated with lifetime and current illicit substance use disorders and in-site health risk behaviors in a representative sample of Latino prison inmates

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Abstract

Objectives—This study aimed to explore significant childhood ADHD symptomatology, psychiatric comorbidity, rates of Substance Use Disorders (SUD), as well as their association with high-risk health behaviors and adverse health outcomes in prison.

Method—A randomly selected representative sample of inmates in the Puerto Rico correctional system ($n = 1,179$) were assessed with the Spanish language Wender Utah Rating Scale (WURS), the CIDI modules for lifetime/current MDD, GAD and SUD, the Davidson Trauma Scale (DTS, PTSD), and self-reports of in-site high risk behaviors.

Results—Wald χ^2 tests revealed significant associations of ADHD with MDD, GAD and PTSD, as well as increased risk for overdosing and IV drug use in prison. A Logistic Regression model adjusted for mood and anxiety comorbidity predicted lifetime SUD diagnosis (OR 2.38; CI 1.15–4.94).

Discussion—Our results provide evidence on the extent of the association of drug dependence and ADHD symptoms, and their over-representation among prison inmates.

INTRODUCTION

The rates of some psychiatric illnesses are significantly more prevalent in the imprisoned population when compared to estimates from community samples (Fazel & Danesh, 2002; James & Glaze, 2006; Mumola & Karberg, 2006). Adult attention deficit/hyperactivity disorder (ADHD) appears particularly over-represented among incarcerated individuals (Dalteg, Lindgren, & Levander, 1999; Ginsberg, Hirvikoski, & Lindefors, 2010;

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Gudjonsson, Sigurdsson, Young, Newton, & Peersen, 2009; Retz et al., 2004; Rosler et al., 2004; Rosler, Retz, Yaqoobi, Burg, & Retz-Junginger, 2009; Vitelli, 1996). ADHD prevalence estimates among male inmates are approximately around 10% when full DSM-IV criteria are assessed (Einarsson, Sigurdsson, Gudjonsson, Newton, & Bragason, 2009; G.H. Gudjonsson et al., 2009; Rösler et al., 2009). When either subthreshold criteria or retrospective screening approaches are used, these can increase to approximately 45%–50% (Edvinsson, Bingeors, Lindstrom, & Lewander, 2010; Einarsson et al., 2009; Gudjonsson et al., 2009; Rosler et al., 2004; Vitelli, Chiariello, Lattero, Bruni, & Bucci, 1996). These figures are strikingly higher than ADHD prevalence rates reported for the adult US population, which range from 3.4% to 4.4% (Fayyad et al., 2007; Kessler et al., 2006). Furthermore, reports of screening for ADHD symptoms among female inmates show the same trend, and also appear high (50%, Edvinsson et al., 2010; 24.5 %, Rosler et al., 2009). The difference in prevalence rates among incarcerated samples is noteworthy, considering the lower female ADHD prevalence in the community relative to males (respectively, 3.2% vs. 5.4%, OR 1.6; Kessler et al., 2006). Additionally, adult ADHD is known to co-occur frequently with other mental health disorders, such as Mood, Anxiety and Personality Disorders (Biederman et al., 2006; G.H. Gudjonsson et al., 2009; Harrington et al., 2012; Philipsen et al., 2008). There is also evidence demonstrating a high co-occurrence of ADHD with Substance Use Disorders (**SUD**; Adler, Guida, Irons, Rotrosen, & O'Donnell, 2009; Biederman, 2004; Biederman et al., 2006; Kessler et al., 2006; Wilens et al., 2007).

In view of these rates, the potential for ADHD co-occurring with SUD in the correctional setting is noteworthy. Estimates from the Bureau of Justice Statistics reveal that 53%–45% of state and federal prisoners in the US have a SUD (Mumola & Karberg, 2006). However, there are scarce representative reports regarding the prevalence of SUD with psychiatric disorders (Baillargeon et al., 2010), and very few with ADHD, in this setting. Some reports have highlighted the co-occurrence of ADHD symptoms and substance abuse and dependence in the imprisoned population, although they have been limited by small sample sizes and virtually no ethnic diversity. In a notable study, Young et al. (2011) found that meeting the criteria for opioid dependence among inmates (n = 198) predicted current ADHD diagnosis. Additional research reports from prison samples indicate that SUD and ADHD are also common among inmates within the prison context (Gudjonsson et al., 2009; Rosler et al., 2004; Rosler et al., 2009)

Dually diagnosed inmates have generally poorer prognosis and more adverse outcomes (Baillargeon, Binswanger, Penn, Williams, & Murray, 2009). ADHD co-occurring with a SUD has serious implications for rehabilitation efforts, since it is well documented that ADHD can worsen a co-occurring SUD and hinder its treatment (Adler et al., 2009; Carroll & Rounsaville, 1993; Levin et al., 2004; Wilens & Upadhyaya, 2007). Additionally, an untreated SUD in this population can contribute to individuals engaging in illicit substance related offenses, which in turn may lead to re incarceration. Therefore, ADHD can become an additional liability to an already long list of barriers that obstruct community re-entry in inmates, such as poverty, low education, poor familial support and social stigma (Baillargeon et al., 2010; Diamond, Wang, Holzer, Thomas, & des Anges, 2001).

Adult ADHD has been repeatedly associated with several psychosocial impairment outcomes. Even in absence of full DSM-IV criteria, mild to moderate impairment has been reported in adults with ADHD (Biederman, Mick, & Faraone, 2000; Kooij et al., 2005; Solanto, Marks, Wasserstein, & Mitchell, 2011). We argue that within the penitentiary setting ADHD represents a vulnerability factor for further impairment in imprisoned individuals, considering the high indices of comorbidity and SUD (Diamond, 2001; Fazel & Danesh, 2002; Fazel, 2006), and rates of risk behaviors occurring in the prison setting (Hammett, 2006). Risk behaviors that lead to blood-borne virus infection and those that lead to adverse outcomes of drug use have been identified as high among inmates (Dissabandara, Dias Shavindra, Dodd, & Stadlin, 2009; Koulirakis, Gnardellis, Agrafiotis, & Power, 2000; Power et al., 1992; Rotily & Galinier-Pujol, 1995). There are no studies of the impact of ADHD symptoms, particularly its associated impulsivity dimension, on these adverse outcomes in the prison context.

Identification and understanding of the complexity of this issue will provide much needed relevant data to inform rehabilitation efforts and impact correctional policy. However, the majority of studies on the subject of ADHD in adult prison inmates have been performed in European countries (i.e., Germany, Iceland, Norway, Sweden & the United Kingdom) and in Japan. The estimated rate of sentenced male prisoners under state and federal jurisdiction of Latino origin for 2010 is 22.6% (Guerino, Harrison, & Sabol, 2011), but little is known about ADHD and its associated co-occurring conditions in Latin American communities in the US or elsewhere. Even though we lack studies of ADHD in the Puerto Rico (PR) criminal justice system, the high prevalence rates of ADHD in Puerto Rican children (7.5% – 8%) (Bauermeister et al., 2007; Canino et al., 2004), as well as the national (i.e., intra-island) high overall crime and recidivism rates suggest that PR could potentially have ADHD inmate rates comparable to that of other western countries. To our knowledge, this is the first report of adults with childhood history of ADHD symptoms in a Latin American sample of inmates.

Our main aim is to explore significant childhood ADHD symptomatology in a representative sample ($n = 1,179$) of inmates in the correctional system of PR, and their relation to psychiatric comorbidity and rates of SUD. We are also interested in testing whether retrospective/childhood ADHD symptoms are associated with high-risk health behaviors in prison, and adverse health consequences potentially occurring from these behaviors. We also use ADHD to predict lifetime SUD in these inmates, adjusting for further psychopathology. By exploring these variables in association to history of ADHD we intend to examine the level of overall impairment in adult Latin inmates with ADHD.

METHODS

Sample and Procedures

This study makes use of data from a cross-sectional anonymous survey of sentenced inmates in the state prisons of Puerto Rico (PR). The study, commissioned by the Puerto Rico Department of Correction and Rehabilitation, was conducted in 2004–2005 to assess drug treatment needs and inform health services planning (Albizu-Garcia, Caraballo, Caraballo-Correa, Hernandez-Viver, & Roman-Badenas, 2012). The study sample consisted of 1,331

randomly selected sentenced inmates from 26 penal institutions, out of the 39 institutions in the Puerto Rico prison system during 2004, representing 13% of the total sentenced inmate population.

A complex, probabilistic, multistage sampling and design was used. Details of sampling procedures have been described elsewhere (Albizu-Garcia et al., 2012; Pena-Orellana, Hernandez-Viver, Caraballo-Correa, & Albizu-Garcia, 2011). The research team carried out subject selection anonymously several days prior to initiating interviews. At each institution, one staff member was assigned to collaborate with the researchers; this person conveyed the invitation to attend the orientation that was provided by the research team to the inmate population. After the orientation, inmates that provided oral consent to participate were interviewed. Interview facilities provided privacy and protected confidentiality. A total of 1,179 individuals participated in the study (89% response rate). The study was reviewed and approved by the University of Puerto Rico Medical Sciences Campus Institutional Review Board, which included a prisoners' advocate.

Comparison groups were formed on the basis of their scores on the Wender Utah Rating Scale (WURS) cutoff of 36 or more (see Ward, Wender & Reimherr, 1993). 32% of participants scored above the cutoff for significant childhood ADHD symptomatology. Although the WURS scale was developed to assess childhood symptoms retrospectively, an adaptation of the scale to assess current symptoms was reported by Mc Cann et al. (2000). The availability of this adapted scale allowed us to obtain an estimate of the proportion of cases above the cutoff in both versions, therefore an estimate of the persistence of current symptoms of ADHD in this sample. 43.5% of cases with significant ADHD symptomatology also displayed significant current symptoms (14.0% of the total sample). An examination of current ADHD in relation to our series of outcomes is outside the objectives of the current report.

Measures

Sociodemographic variables measured included gender, age, educational level and number of dependents each participant had. Two computerized interview modalities were used for data gathering: CAPI (Computer Assisted Personal Interview) and ACASI (Audio Computer Assisted Self Interview). Trained interviewers conducted the computerized personal interview and were available to answer questions during the self-administered interview. Health high-risk behaviors in prison such as tattooing in prison and IDU injection were assessed via direct yes/no questions. Self-reported infection of blood-borne pathogens such as Hepatitis C (HCV) and HIV were also assessed.

Wender Utah Rating Scale (WURS; Spanish)—For the assessment of ADHD symptoms we administered the Spanish version of the Wender Utah Rating Scale (WURS; (González Rodríguez & Vélez Pastrana, 2007) to all interviewed inmates. The WURS is a self-rating instrument developed for the purpose of assessing the presence of ADHD symptoms retrospectively (Ward, Wender, & Reimherr, 1993). The scale originally consisted of 61 items describing the symptoms of ADHD and was later reduced to the 25 items that distinguished patients with ADHD from non-patients, as Ward, Wender, and

Reimherr reported in 1993. The 25 items in the WURS describe ADHD-relevant behaviors and symptoms (for example “As a child... I had concentration problems, easily distracted/ Trouble with stick-to-it-tiveness, not following through, failing to finish things started”). These are rated on a 5-point scale, ranging from 0 (“not at all or very slightly”) to 4 (“very much”). Possible total scores range from 0 to 100. Ward, Wender & Reimherr (1993) proposed a cut-off score of 36 or higher, which identified 96% of adults with childhood ADHD. The instrument has been translated into several languages, and its psychometric properties widely reported (Bayle, Krebs, Martin, Bouvard, & Wender, 2003; Fossati et al., 2001; Lara-Munoz, Herrera-Garcia, Romero-Ogawa, Torija, & Garcia, 1998). The WURS Spanish version has a Cronbach’s alpha coefficient of .94 (González Rodríguez & Vélez Pastrana, 2007). This reliability index is consistent with what is reported for the WURS versions across several languages, which tend to be above .90. As a dimensional measure of ADHD symptoms it has been found to be a valuable instrument. It has shown to correlate and have shared variance with some objective measures of attentional dysfunction, such as omission errors on the Continuous Performance Test (Asbjørnsen, Jones, Munkvold, Obrzut, & Manger, 2010).

University of Michigan Composite International Diagnostic Interview (UM-CIDI)—Lifetime and current diagnoses of drug abuse/dependence, Major Depression Disorder (MDD) and Generalized Anxiety Disorder (GAD) were measured with the University of Michigan-Composite International Diagnostic Interview UM-CIDI (Kessler & Ustun, 2004), which is a modified version of the Composite International Diagnostic Interview (WHO-CID).

Statistical Analyses

All statistical analyses were conducted using SUDAAN software release 10.0. to account for the complex design of the sample. For our analyses we took into consideration stratification of the primary sampling units (PSU), unequal weights and correlation between subjects induced by cluster sampling. For bivariate analyses, Chi-square/Wald distribution tests were used to test the association of self-reported ADHD symptoms with all other categorical variables of interest. Univariate logistic regression models and their respective Odds Ratios (OR) were calculated in order to establish the presence of significant probabilities with childhood ADHD symptoms as predictor, and to determine if they were associated with health risk behaviors, mental health and SUD. All association analyses were tested using a $p < .05$. Finally, considering the marked association of adult ADHD and SUD we developed a binary logistic regression model for prediction of lifetime SUD, adjusting for the effect of early onset criminality (i.e., indicator of conduct disorder/antisocial behavior) and psychiatric comorbidity.

RESULTS

We examined the association of childhood ADHD symptoms to sociodemographic, psychiatric comorbidity (i.e., PTSD screening, MDD and GAD), SUD and health risk behaviors such as intravenous drug use (IDU) and getting a tattoo in prison, and adverse outcomes including prevalence of HIV and hepatitis infection. We used the chi-square/Wald

statistic to test for significant associations between presence of ADHD symptoms and these categorical variables. Early age of onset of criminal behavior (i.e., arrested before age 15) was used as a proxy variable to control for the potential presence of conduct disorder in our prediction model for lifetime SUD, a procedure employed by Young, Wells & Gudjonsson (2011).

Socio-demographic characteristics, health history and risk behaviors

Approximately half (51.4%) of the sample had not attained a high school degree. Additionally, 46.3% of the total sample reported having 3 familial dependents or more. As shown in Table 1, 32.0% of the sample had ADHD symptoms above the cutoff score of 36 on the WURS-C scale, which is compatible with a significant childhood history of ADHD. Significantly more females than males (40.7% vs. 28.8%, $p < .05$) scored above the cutoff score, reporting significant childhood symptoms of ADHD.

With respect to health history variables, behaviors that increase the risk for infection with blood-borne viruses, such as intravenous drug use (IDU) and getting a tattoo while in prison were significantly associated with ADHD symptoms (Table 2). Significantly higher proportions of inmates with ADHD symptoms tended to report IDU before (37.7% vs. 25.1%) and during incarceration (29.5% vs. 20%), getting a tattoo (78.1% vs. 72.9%) and overdosing while in prison (16.0% vs. 10.3%). Similarly, a higher proportion of inmates with ADHD (8.4%) presented HIV infection than their counterparts (3.6%). There were, however, no significant associations between ADHD and hepatitis B or C infection.

Psychiatric comorbidity

We analyzed the presence of Major Depression Disorder (MDD) and Generalized Anxiety Disorder (GAD), as well as a valid screening for Post-traumatic Stress Disorder (PTSD) in terms of their association with retrospective ADHD. The probability of participants above the cutoff for significant childhood ADHD symptoms to have suffered MDD in their lifetime was twofold (OR 2.13; $p < .001$), while for MDD in the last 12 months it was 2.63 (17.0% vs. 7.2%; $p < .001$). Meanwhile, there was no association, nor trend between ADHD and GAD in our sample. A caveat must be observed regarding GAD, as the sample for inmates with this anxiety disorder was quite small ($n = 25$). Perhaps the most striking finding regarding mental health is that within the ADHD group, 29.2% screened positive for PTSD, as opposed to 5.3% with positive PTSD and no significant ADHD symptoms (OR 7.31).

Substance Use Disorders

In Table 3 we present an SUD profile of the participants, comparing those with/without childhood ADHD symptoms on SUD variables, including lifetime and past year abuse and dependence of alcohol or illicit substances. All SUD variables were significantly associated with retrospective ADHD, with the exception of lifetime substance *abuse* and alcohol dependence in the last 12 months. Higher proportions of inmates with childhood ADHD symptoms had a SUD (66.7% vs. 46.7%), including abuse and dependence. These rates and their respective OR are presented in Table 3, which also includes OR adjusted for comorbid MDD, GAD and positive PTSD screening. The significant associations from the first step

were lost after adjusting for comorbid psychiatric disorders on the variables related to problematic alcohol use, specifically alcohol dependence (lifetime) and abuse (lifetime). Substance (illicit drug) abuse in the last 12 months and dependence remained associated to retrospective ADHD after controlling for psychiatric comorbidity.

ADHD was significantly associated with early age of onset of criminal behavior. We found a significant interaction effect between having significant symptoms of ADHD in childhood combined with an early onset of criminal behavior, which increases the probability of a SUD (Figure 1). The probability of drug abuse or dependence was higher among inmates that have a childhood history of ADHD and who initiated criminal behavior at an earlier age, before age 15 specifically. The probability of a SUD was equal among inmates without childhood ADHD symptoms, without regard to the age of onset of criminality. However, when there is a history of ADHD, the probability of SUD is greater (.73 vs. .51) among those inmates who had an arrest at an earlier age.

A logistic regression analysis was conducted to predict SUD using sex and childhood ADHD, early onset of criminal activity and mental health as predictors. Among these, sex and the interaction between ADHD and early onset of criminal activity were significant ($p < .05$) among all variables on the last block, significantly predicting lifetime SUD status. This model is presented in Table 4.

DISCUSSION

Our findings suggest that 32% of prison inmates present a childhood history of significant ADHD symptoms. These results indicate that incarcerated individuals who present a childhood history of ADHD symptoms are at an increased risk for adverse health outcomes, have additional psychiatric comorbidity and SUD, when compared to inmates without ADHD. Our estimate of significant childhood ADHD symptomatology is consistent with other findings in correctional samples (Dalteg et al., 1999; Gudjonsson, et al., 2009; Retz et al., 2004; Rösler et al., 2009; Rösler et al., 2004; Young et al., 2009). Moreover, the retrospective ADHD rate for this study is similar to what has been reported by other researchers with females in prison (Edvinsson et al., 2010; Rosler et al., 2009). The proportion of cases in our sample with retrospective ADHD symptoms was significantly higher in females than in men (40.7% vs. 28.8%), in contrast with national and international community prevalence rates for the disorder, which favor males. This may suggest that there are social or cultural contributing factors. It is worth noting that the rates of ADHD amongst female inmates in the other two prison studies cited (Edvinsson et al., 2010; Rosler et al., 2009), whilst higher than those of the general population, were not higher than that of male prisoners. However, there has been little research into incarcerated females with ADHD to date and our findings hopefully validate opening up this research avenue.

Although we only had a retrospective measure of ADHD available for this Spanish-speaking prison sample, it is evident from similar studies that a significant proportion of adults with scores above the established cutoff have adult ADHD as well. It has been suggested in other reports that different versions of the WURS identify adult ADHD, even though it was developed for adults to focus on childhood retrospective symptoms. For example, Absjörson

et al. (2010) suggested that their prison sample responded to the WURS questionnaire in terms of how they experience their symptoms currently. Many other researchers have employed screening methods for identifying ADHD in prison samples, specifically the WURS (Ginsberg et al., 2010; G.H. Gudjonsson et al., 2009; Matsumoto et al., 2005; Retz et al., 2004; Rosler et al., 2004; Rosler et al., 2009). For instance, Einarsson et al. (2011) found 50% of their sample screened positive for ADHD, while Gudjonsson et al. (2009) reported a rate of retrospective ADHD of 52.2%. Additionally, in a study of specific drug use and ADHD symptoms, Matsumoto et al. (2005) found 40.5% of cases had scores above the cutoff on the scale. It should be noted that in studies that have validated DSM-IV diagnosis by including rating scales or in-depth assessments, the number of ADHD cases usually decreases by a proportion of over .20 (50.0% to 15.5%, Einarsson et al., 2008; 45.0% to 40.0%, Ginsberg et al., 2010; 52.2% to 19.5%, Gudjonsson et al., 2009). The childhood rates in these studies are consistent with our reports for retrospective ADHD data.

Lifetime and current SUD for the sample was 53% and 13% respectively. ADHD symptoms significantly increased risk for our participants having a SUD, which is consistent with reports in community and clinical samples (Biederman et al., 2006; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993, 1998; Wilens et al., 2007), and incarcerated samples (Ginsberg et al., 2010; G.H. Gudjonsson, Wells, & Young, 2012; Young, Wells, & Gudjonsson, 2011). History of ADHD symptoms appears to be more associated to lifetime and current drug dependence than to abuse in our sample. Overall SUD, but drug dependence in particular, remained significant after adjusting for comorbid psychopathology, consistent with reports of an ADHD-heroin dependence relationship (G.H. Gudjonsson et al., 2012; Young et al., 2011) and a significant history of hyperactivity symptoms among a sample of opiate addicts (Eyre, Rounsaville, & Kleber, 1982). Other researchers have established the overrepresentation of psychiatric comorbidity and ADHD in opiate-dependent individuals (Brooner, King, Kidorf, Schmidt, & Bigelow, 1997; Kolpe & Carlson, 2007). Alcohol-related abuse and dependence appear to be driven by comorbid mental health disorders (i.e., MDD and PTSD), thus not predicted solely by retrospective ADHD symptomatology.

Additionally, participants in our sample who report a significant history of ADHD symptoms seem to engage in behaviors that lead to potentially adverse health consequences, such as IDU or getting a tattoo during their imprisonment. Inmates with childhood ADHD symptoms were almost twice as likely to use IV drugs before and while in prison, therefore it is not surprising that we also observed a higher proportion of overdosing within this group. We could not identify other studies in the literature that have examined this association. Strikingly, the proportion of HIV-positive cases was double in participants who endorsed childhood symptoms of ADHD, a finding that can be associated to the high proportion of IDU use among this group. While the high prevalence of risk behaviors for blood-borne infections among inmates has been documented (Dissabandara et al., 2009; Koulierakis et al., 2000; Power et al., 1992; Rotily & Galinier-Pujol, 1995), the increased risk that a history of ADHD presents has not been studied sufficiently. However, research has established that in adolescents with ADHD, high-risk behaviors (e.g., unprotected sexual intercourse) appear to be related to underlying processes of impulsivity and poor-self control. For example, childhood ADHD has been shown to predict earlier onset of sexual

activity, having more sexual partners, engaging in casual sex, and unintended pregnancies (Flory, Molina, Pelham, Gnagy, & Smith, 2006). These authors argue that ADHD makes an independent contribution to these sexual risk behaviors, beyond childhood conduct problems, suggesting the ADHD characteristics are markers of later vulnerability.

Meanwhile, other reports suggest that individuals with Learning Disabilities or ADHD with poor cognitive performance are more likely to contract an infectious disease (Severtson, Hedden, Martins, & Latimer, 2010). We hypothesize that in our sample these could be driven by psychosocial determinants and comorbid psychiatric disorders as well.

Psychiatric comorbidity has been associated with increased rates of HIV risk behavior and infection, as well as greater drug use and psychosocial impairment, but findings in the literature relating ADHD with high risk IDU and its adverse health consequences are non-existent. Generally, there is not much data available on IDU abusers that are not enrolled in treatment (Kidorf et al., 2004). Nevertheless, studies with other Axis I diagnoses, such as depression, have shown it to be associated with greater frequency of injection risk behaviors among IDU users (Stein, Solomon, Herman, Anderson, & Miller, 2003). Greater risk of HIV transmission has also been reported in drug abusers diagnosed with Axis II disorders, specifically Antisocial Personality Disorder (ASPD; Brooner et al., 1997). In both Brooner et al. (1997) and Kidorf et al. (2004), ASPD was a significant mediator factor that increased the risk of opioid abuse and of getting infected with HIV, which has relevant implications for our findings. For the present study, we did not have available data on ASPD.

Considering ASPD's extensively documented relationship to ADHD (Mannuzza et al., 1998; Satterfield et al., 2007; Satterfield & Schell, 1997), this could potentially underlie the association observed between retrospective ADHD, IDU risk behavior and the proportion of cases with HIV infection. In any case, the relationship between psychiatric comorbidity and drug problem severity may be particularly problematic when combined with IDU. Individuals with both ASPD and an additional Axis I diagnosis have been reported to have increased risk of being infected with HIV and other blood-borne viruses and transmitting it to others (Disney et al., 2006).

Inmates in the childhood symptoms of ADHD group present a poorer mental health status, marked by more presence of comorbid psychiatric disorders. These inmates are 3 times more likely to have current depression, which is consistent with findings by Biederman et al. (2008), Biederman, Faraone, Mick & Lelon (1995) and Clure et al. (1999) that have reported higher comorbidity of mood disorders in ADHD. Meanwhile, the risk for post-traumatic stress disorder was more than five times in subjects in the ADHD group, a finding that could be related to a high incidence of traumatic experiences in this population. Studies performed among military and veteran samples reported high indices of comorbidity and a significant relation between PTSD and ADHD (Adler, Kunz, Chua, Rotrosen, & Resnick, 2004; Harrington et al., 2012). These findings suggest a possible dimensional relationship between ADHD and PTSD symptomatology that warrants further examination.

The inmates in the present study were more than twice as likely to have been incarcerated before age 18 and during their adolescence, suggesting a role of ADHD in early involvement in criminality, consistent with other reports in prison inmates (Retz et al., 2004; Rösler et al.,

2009; Rösler et al., 2004). On their follow-up study, Satterfield & Schell (1997) documented the relationship between age of incarceration and ADHD, while Mannuzza et al. (2008) did not find significance in this aspect. Considering that early criminal involvement has been linked to CD, we used this finding in our sample to test how childhood ADHD symptoms explain SUD beyond the effect of early criminal activity and age.

These results should be interpreted taking into consideration the implications of conducting research in samples of the criminal justice population, as opposed to community participants. Risk for developing a SUD has been shown to be sensitive to social class (Monuteaux, Wilens, & Biederman, 2007), while imprisonment disproportionately affects people at lower socio-economic levels (Diamond, 2001). These facts need to be taken into account when drawing conclusions from findings in prison samples. It is evident that people who are incarcerated and exhibit ADHD-associated symptoms become more vulnerable to multiple health and social adversity. More research is needed in order to understand which factors are significant for young people with ADHD who become involved with the criminal justice system (e.g., SUD), and to identify factors that protect people with ADHD from engaging and persisting in criminal activity and health risk behaviors. Additionally, a context appropriate assessment of specific adverse life events should form part of research studies performed in prison samples, particularly when testing potential associations between mental disorders and health risk.

Additional considerations should be reflected on when interpreting these results. As is common in the literature on ADHD in imprisoned populations, a current diagnosis of ADHD was not established; a self-report measure of retrospective symptoms was used. Although the rating scale available for our research purposes has been extensively employed and studied, it is not strictly based on DSM-IV criteria. It has been argued that the WURS scale seems to be affected by personality style, which likely impacts its construct validity (Hill, Pella, Singh, Jones, & Gouvier, 2009). Additionally, this instrument does not offer provide data on ADHD subtypes, which is therefore another limitation of the present report.

The focus of the current study was on childhood symptoms as assessed by the WURS, and their relation to a series of outcomes in adulthood. The current/adult prevalence rates of ADHD in the correctional setting with valid rating scales and in-depth interviews should be a priority of forensic psychiatric research initiatives.

Furthermore, since a cross sectional instead of longitudinal approach was used, we cannot establish patterns of prediction across time. It is also relevant to consider that cross sectional studies may underestimate the rates of SUD (Fazel, 2006). Additionally, in the study we had no available data on personality disorders, therefore we were unable to control for the presence of ASPD. It is well established that ASPD is associated with both SUD and ADHD.

Despite these limitations, this is the only study of ADHD in the criminal justice system that focuses on Latinos and Spanish-speakers, and one of the few in an American territory. The sample size allows us to draw conclusions about the target population. These findings also have significant implications from a public health perspective. The higher proportion of IDU

drug consumption, overdosing and cases of HIV in our ADHD group demonstrate an urgent need for harm reduction strategies to be reviewed and revised in the correctional setting. Our results demonstrate how the presence of significant ADHD symptoms increases the vulnerability to adverse health outcomes and further impairment among inmates, particularly when co-occurring with a SUD. Based on these findings we highlight the importance of conducting screening for ADHD in prison and in SUD treatment programs.

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Figure 1.
Probability of drug abuse/dependence (SUD) for inmates with/without childhood history of ADHD and whose onset of criminal activity was before or after age 15.

Table 1

Demographic characteristics of participants

	Total sample N=1,179 (weighted %)	ADHD/WURS-C (> 36) (weighted %)	
Variable		No f (weighted %)	Yes f (weighted %)
Sex			
Male	959 (96.9)	675 (97.4)	284 (95.8)
Female	220 (3.1)	127 (2.6)	93 (4.2)
Age			
Mean (SD)	31.0 (8.4)	31.7 (8.5)	29.4 (7.7)
18–24	277 (21.5)	167 (19.1)	110 (27.2)
25–34	561 (50.5)	377 (50.7)	184 (50.1)
35- or more	341 (28.0)	258 (30.2)	83 (22.7)
Educational level			
6 years or less	116 (9.8)	60 (7.5)	56 (14.9)
7th to 11th	490 (41.6)	320 (39.9)	170 (45.1)
High school	403 (34.2)	288 (35.9)	115 (30.5)
Higher education	170 (14.4)	134 (16.7)	36 (9.5)
Number of dependents			
None	357 (25.5)	234 (24.3)	123 (28.4)
1–2	329 (28.2)	226 (29.0)	103 (26.5)
3–4	295 (27.1)	213 (28.7)	82 (23.4)
5 or more	197 (19.2)	129 (18.0)	68 (21.7)
Totals	1179 (100.0)	802 (100.0)	377 (100.0)

Table 2

Health history-related variables: behaviors leading to contagion with blood-borne pathogens and adverse health outcomes related to drug use in incarcerated sample (N = 1,179)

Variable	<u>ADHD/WURS-C (> 36)</u>		Wald (χ^2)
	No f (%)	Yes f (%)	
Hepatitis B			
No	702 (87.3)	304 (82.2)	-
Yes	97 (12.7)	70 (17.8)	3.87
Hepatitis C			
No	610 (74.5)	241 (66.7)	-
Yes	186 (25.5)	131 (33.3)	2.68
HIV			
No	769 (96.4)	344 (91.6)	-
Yes	32 (3.6)	31 (8.4)	7.08*
Overdose in prison			
No	717 (89.7)	315 (84.0)	-
Yes	83 (10.3)	61 (16.0)	5.56*
IDU previous to incarceration			
No	607 (74.9)	245 (62.3)	-
Yes	193 (25.1)	130 (37.7)	11.61**
IDU during incarceration			
No	672 (80.0)	294 (70.5)	-
Yes	128 (20.0)	81 (29.5)	5.94*
Tattooed in prison			
No	179 (27.1)	82 (21.9)	-
Yes	430 (72.9)	237 (78.1)	6.03*

*
p < .05,

p < .01

Table 3

Substance Use Disorder (SUD) profile of incarcerated sample (N = 1,179)

Variable	ADHD/WURS-C (> 36)		Unadjusted OR (95% CI)	Adjusted OR (95% CI) ^a	Adjusted OR (95% CI) ^b
	No f (%)	Yes f (%)			
SUD (abuse and/or dependence; lifetime)					
No	434 (53.3)	122 (33.3)	-	-	-
Yes	368 (46.7)	255 (66.7)	2.19 (1.36–3.54)*	2.01 (1.22–3.32)*	1.98 (1.20–3.28)*
SUD (last year)					
No	721 (91.0)	303 (82.4)	-	-	-
Yes	81 (9.0)	74 (17.6)	2.16 (1.31–3.55)**	2.03 (1.16–3.53)*	2.03 (1.17–3.55)*
Substance dependence (lifetime)					
No	582 (70.4)	207 (56.0)	-	-	-
Yes	220 (29.6)	170 (44.0)	1.81 (1.32–2.49)**	1.64 (1.18–2.28)**	1.64 (1.18–2.28)**
Substance dependence (last year)					
No	749 (93.8)	325 (87.3)	-	-	-
Yes	53 (6.2)	52 (12.7)	2.21 (1.26–3.89)**	1.98 (1.10–3.56)*	2.00 (1.11–3.62)*
Substance abuse (lifetime)					
No	654 (83.0)	292 (77.4)	-	-	-
Yes	148 (17.0)	85 (22.6)	1.41 (0.89–2.24)	1.44 (0.86–2.43)	1.41 (0.84–2.37)
Substance abuse (last year)					
No	732 (92.6)	313 (85.6)	-	-	-
Yes	70 (7.4)	64 (14.4)	2.07 (1.25–3.43)**	1.73 (0.96–3.10)	1.74 (0.97–3.13)
Alcohol dependence (lifetime)					
No	757 (93.5)	321 (88.0)	-	-	-
Yes	45 (6.5)	56 (12.0)	1.98 (1.24–3.17)**	1.41 (0.41–4.78)	1.42 (0.76–2.64)
Alcohol dependence (last year)					
No	792 (98.2)	368 (98.1)	-	-	-
Yes	10 (1.8)	9 (1.9)	1.07 (0.31–3.63)	0 (0-inf.) ^c	0 (0-inf.) ^c
Alcohol abuse (lifetime)					

Variable	ADHD/WURS-C (> 36)		Unadjusted OR (95% CI)	Adjusted OR (95% CI) ^a	Adjusted OR (95% CI) ^b
	No f (%)	Yes f (%)			
No	664 (79.1)	290 (73.2)	-	-	-
Yes	138 (20.9)	87 (26.8)	1.40 (0.99–1.99)	1.57(1.09–2.27)*	1.56(1.08–2.26)*
Alcohol abuse (last year)					
No	783 (97.1)	355 (94.2)	-	-	-
Yes	19 (2.9)	22 (5.8)	2.06 (0.93–4.58)	2.00(0.76–5.27)	2.02(0.76–5.35)

* p < .05,
** p < .01,
*** p < .001

^a Adjusted for comorbid MDD and positive PTSD screening

^b Adjusted for comorbid MDD, GAD and positive PTSD screening

^c Model did not yield a solution

Table 4

Summary of Logistic Regression analysis predicting SUD using sex childhood ADHD, early onset of criminal activity and mental health variables

	Step 1	Step 2	Step 3	Step 4
	OR (IC 95%)			
Sex				
Female	1.36 (.99–1.87)	1.54 (1.12–2.12) *	1.44 (1.05–1.97) *	1.48 (1.07–2.05) *
Male	-	-	-	-
ADHD/WURS-C (> 36)				
Yes	2.27 (1.38–2.74) **	1.93 (1.15–3.26) *	1.89 (1.10–3.24) *	1.08 (.46–2.50)
No	-	-	-	-
Early onset criminal activity				
< 15		1.48 (1.10–1.99) *	1.38 (1.03–1.85) *	1.10 (.78–1.55)
> 15		-	-	-
Comorbidity Index ^a				
Yes			.97 (.71–1.34)	.98 (.71–1.37)
No			-	-
Interaction ADHD * early onset criminal activity				2.38 (1.15–4.94) *

Note: Step 1 $p < .001$; Step 2 $p < .001$; Step 3 $p < .01$; Step 4 $p < .01$

^aIncludes MDD, GAD and/or positive PTSD screening

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$